Report of Investigations for March, 1944

M. VAN LOO

#97 - SWP 471

The shortage of magnesium silicate has stimulated considerable interest in replacement extenders. Reference was made to our inert study of August, 1943 previously described in these reports. The formula of most interest was the oil conservation formula of SWP Gloss White of 1-22-43, which showed the following viscosity comparisons, as taken on the No. 3 orifice on the S-W cup:

Extender Used		Viscosity Aug. 1943	Viscosity Mar. 1944
20 L	Magnesium silicate	29"	27.4"
2188	Micro Velva A	Too puffy	61"
8	China Clay	44"	37"
2077	Celite 281	Too puffy	Too puffy
213	Blanc Fixe	" "	" "
306	Barytes	15.2"	13"
566	Water Ground Georgia Marble	18.6"	16"
2500	Suspenso 101 (Precipitated $CaCO_3$)	19.1"	24"
2247	Atomite	20.1"	20"
1817	Surfex	17.1"	21"
3	Silica	19.2"	19"
1779 + 20 L	Mica + magnesium silicate	43.6"	33.2"
	50% 566 - 50% 20 L	21.4"	17.2"
	50% 1817 - 50% 20 L	22"	20"

Further suggestions were made to conserve magnesium silicate, starting with half magnesium silicate and half silica. Other inerts considered included Carbola Talc and Metronite. Further batches were ground, using the SWP Gloss White formula of 1-22-43, replacing the extenders on the basis of volume. Results were as follows:

Formula	Extender	T. Wt.	A. Wt.	Viscosity #3 Orifice Fresh	Viscosity #3 Orifice 4 Weeks
BC 912	20 L Magnesium Silicate	15.50#	15.48#	24.2"	25.4"
913	566 Water Ground Georgie Marble	15.34	15.30	18.6"	17.0"
914	20 H.O. Mg. Sil. High Oil Abs.	15.50	15.45	Too hvy	51"+1/8 cup
915	2188 Micro Velva A	15.29	15.20	52.2"	52"+1/4 cup
916	2201 Metronite BXXXX	15.52	15.45	20.0"	16.2"
917	2203 Carbola Talc	15.28	15.34	45.0"	37"
918	50% (Vol.) 566, 50% 20 L	15.43	15.45	24.2"	25"
919	50% 566, 50% 20 H.O.	15.43	15.40	29.0"	24.6"
920	50% 566, 50% 2188	15.42	15.44	39.0"	34"
921	66-2/3% 2203, 33-1/3% 2201	15.45	15.51	28.0"	24"

M. VAN LOO
Cont.

#37 - Cont.

The information from this set has been of assistance in suggesting substitutions for magnesium silicate in exterior formulas. Subsequently, the above list was increased, and batches prepared for exposure in both the pre-conservation and oil conservation SWP formulas, white, Colonial Yellow, and Slate. Details will be given in the April report.

A sample of Pyrophyllite (standard 325 mesh) was received from Geo. B. Cary and Son, and compared with Pyrax B and 20 L, for texture and grinding qualities. The special Pyrophyllite and Pyrax B were hard in texture and could not be used on a roller mill, because their abrasiveness produced a gray color. The viscosities in the oil conservation SWP Gloss White formula of 1-22-43 were:

OJ 478 H	Using 20 L	30 sec. on #3 orifice
OJ 479 H	Special Pyrophyllite	34 "
OJ 480 H	Pyrax B	38 "

Because of texture and abrasiveness the two special inerts would not be suitable for use in house paint formulations. Panels 8067-70 were prepared for exposure at Chicago only, using Pyrax HP, the coarser parallel of Pyrax B, substituted for 20 L in SWP and Family Paint.

Panels 8058-60 were prepared for exposure at Chicago and Miami comparing SWP Gloss White with Cook's O.W. House Paint 383-W-11 and Superwhite O.W. 383-W-77.

A publicity story was prepared for distribution to the S-W sales department on the performance of oil conservation SWP compared with the pre-conservation formulas. Several photographs were included to illustrate certain points. Evidence was presented to show that film thicknesses were substantially equal, and that by the use of bodied oils in the conservation formula, flow was improved, drying improved, dirt retention reduced, and adequate durability maintained.

A series of experimental paints were prepared for exposure to study the proper type and amount of bodied oils in house paints. (48) was selected for SWP because it could be used up to 40% in the vehicle solids and permit close to the maximum conservation of oil under O.P.A. regulations, without serious impairment of brushing qualities. This series was prepared to formulate using oils having various degrees of polymerization, using the transparent litho oils in the 300 series and the regular litho oils in the 500 series. The 500 series paints were shaded to Colonial Yellow. The formula used was SWP Gloss White of 10-4-43 so that the tinted paints will show excessive fading, but performance will be comparative.

M. VAN LOO
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#164 - Reformulation Studies of House Paints to Reduce Dirt Collection

Previous exposures on maleic treated soya oils V-11067 and V-11069 have shown good durability when used in house paints. Based on this work, the Varnish Research Division prepared a series of maleic and fumaric treated oils, which we have incorporated into the SWP Gloss White formula of 10-4-43, the SWP Colonial Yellow formula of 1-17-44, and the so-called Post-War SWP formula.

