Inspection Trip
Exposures - du Pont Pigments Department
Titanium Pigment Corporation
National Lead Company
June 21 and 22, 1956

General Statement

On June 21 I examined the house paint exposure panels and some of the house tests conducted by the Pigments Department of E. I. du Pont de Nemours and Company in Wilmington, Delaware. On June 22 I examined the house paint exposure panels of Titanium Pigment Corporation and some tests of house paints and of metal primers and paints conducted by the National Lead Company, both at Sayville, New York.

As usual, the personnel of all three companies showed us every courtesy and did everything to make the inspection trip informative and pleasant. Unfortunately it rained most of the day of the du Pont inspection. Obviously this made any real analysis of paint performance rather sketchy and very few notes could be taken. The weather was ideal at Sayville.

The following comments are offered as general observations.

1. There are no particularly new or novel ideas in formulation evidenced in any of the groups of exposures examined.

2. Proportionately more attention is being paid each year to emulsion paints (especially on masonry surfaces), to blister and stain resistant paints, to flat exterior paints, to tints and colors, and to film preservatives (fungicides).

3. Both du Pont and Titanium Pigment Corporation are still very conservative in any remarks regarding the use of exterior emulsion paints on wood, but they are keeping an open mind on the subject. Prospects on masonry surfaces are more favorable. In general, they show best results with some of the polyvinyl acetates and AC-33 acrylic, both out-performing butadiene styrene paints. No results were available on Monsanto's L-680.

4. We are concerned about the "anemic" appearance of tints made using a non-reactive pigmented tint base. In Wilmington, zinc oxide-TiO_2 combinations are superior to leaded zinc-TiO_2, and both are better than the typical blister and stain resistant tints with no lead or zinc.

5. No outstanding film preservative (fungicide) has appeared in du Pont's or TPC's tests which are not already in our own evaluations. The value of using preservatives in the primers was shown in both places. For example, a total investment of 24¢ in preservatives is better spent if divided 12¢ each in the first and second coats than none in the primer and 24¢ in the top coat.

Certain observations on specific items may be summarized as follows.

1. Special attention was paid to TPC's quality control exposure tests on their non-chalking rutile TiO_2 Titanox RANC. More detailed discussion will appear later. However, tests in alkyd automotive enamels show that by selecting the right panels one could prove anything. Actually, as many of the lots of RANC showed slight superiority over R-610 samples in fade and chalk resistance as there were inferior lots, and generally RANC was definitely superior to CR-640. There were exceptions to every one of these statements in isolated cases and one lot of RANC was poor. R 610 showed uniform performance at a good level in the few samples tested. Confirming TPC's earlier statements, RA 90 showed a high level of gloss and color retention, generally the best of all the rutile pigments in this series. Naturally the one poor lot of RANC is a matter of great concern. TPC's production department has been shown these exposures and are aware of the dangers of any laxity in control of quality. We would anticipate that in future shipments of RANC there will be a narrower range in fade and chalk resistance.

It should be noted that no numerically equal number of tests of either R-610 or CR-640 were available for evaluation. Therefore no comment can be made as to the actual range of quality of either du Pont's or Calco's production. A few tests of Glidden's rutile pigments showed inferior chalking, gloss and color retention.

Since results of tests in automotive enamels may not correlate with performance in oil or alkyd house paints or in emulsion paints, Titanium Pigment Corporation is initiating an extensive series of tests to cover these points. The tests will include various lots of RANC in lead-zinc-titanium-extender tint base house paints, in non-reactive pigment tint base, in alkyds and in emulsion paints, as well as the usual automotive enamels.

2. Up to this year du Pont has promoted a lower cost leaded zinc-TiO_2-calcium carbonate pigmentation. To improve the durability of a white of this kind they had recommended that up to 1/3 of the TiO_2 be non-chalking rutile R-610. Color was not too good for a white. They now report that upon prolonged exposure such a paint shows good film retention, but eventually showed checking and cracking. They now prefer for a low cost house paint a lead-free formula, using one pound per gallon of pure zinc oxide, with calcium carbonate, which shows no or very little cracking at five to six years.

3. We did not have time during the ASTM meeting in Atlantic City to go to Ocean City, New Jersey to inspect the house tests of emulsion paints reported last year. Dr. Vannoy stated that results this year varied, sometimes to the advantage of acrylics, and at other times to the advantage of polyvinyl acetate 81-900. No details were given.

4. There was some evidence on du Pont's panels which checks our preliminary observation that R-110 chloride process is more susceptible to rutile yellowing than R-110 sulfate process.

du Pont Exposures

White House Paints - Selection of TiO_2 Type

du Pont has put out exposures every year since 1951 on the following comparisons of titanium pigments, making all substitutions at equal hiding and "equal free binder." du Pont's conception of "equal free binder" is that an equal volume exchange is made of extender and composite vehicle to bring the consistency of an experimental paint back to that of a control paint. The vehicle used is 75/25 alkali refined linseed/X bodied linseed. We do not think that 25% of an X bodied linseed gives a good "bodied oil" vehicle.

The pigmentations include the following:

	Pounds per Gallon
"Ti-Pure" FF/ZnO/Mg Sil.	1.52/2.76/2.15
"Ti-Pure" Y-CR/ZnO/Mg Sil.	
"Ti-Pure" R-110/ZnO/Mg Sil.	
"Ti-Pure" R-510/ZnO/Mg Sil.	
"Ti-Pure" R-610/ZnO/Mg Sil.	
"Ti-Cal" R-25/ZnO/Mg Sil.	
"Ti-Pure" FF/35% LZ/Mg Sil.	1.80/4.24/2.58
"Ti-Pure" Y-CR/35% LZ/Mg Sil.	
"Ti-Pure" R-110/35% LZ/Mg Sil.	
"Ti-Pure" R-510/35% LZ/Mg Sil.	
"Ti-Pure" R-610/35% LZ/Mg Sil.	
"Ti-Cal" R-25/35% LZ/Mg Sil.	

