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June 7, 8, 9, 1[illegible]

JCWeaver
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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 Titanium Pigment Corporation has withdrawn any previous recommendations for low p.v.c. house paints which contain no extender, and in which the vehicle is neutralized with sodium hydroxide.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.

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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.

<u>National Lead Company - Sayville, Long Island, New York</u>

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 <u>are</u> 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 ba. ...rbonat ... ic silicate in T. ...W-401 exteric ...rimer shows su... ...i. equal performance aft... .../2 years. Not... hese panels were ...ainte... ...ound 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 Corpoı. Sayville, Lo sland, New ork

(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.

[illegible]ietary paints exposed for [illegible]iod include [illegible] and [illegible] High Standard, both in good con[illegible] Montgomery [illegible]'s paint, w[illegible] evidently had very good flow, is [illegible]aps 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, ser . wa posed using the following pigmenta 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) ... led zinc - 35 ... nox RC HT ... silicate

Vehicle: 75% re... ed linseed oil - 25% Z_2 ... ied linseed oil

77% N.V.M. 35% 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 - 50% 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.

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The use of in ange from ea formul ci retards the slightly exces. w of previous p.v.c. pai ts a . is intended to reduce tendenci. owards slit crack.g. 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 1945, 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.

. ‚ Ja. ; 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 ...res ... ...ts at Sayville with regular percentag... of Titanox A are ...e cle...st 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-60.

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.

groups put [illegible] 1943, [illegible] [illegible]spected to get the [illegible] fter 1, 3 and [illegible]ears' expos[illegible]re. [illegible]-Pu[illegible] showed better self-c[illegible]g properties th[illegible] R-200, Y-CR or R-110, t[illegible] 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% " - 37.5% 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 Ex. in House Pain

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) 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 2175 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 a[illegible] [illegible]e added. The [illegible]partment 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_3 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. Tar.   Newark, Dela

Thi   ..se compares the . nventional 'Ti-S..l" pre-...r paint with a special, 40% Ti-Cal R 25 - 50% loaded 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.

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.

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M. VAN LOO

Director of Paint Research