The oils used included:

ARV 3404 - V 11065 standard. 3.2% maleic soya. Body 46"
ARV 3340 - V 11069 standard. 3.2% maleic soya. Body I-J
ARV 3331 - V 11065 Monoglyceride. 3.2% maleic soya. Body 44"
ARV 3332 - V 11069 Monoglyceride. 3.2% maleic soya. Body H
ARV 3363 - 6% Maleic soya, monoglyceride. Body 61"
ARV 3366 - 6% Fumaric soya, monoglyceride. Body 54"
ARV 3397 #2 - 6% Maleic linseed, monoglyceride. Body 62"
ARV 3403 #2 - 6% Fumaric linseed, monoglyceride. Body 64"

Kellin, Kellsoy, and (2327) were added to the above series of oils. Panels will be exposed south and north vertical at Chicago and south vertical in Coffeyville.

Panels 8013-30 were prepared for exposure at Chicago and Coffeyville to determine the durability and chalking characteristics of R-200, R-510, and R-610 titanium oxides and the extended rutile titanium calcium pigments in SWP. This is a duplication of panels 7106-23, and is the second in a series of four successive paintings of the same paints, to compare seasonal effects and to permit direct comparisons of exposures at various stages of film breakdown.

#77 - Mildew Inhibitors

SWP Mildew Resistant Treated Gloss White - Rex 63057 has been revised to use half 1403 dry and half 2030 T as an emergency alternate, because of the shortage of 1403 dry. The new formula, OJ 373 H, is being made at the Chicago plant, but has not been distributed as a regular revision.

Panels 6182-5 F, FY testing Dowicide 6 in Rex 471 SWP Gloss White and Rex 63057 Mildew Resistant Treated Gloss White, and the respective primers, Rex 450 and Rex 63056, were examined after 24 months' Florida exposure. The exposures, which are on both cedar and yellow pine siding, compare the following systems:

(1) Rexes 450 and 471, laboratory batches, late 1941 formulas.
(2) Same with 3% Dowicide 6 (tetrachlorphenol) added.
(3) Rexes 450 and 471, regular stock, 1941 production.
(4) Rexes 63056 and 63057, regular stock.

M. VAN LOO
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#77 - Cont.

The regular guides, laboratory and production samples, untreated, look better at this point than the special paints carrying tetrachlorphenol, because of less dirt collection, mildew, and water staining. The Dowicide treated sections to the eye appear to hold fully as much mildew as the regular paints, although it is difficult to distinguish between dirt and mildew. The Dowicide seems to cause a peculiar surface wrinkling, which was also noted at 6 months' exposure. Under the microscope, the surface appears pitted, with an effect similar to erosion. There is also a greater tendency toward checking and cracking due to Dowicide 6. Because of previous indications of weakness, due to the chlorinated phenols, exposures including other fungicidal agents are now out. Routine examination data on the Chicago exposures up to 21 months shows no film failures, or behavior unfavorable to Dowicide 6, except slightly retarded chalking.

We have had an inquiry from the Curtis Companies, Inc., Clinton, Iowa, for a decay fungus resistant pigmented primer for shop priming assembled window sash and frame and door frames in post-war production. At present a fungicidal treated clear moisture proofing sealer is being used.

It was agreed that the Curtis laboratory would check fungus and moisture resistance by standard NDMA tests of samples of clears supplied by the Varnish Department, and treated pigmented sealers from this laboratory. We are basing our formulations on CH 5285, using chlorinated phenols such as tetrachlor, pentachlor, and 2-chlor orthophenylphenol, as well as phenyl mercury oleate. The p.v.c. was reduced to 38.6%, with zinc oxide content at 10%, and hiding power of 12,766 units.

The primers have shown a tendency to body up on aging, perhaps due to some incompatibility between the Bilinco 101 and the fungicide. Stronger solvents such as Solvesso No. 1 and xylol are being tested, to control viscosities. Much of this primer will be applied by dipping, using a conveyor system, and the necessity for very fast drying makes stability a real problem.

#112 - Fire Retardant Paints

du Pont is promoting the use of Chromated Zinc Chloride for the impregnation of lumber to impart fungus, termite, and fire resistance. Arrangements have been made with the Koppers Company, Wood Preserving Division, of Orrville, Ohio, to impregnate a group of cedar siding panels which will then be compared with similar untreated panels as to paint holding properties, and nail rusting.

#163 - One Coat House Paint

Panels 8050-7 were prepared to supplement our previous series at Chicago on one coat house paints, panels 7344-51 CS and CN, using the pigmentation agreed upon with Mr. Fasig, and using Lowe Brothers' vehicles V-791 and V-35. The p.v.c.'s were 35%, 29%, and 22%. This set is for exposure at Miami only.

M. VAN LOO
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#163 - Cont.

There has been no further progress in arranging for house painting tests on the one coat house paints in Florida. We hope to get some house tests in Chicago suburbs this spring and summer. Both white and tint base are available.

#86 - Durability of Pigments with Special Reference to Leaded Zinc and White Lead

Panels 8061-66 were prepared for exposure at Chicago and Florida to compare Oakland's S-W Liquid Ozlo and SWP Gloss White. The Liquid Ozlo formula is interesting because of its good hiding and low TiO_2 content at low raw material cost. A special formula was also included in which an improved vehicle combination similar to SWP was used.

#12 - Exterior Primers

Study of the absorption of oil by wood from various vehicles has continued on a much more satisfactory basis than was true previously. It is felt that we now have an accurate and efficient method of determining the absorption for the usual house paint formulations. The difficulties presented and the steps involved in their solution were presented at some length in the last monthly report.

The final procedure involves the steps: (1) brushing of the paint on selected siding panels at a given spreading rate, (2) air-drying at 4 hours, (3) scraping off the semi-dry paint as the sample to be tested, (4) extraction by percolating with a benzol-ether solvent, (5) centrifuging and decantation (twice, using the percolation bottle directly in the centrifuge), and (6) final washing, drying and weighing. The "loss" from the bottle is used to check the basic results, i.e., weight of oil found. A correction is made for the retention of volatile by the semi-dry film, and uniformity of handling seems to eliminate all the other sources of error quite effectively.

The following brief summary of results, as regards paints previously examined will be supplemented by a more complete study as soon as time permits:

1. SWP Undercoater Rex 450, as of late 1945, fresh laboratory batch, gave uniform results with the perfected method, entirely logical as compared to a large number of earlier results, which were rejected due to known errors. 35% by weight of the original vehicle solids seems to be the true amount absorbed by wood, with a probable error of less than 2%.

2. The old Rex 450 of 1938, run many times in an attempt to check the results obtained by F. M. Nelson, gave some fairly uniform results at a slightly higher oil absorption value than new Rex 450, but much less than reported by Nelson. However, difficulty in making fresh batches of correct viscosity halted the study of this material before it was possible to obtain such reliable data as described in (1).

M. VAN LOO
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#12 - Cont.

3. Titanium Pigment Corporation's EX 4140 ("neutralized oil" paint) was repeated several times, including fresh batches, and it was concluded that nothing valid could be determined for this paint by means of the present procedure. Turbidity of the oil solution cannot be removed by centrifuging or filtering.

The most conclusive work with the latest technique was a special study of the absorption of oil from Rex 471 Gloss White, regular oil type as of 4-8-42 versus the Oil Conservation Type as of 1-22-43. These paints were tested both over bare wood and over Rex 450 at normal drying time. Filter paper tests had shown the newer type to have much less penetration than the old. Several runs each were made of both old and freshly made laboratory batches, with excellent correlation. The following table shows essential results:

Paint	% Oil Found	% Oil; Theoretical	% Found of Total	% Absorbed	P.V.C. of Fresh Paint	P.V.C. of Film	Thickness of Film
(A. Typical Run, #40)							
Old Rex 471, bare wood	16.83%	32.55%	52.7%	47.2%	30.04%	44.60%	0.00208"
Duplicate	"	"	"	"	"	"	"
Rex 471, cons. type	15.55	26.67	58.25	41.75	36.85	50.00	0.002025
Duplicate	15.50	"	58.10	41.90	"	50.02	0.002023
(B. Average values of best runs; calculations approximate, to allow for maximum and minimum data found).							
Old, bare wood	16.60	32.55	51.9	48.0	30.04	45.0	0.00210
" , over Rx 450	31.3	"	96.2	3.9	"	30.8	0.00322
New, bare wood	15.5	26.67	58.25	41.75	36.85	50.0	0.002025
" , over Rx 450	26.1	"	98.0	2.0	"	37.3	0.00272

The major portion of these results were included in the special report on regular versus Oil Conservation SWP mentioned under #97. It is felt that the results show conclusively that Oil Conservation Rex 471, partly because of the lower oil absorption demonstrated, presents a film which is not "poor in oil," despite the high-volatile, low-oil-solids content of the paint. It seems quite clear that a low penetration tendency on filter paper, such as was indicated by the bodied oil-raw linseed blend in this particular case, indicates a similar low absorption tendency when applied to wood.

M. VAN LOO
Cont.

#177 - Pigment Studies

Opacity Studies

In the February report of investigations a program was outlined for the evaluation of white pigments as regards opacity and brightness. Work on this investigation has now progressed to the point that we have completed a preliminary exploration in the first and second type formulations, i.e., the exterior oil type house paints and the interior "varnish type" flat wall paint formulations.

Although results thus far are only exploratory, we feel very much encouraged by the fact that the correlation between the test series is good. As would be expected, the flat wall formulations develop approximately 10 - 15% greater opacity per pound of hiding pigment than do the same pigments in the oil type formulation. The results of these tests will be reported in detail as soon as they have been verified by repeat tests.

2233 M

The examination has been completed of Gloucester TiO_2 - 2233 M dry in the Rex 450 Undercoater formula and in a special formula based on Rex 450 except that the titanium is the only opacity pigment. There were five lots of 2233 M available in the plant at the time these tests were started. Each of these lots were made into the standard Rex 450 by displacing the TiO_2 normally used as 2209 dry. The results of this comparison are reported under Series I below. The variation between various lots of 2233 M is illustrated in the hiding figures. However, it is notable that uniform color has been accomplished by reviewing the brightness values. These are measured over the white portion of the Morest hiding charts used.

Series I - Rex 450 Undercoater

Pigmentation as of 9-24-43 - Card 18

80	pounds	1552 dry	Celite
3	"	547	Aluminum Stearate
200	"	20 L	Magnesium Silicate
120	"	Titanium Oxide	
144	"	413	Leaded Zinc
386	"	18	White Lead Carbonate

Hiding Comparison

Paint No.	TiO_2 Pigment	Brightness	Hiding as Sq. Ft./Gal. 91% C.R.		93% C.R.	
RB 382	2269 Dry Titanox RA 10 MO	84.3%	678	100*	584	100*
383	2233 M Lot G 379 X	81.9	492	72.6	380	65
384	" " G 379 T	81.4	464	68.4	360	61.6
385	" " G 379 W	81.3	532	78.5	448	76.7
386	" " G 379 S	81.4	544	80.2	460	78.7
387	" " G 379 U	81.3	500	73.7	424	72.6

M. VAN LOO
Cont.

#177 - Cont.

*Mathematical ratio between hiding of 2269 dry paint RB 382 as standard equal to value of 100 and the test paint containing 2233 M equal to X.

Series I and II paints were started at the same time. One 2233 M lot was selected at random for the evaluation as a single pigment against 2269 dry. Unfortunately the lot selected, G 379 T, was the lowest in hiding of all those tested but there was no way of knowing this when starting the test. Series II reported below evaluates 2269 directly against G 379 T. The results are self-explanatory.

Series II

Single hiding pigment test paint.
P.V.C. = Rex 450, card 18.
Ratio - TiO_2/extender = ratio in standard Rex 450, card 18.

Pigmentation

80	pounds	1552 dry	Celite
5	"	547	Aluminum Stearate
365	"	20 L	Magnesium Silicate
219	"	Titanium Oxide	

Hiding Comparison

Paint No.	TiO_2 Pigment	Brightness	Hiding as Sq. Ft./Lb. TiO_2 91% C.R.		93% C.R.	
RB 388	2269 Titanox RA 10 MO	87.6%	326	100*	278	100*
RB 389	2233 M Lot 379 T	82.7%	189	58	162	58.3

In summary, Gloucester TiO_2, lot G 378 T is deficient in hiding as compared with 2269 dry by 42% and is lower in brightness by a 4.9% differential.

414 Dry - Leaded Zinc

Coffeyville has been in production on the new 414 dry leaded zinc since about the middle of March. Samples of this material have been submitted daily for our test. To date it may be reported that the product is a marked improvement over the old 414 dry from the standpoint of color. Numerous batches of paint have been made which show that from the standpoint of color the material is readily usable for whites as well as for tints. This is true for all 414 lots up to lot #964 except the first lot #774 and lots 924, 934, and 944, which were deficient in whiteness.

M. VAN LOO
Cont.

#177 - Cont.

The prevailing fault which has been associated with the new 414 dry to date is the texture. This is apparent when making a rub-up as a very gritty feeling under the spatula. In the plant this texture is reflected by a 30 - 70% drop in production rate on the Premier mill and a drop of 25 - 30% in the production rate on the roller mill. Acme has reported that it did not greatly affect the production rate on the 30 inch stone mill.

Coffeyville is making every effort to improve the texture. A recent sample ground on the Stedman mill shows a considerable improvement in texture and wettability, and a sufficient quantity has been requested for a production run at Kensington.

In connection with the work on 414 dry, the limits on brightness were checked to determine whether it would be possible to make the more difficult tints of SWP, such as 496 Ivory, 569 Light Blue and 383 Pea Green (latter two inactive but selected for purposes of test). As a minimum standard Lot 185 of the previous production run of 414 W was selected. Using the specified shading bases, the color matches against the standards were considered satisfactory. Since the current production of 414 is much better in color than Lot 185, there should be no difficulty in this respect.

A set of experimental paints were prepared for exposure of laboratory processed leaded zinc 414 from the same source as the current Coffeyville production. This amplifies the series mentioned in the January report.

#105 - Metal Protective Paints

Panels 7998-8001 were prepared for exposure at the Chicago Exposure Farm of the rust inhibitive coating materials received from the Kendall Refining Company, described in the last report. They were compared with T-607 from the Coal Tar plant. Panels were also prepared for salt fog testing and for the humidity cabinet.

A synthetic Wool Grease emulsion was prepared for exposure on panels 8071-2 to supplement the 1943 series of natural wool grease emulsion series. The formula submitted by the Coal Tar laboratory was:

Synthetic Wool Grease	22.5%
Rosin	9.0%
Paralite	9.0%
(a coal tar bituminous material from Standard Oil)	
Water	54.1%
Ammonia (28%)	5.4%
	100.0%

The panels were exposed as one coat work on a steel panel against one coat of Rem Kromik, at Chicago only.

M. VAN LOO
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#103 - Cont.

Approximately a year ago, Monsanto supplied us with two samples of ferric orthophosphate, one ground and air separated to scalp out oversize particles, and was approximately 96% minus 325 mesh, the other the dust fraction from No. 1 . The samples were substituted pound for pound for the zinc dust in G and G Industrial Primer. The ferric orthophosphate retarded the drying badly, but exposures were prepared one coat on 8" x 24" hot rolled steel and on galvanized steel panels, and exposed at Chicago, 45° south, to see if they had any merit. G and G Industrial Primer was used as the control. After one year's exposure the galvanized panels are still in good condition except for dirt. On hot rolled steel the zinc dust-zinc oxide G and G Primer is still in good condition, with no rust except around the X-mark, where rust creep is only medium. However, both ferric orthophosphate paints on steel show very bad rusting, and bad rust creep, so that this pigment shows little promise as a rust inhibitive pigment.

During the month, further work on the formulation of experimental Chemically Resistant Metal Protective Finishes was carried out. As stated in a previous report, a series of exposure tests under various severe conditions is being planned, and experimental finishes utilizing chlorinated rubber, methacrylate polymers, and Vinylite resins are to be included. In preparing the Vinylite finishes we have encountered some difficulty with VMCH, Vinylite. This is a modified co-polymer and is supposed to give better adhesion on air-drying than the regular VYHH grade. It appears to be much more difficult to get satisfactory dispersions of TiO_2 in this resin and package stability has not yet been obtained.

In last month's report, details were given with respect to precoat systems used under the metal protective primer film with the hope of improving adhesion and blistering properties.

Accelerated tests have now been completed on the series with respect to blistering in salt and distilled water as well as salt spray tests to check on rust creep and general film properties. In the evaluations listed below, ratings are made in terms of arbitrary values of from 1 - 10, 10 being perfect, 9 indicating slight, 6 considerable and 3 as bad condition of rust and/or blistering.

Listed below is a summary of results obtained on distilled water immersion, 3% salt water immersion and 5% salt spray.

M. VAN LOO
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#103 - Cont.

Blistering

Immersion Distilled H_2O	Rex 13174 Brown 375 Hrs.	Class XXII Red Lead Maritime Primer 375 Hrs.	52-P-18 Bureau of Ships Zinc Chromate Primer 375 Hrs.	52-P-18 Bureau of Ships Zinc Chromate Primer 250 Hrs.	52-MC-29 Maritime Commission Zinc Chromate Primer 250 Hrs.	52-MC-29 Maritime Commission Zinc Chromate Primer 375 Hrs.
1. Stearic Acid	9	9.5	9.5	10	6	3
2. Oleic "	9	9.5	9.	3	6	3
3. (2120) Linseed Fatty Acids	6	9.5	9	9	3	3
4. Diamer A	6	9.5	3	3	6	3
5. (48) Bodied Linseed Z2 - Z3	10	9.5	9.5	9.5	3	3
6. (324) Bodied Linseed 13'	10	9.5	9	9	6	3
7. Bilinco 101	10	9.5	6	6	3	3
8. (2325) Dehydrol	10	9.5	9	9	3	3
9. (3128) Soya Alkyd	9.5	9	10	10	6	3
10. (3128); (48)	10	9	9	9	6	3
11. (3950)H Phenolic	9.5	9	5	6	6	3
12. (3950)H; (48)	10	9	5	6	6	3
13. (2) Raw Linseed	4	9	9	9	3	3
14. (3080)E Varn.	9	9	3	3	3	3
15. Control	10	9.5	9.5	9.5	5	3

M. VAN LOO
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#103 - Cont.

Blistering

Immersion 5% Salt Water	Rex 16174 Kromik Hours 64	130	Class XXII Red Lead Maritime Primer Hours 64	130	52-P-18 Bureau of Ships Zinc Chromate Primer 64 Hrs.	130 Hrs.	52-MC-29 Maritime Commission Zinc Chromate Primer 64 Hrs.	130 Hrs.
1. Stearic Acid	3	1	6	3	6	3	10	6
2. Oleic Acid	9	6	6	3	6	3	10	6
3. (2120) Linseed Fatty Acids	3	3	6	3	9	4	9	6
4. Diamer A	9	6	9.5	6	9	6	10	9
5. (48) Bodied Linseed Z2 - Z3	9.5	6	9	6	7	3	9	3
6. (324) Bodied Linseed - 13'	9.5	6	9	6	9	3	9.5	3
7. Bilinco 101	9.5	6	3	3	6	3	9	5
8. (2325) Dehydrol	10	6	9	6	6	3	9.5	6
9. (3128) Soya Alkyd	9.5	3	9	6	6	3	9.5	9
10. (3128); (48)	9.5	6	9	6	6	3	9.5	9
11. (3950)H Phenolic	9.5	6	3	3	6	3	9.5	9
12. (3950)H; (48)	9.5	6	9	6	7	3	9.5	9
13. (2) Raw Linseed	9.5	3	9	6	5	3	9	6
14. (3880)E Varn.	9.5	6	9	6	5	3	9.5	6
15. Control	10	9	3	3	3	3	9	6

M. VAN LOO
Cont.

#103 - Cont.

Blistering - Rust Creep - Rust

710 Hours 5% Salt Spray	Rex 16174 Kromik	Class XXII Red Lead Maritime Primer	52-P-18 Bureau of Ships Zinc Chromate Primer	52-MC-29 Maritime Commission Zinc Chromate Primer
1. Stearic Acid	8	4	8	9
2. Oleic Acid	9.5	6	9	9
3. (2120) Linseed Fatty Acids	3	3	4	4
4. Diamer A	4	2	4	7
5. (48) Bodied Linseed Z2 - Z3	9	6	9	8
6. (324) Bodied Linseed - 13'	9	6	9	8
7. Bilinco 101	7	3	6	9
8. (2325) Dehydrol	8	7	8	7
9. (3128) Soya Alkyd	7	4	7	7
10. (3128); (48)	7	5	8	8
11. (3950)H Phenolic	7	6	8	9
12. (3950)H; (48)	7	6	8	9
13. (2) Raw Linseed	5	7	8	8
14. (3080)E Varn.	8	7	7	9
15. Control	8	3	7	9

M. VAN LOO
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#103 - Cont.

Before discussing the above results a few remarks should be made with respect to the effect of the precoat on the adhesion of the primer. Stearic acid in general greatly reduced the adhesion of the primers to the panels. Very poor adhesion due to stearic acid resulted with Rex 16174, poor adhesion with Red Lead and 52-P-18, with the least effect on 52-MC-29. In general the rest of the precoat materials showed only very slight effect on the adhesion of the primer film as far as could be determined by finger nail tests.

Examination of the test results indicate wide differences in the behavior of the undercoat materials depending on the nature of the primer used. Hence, if these materials were to be used, it probably would necessitate actual exposure results on the system before a recommendation could be made.

In distilled water immersion tests no improvement in any case with respect to blistering was noted with Rex 16174. The following vehicles did not increase the blistering tendencies of film - viz., (48), (324), Bilinco 101, (2325), (3128)-(48) and (3950)H-(48). However, (2) produced rather bad blistering with Rex 16174.

No pronounced effect was noted with any of the precoat materials on blistering of 52-MC-22 red lead primer in distilled water.

A precoat of (3128) under 52-P-18 slightly improved the blistering resistance of this primer in distilled water. On the other hand, (3880)E and dimerized acids produced bad blistering of the primer.

With the 52-MC-29 primer, the improvement resulting from the use of a precoat is conjectural with respect to blistering in distilled water. However, several of materials definitely reduced resistance to blistering.

In salt water immersion tests with Rex 16174, only (2325) gave results comparable with the control. Stearic acid produced very bad blistering in 24 hours with this primer, while (2120) was also bad in this respect. In general throughout the series stearic acid was much inferior to oleic acid as a precoating material. This is probably due to loss of adhesion of the primer, and also is probably related to the microcrystallization of the stearic acid on the test panels. On the other hand, oleic and linseed oil fatty acids were bad from the angle of very strong crawling tendencies on the panels.

There was considerable improvement in the performance of the red lead primer with respect to salt water blistering resistance by the use of a number of the test materials. The best probably was the dimerized fatty acids, whose main effect was probably one of increasing adhesion. Only two materials did not increase blistering resistance, viz., Bilinco 101 and (3950)H. Curiously enough, stearic acid which reduced the adhesion of this primer to a large

M. VAN LOO
Cont.

#103 - Cont.

extent showed up better than a number of other materials which did not affect the adhesion of the primer.

In the 52-P-18 primer panels, only the dimerized fatty acids produced much of an improvement in resistance to salt water blistering. Several others showed some improvement, while in no case was there increased blistering tendencies of the 52-P-18 material in salt water because of usage of a precoat.

In the 52-MC-29 series improvement in blistering properties of the primer in salt water was noted especially with (3128), (3128) and (48), (3950)H, (3950)H and (48) and Diamer A. The bodied oils as (48) and Bilinco 101 increased blistering properties of the primer.

In salt spray tests the indices reported are an average of rusting, blistering and rust creep. On this basis, test results indicate that no large improvement in performance can be realized in the case of Rex 16174 by the usage of a precoat. The improvement realized by the use of oleic acid was entirely along the lines of rust creep from a scratch on the surface. Linseed fatty acids (2120) was characterized by bad rust creep in all cases in this series, which is difficult to reconcile with the mono-molecular theory of metal protection. It may well be that the (2120) contains corrosion inciting ions from the hydrolytic agent used to split the triglycerides of linseed oil. Dimerized fatty acids also gave bad rust creep.

With respect to the red lead primer, a rather large improvement could be accomplished by using the bodied oils as (48), (2325), etc. and (2) and (3880)E. It was noted again that bad rust creep resulted by the use of Diamer A and (2120).

The 52-P-18 material was slightly improved in performance in the salt spray test, by using oleic acid, the bodied oils as well as several of the other materials. Again (2120) and dimerized fatty acids produced bad rusting away from the scratch marked face of the panel.

No improvement was effected by the use of precoat materials with primer 52-MC-29 with regards to its ability to resist salt spray. However, several materials definitely increased salt spray break-down of the primer film, viz., (2120), Diamer A, and others.

Summarizing these accelerated tests we believe that as far as the tests are indicative of what is obtainable on exterior exposure, improvements in the performance of the primer are in most cases slight or non-existent. The particular precoat to use in any case for an improvement in performance being entirely a matter of the type of primer used. As far as the experimental data are concerned, Rex 16174 seems to be improved in only one respect by a precoat and that by reduction of rust creep by use of oleic acid. Class XXII red lead primer can be improved by the use of several of the bodied oils, with respect to salt spray and blistering resistance.

M. VAN LOO
Cont.

#103 - Cont.

The 52-P-18 specification may be improved somewhat in performance with respect to blistering and salt spray resistance, whereas it is very much of a question whether any improvement can be realized by using a precoat under the 52-MC-29 material.

Exterior exposures of the precoat materials without a top coat showed that after one week at the exposure farm, the panels coated with stearic acid, oleic acid and (2120) had rusted very badly, while the rest of the panels showed slight rust.

Examination was made during the month of two series of panels put out by Van Nordstrand of zinc chromate in two series of vehicles. Series I consisted of the following single pigments:

1. 12054 Zinc Chromate in (2) Raw Linseed Oil P.V.C. at 28.8%
2. " " " " (48) Bodied Linseed Oil " " "
3. " " " " (2325) Dehydrol " " "
4. Kentucky Color Zinc Chromate #2813 in (2) Raw Linseed Oil " " "
5. Reichhold #1420 " " " (2) " " " " "
6. Zinc Tetroxychromate in (2) Raw Linseed Oil " " 25.5%
7. Kromik #74 of 8-15-39
8. Red Lead in (2) Raw Linseed Oil
9. " " " (48) Bodied Linseed Oil
10. " " " (2325) Dehydrol

The top coat used was Metalastic Black (exposure 2 years). The exterior exposure results indicate no apparent differences between the zinc chromates 12054, K. C. #2813, Reichhold #1420 and Zinc Tetroxychromate, except that Kentucky Color's #2813 showed definitely less rust creep in raw linseed oil than the other chromates. The films of all were in good condition. (48) and (2325) definitely control the rust creep with 12054 dry. Kromik #74 was disappointing, showing bad film break-down and rusting, as well as just creep. This is probably related to the (44) alkali refined linseed oil used in this particular formula. Red lead in (2) showed bad rust and film break-down, whereas red lead in (48) and (2325) showed slight rust and only moderate film break-down due to carbonation.

Series II consisted of a series of Rex 43813 Aircraft Zinc Chromate Primer, using the above zinc chromates versus Kromik #74 of 8-15-39. After exposure for two years and three months on hot and cold rolled steel, the zinc chromate primers were all in relatively good condition, except for the Zinc Tetroxychromate primer on hot rolled steel, which showed considerable rust spotting. Surprisingly, only slight rust creep was evident on both hot and cold rolled steel, which is unusual considering the (3110) alkyd vehicle. The Kromik #74 primer showed bad rusting and rust creep on both hot and cold rolled steel.

M. WAN LOO
Cont.

#103 - Cont.

The above results would indicate that Zinc Tetroxychromate does have good performance characteristics in both synthetic and oil vehicles, giving results on actual exterior exposure which exceed those obtained in accelerated tests.

A series of steel rod slurry tests were run during the month on a group of pigments. The technique has been described in past monthly reports. The series tested includes the following dry numbers:

45 Day Immersion

18	Basic Carbonate White Lead	Heavy coating of lead on rod.
412	Leaded Zinc	" " " " " "
45	$CaSO_4$	Cons. staining, no apparent rust.
1817	Surfex	Slight " , " " "
20 L	Asbestine	Cons. " , " " "
108 N	ZnO	Dark " , " " "
ZZZ-53	ZnO	" " , " " "
12054	Zinc Chromate	Slight " , very slight rust.
D 2689	" "	Questionable staining; quest. rust.
1503	Red Lead	No staining, slight rust.
12093	Basic Lead Chromate	Slight staining, cons. rust.
54	Fe_2O_3	V. dark " , no apparent rust.
354	Black Iron Oxide	Deep staining, cons. rust.
315	Blue Lead	No staining, bad rust etching.

The results are difficult to interpret because of the questionable nature of the staining phenomena, which may or may not be related to corrosion incitation, which immediately poses the question of its practical value. However, on the basis of freedom of staining and rust, the results at least indicate that Surfex, 12054 Zinc Chromate, D 2689 Zinc Chromate and 1503 dry Red Lead are the pigments which show the greatest effect in reduction of rusting.

#162 - Studies in Flat Wall Paint Formulation

Flat Wall Paints

Because of the limited availability of magnesium silicate, the Alternate A formulas of Flat-Tone White and tints, and Paintercraft Flat #10 to use 2205 dry Carbola Talc have been sent to Cleveland for distribution.

A number of tests were conducted during the month to evaluate deodorized thinners submitted by the Commerce Petroleum Company, Oil Research, and Resin Research. The entire volatile in the Alternate A formula for Flat-Tone White was replaced by each thinner in turn. The paints were applied on Upson board and the odor tests conducted in an enclosed space built up of the Upson panels.

M. VAN LOO
Cont.

#162 - Cont.

The next group with respect to gloss was composed of Enameloids made with (2848)N, (3848)E and (4850)N. Gloss retention in this group was best with (2848)N and poorest with (4850)N, but differences were slight.

The poorest gloss retention in the series of white enamels was shown by Sears Roebuck and Pittsburgh products and Enameloid made with a wood oil-phenolic vehicle (2946)EA.

In the series of Ivory Enamels, bad chalking and fading was evident on all panels except one finished with Devoe's "Honey Color (N)." This product was given a general appearance rating of "fair" as compared with "poor" for others in the series.

A number of gray enamels were included in this exposure series. The vehicles used in the enamels were single varnishes, all of which have been used at one time or another in Enameloid, - either alone or in combination with other vehicles. The gray enamels were all pigmented with rutile TiO_2, non-chalking, 2174 dry, and tinted with Lamp Black. The P.V.C. was the same in all enamels.

At the end of 10 weeks the alkyds (3111) and (4100) showed good gloss and color retention and were rated best of the series. (2843)GS and (3850)N showed considerable fading and chalking and presented a poor general appearance. (1567) showed considerable checking.

The following chart gives detailed readings for the gray series:

Exposure test for 10 weeks in Florida at 45° south.
Gray enamels pigmented with non-chalking rutile TiO_2, 2174, and Lamp Black (same P.V.C. in all enamels).

Panel	Varnish used in Enamel	Fade	Gloss	Check-ing	Mil-dew	Dirt	Chalk-ing	Gen. App.	Rain Spotting
7480	(4100)		(G)					G	S
7481	(2946)EA		(G)		(S)		C	G	S
7482	(2848)N	S	G				(S)	F	S
7483	(2847)S		(G)				(S)	G	(S)
7484	(3843)E		(G)		(S)	(S)	(S)	G	(S)
7485	(4850)N	(S)	E	(S)			(S)	G	S
7486	(1567)		(G)	C				F	C
7487	(3111)		G					G	S
7488	(6100)	(S)	(G)		(S)			G	S
7489	(2945)EA		E		(S)		(S)	F	S
7490	(2843)G.	S	E		(S)		C	F	S
7491	(3850)N	C	E				C	P	S
7492	(2841)G	S	(G)				C	F	S
7493	(2843)GS	C	E		(S)		C	P	S

M. VAN LOO
Cont.

#162 - Cont.

Porch and Deck Paints

Panels 7602-31 F were returned for examination after 10 weeks' exposure at Miami, 45° south, of various Porch and Deck paints covering variations in pigmentation and vehicle. These were described in the October, 1943 report.

The panels are 8" x 24" medium quality Douglas Fir panels, given two coats of each paint, applied by brush, with care taken to apply equal film thicknesses. After 10 weeks of exposure there are wide variations in appearance but very little in durability. Pitch spots are very noticeable, but their frequency may be more a function of the wood than of the coating.

Disregarding the pitch spots, in general the paints using 2140 titanium calcium pigment show poorer color but better gloss than the leaded zinc formulations. Chalking is no more than slight in any case, mostly on the leaded zinc panels, so that apparently the fading of the 2140 formulas is chemical fading rather than "chalk-mask." A single test of 2174 rutile non-chalking R 610 TiO_2 and Micro Velva A shows up better than the average in all respects.

With respect to the vehicles, differences in performance are still small. (1567)A, an ester gum-chinawood linseed varnish is very bad in all respects, but improves with phenolic added. (3850)N Velsicol varnish is one of the poorest in both color and gloss. The alkyds (4100), (6100), and (3111) tested only with Titanium Calcium RC, show up very well. The panels will be re-exposed. At Mr. Mills' suggestion, a special test is being arranged to combine horizontal exposures with occasional scrubbing, and eventual recoating, particularly to determine the importance of chalking, and adhesion.

#182 - Study of Improved Mixing and Grinding Practices

Mr. Clingan is undertaking a survey of mixing and grinding operations to see what opportunities may exist to reduce costs of mixing and grinding operations, or to expedite production rates. The work up to the present has involved a review of the literature on this subject, including the Production Clubs' reports, and technical information on wetting and dispersing agents, and grind aids. A selected series of such chemicals have been ordered. We will attempt to use the Brabender Plastograph in our evaluation.

No work done during the month on:

#160 - Painting of Bricks

#148 - Examination of White Lead

#150 - Durability Studies of Zinc Sulphide Pigment Combinations

#178 - Studies of Dark Colored House Paints