As expected, Ti-Pure FF shows better clean-up than Y-CR, R-110, 510, 610 and rutile titanium calcium Ti-Cal R-25. du Pont recommends only FF, Y-CR, and R-610 for exterior use. However, we should keep in mind that they would like to discontinue production of Y-CR and titanium calcium, so their recommendations are biased. Actually, Y-CR and R-25 are performing very well when used properly.

SWP 430 Undercoater-SWP 471 Gloss White, put out in October 1952, looks good in comparison with the du Pont formulations and considerably better than some of the competitive proprietary paints (not identified) in the series.

White House Paints - TiO_2 Blends for Chalk Retardation

One group of the paints in this series, put out north and south vertical in November, 1953, was based on the following pigmentations:

	Pounds per Gallon
1) TiO_2/35% LZ/Mg Sil.	1.27/4.24/2.97
2) TiO_2/ZnO/Mg Sil.	1.40/2.76/2.55
3) TiO_2/35% LZ/Mg Sil.	1.80/4.24/2.58
4) TiO_2/ZnO/Mg Sil.	1.92/2.76/3.46
5) TiO_2/35% LZ/Mg Sil.	2.22/4.44/1.85

Another group was pigmented as shown below. These paints were formulated at equal hiding power and equal free binder, starting with 4.25 pounds of oil per gallon (75/25 alkali refined linseed/X bodied linseed). The panels were exposed in September, 1949 and are now on north vertical exposure.

	Pounds per Gallon
TiO_2/35% LZ/Mg Sil.	1.80/4.24/2.58
TiO_2/Acic. ZnO/Mg Sil.	1.92/2.76/2.15
TiO_2/Acic. ZnO/Mg. Sil.	2.23/2.89/1.64

du Pont puts out similar exposures annually, including various blends of Ti-Pure FF, Y-CR and R-610.

The same remarks regarding the relative chalking rates apply here as in the first du Pont group described above. They state that 80/20 Ti-Pure FF/R-610 is approximately equal to 50/50 FF/Y CR, but we find that the latter combination is preferred for color.

White House Paints - "One Coat" Hiding

This series contains titanium pigments other than R-610, but the emphasis is on 610, which obviously puts pressure on the problems of color, dirt collection and mildew. The main pigmentations consist of ranges of R-610 TiO_2 from 1.44 to 3 pounds per gallon used in conjunction with (1) 4-1/4 pounds of leaded zinc, and (2) 2-3/4 pounds of Azo 222-33 zinc oxide per gallon, respectively. The typical du Pont bodied oil vehicle is used and the paints are exposed as is and plus 0.2% phenyl mercury oleate. They have put out series of this type since 1949.

They conclude that higher than normal amounts of R-610 or Y-CR may give sufficient self-cleaning for use as a white. We have found that results vary according to climatic conditions - what might be bad in Florida may be good in California, as we observed with Tx 473 Trim and Tinting White. In this and other du Pont series we observed that in Wilmington paints with combinations of R-610 and 4-1/4 to 4-3/4 pounds of leaded zinc did not look as clean as similar paints with 1-1/2 pounds of leaded zinc. The same applied to comparisons of 2-3/4 pounds of zinc oxide with one pound.

In one group put out in September, 1953, both SWP 471 Gloss White and SWP 476 One Coat White were included, applied over a coat of 450 Undercoater on wood. Both look good but the 476 One Coat White is outstanding - white, smooth and clean. 471 is slightly yellower than 476.

If straight R-610 were used in a white house paint for all areas a film preservative (fungicide) should be used. Even the paint with 3 pounds of R-610 mildews in Wilmington without preservative. Use of 2 pounds of R-610 with 1.37 pounds of anatase LW TiO_2 reduces the mildew to slight. 12¢ worth of PMO controls mildew in Wilmington at three years on R-610 with leaded zinc or zinc oxide.

In the series put out in 1953, with leaded zinc, use of 1/3 R-610 - 2/3 FF TiO_2 still permits mildew without preservative, as does straight Y-CR. 50/50 FF/Y-CR is O.K. R-110 shows some mildew, 510 slightly more and R-610 most. R-110 chloride process is about like R-110 sulfate. Straight Ti-Cal R-25 with leaded zinc shows slight mildew but also yellower color.

White House Paints - Calcium Carbonate with Normal or Low Zinc Oxide Content

du Pont has exposed numerous series under this general caption. The more recent pigmentations, exposed approximately yearly since 1952, include the following:

	Pounds per Gallon	#/Gallon ZnO	#/Gallon Oil	Pigment Vol. %
FF/R-610/35% LZ/Mg Sil.	1.11/0.55/4.24/2.71	2.76	4.25	31.4
FF/R-610/35% LZ/$CaCO_3$	1.11/0.55/4.24/4.47	2.76	3.75	41.0
FF/R-610/35% LZ/$CaCO_3$	1.41/0.70/1.00/6.60	0.65	3.51	45.5
FF/R-610/Acic.ZnO/$CaCO_3$	1.18/0.59/2.76/4.98	2.76	3.76	40.7
FF/R-610/Acic.ZnO/$CaCO_3$	1.38/0.69/1.00/6.90	1.00	3.56	44.5
FF/R-610/35% LZ/$CaCO_3$	1.00/0.50/2.50/6.45	1.63	3.47	45.7
FF/R-610/Acic. ZnO/$CaCO_3$	1.00/0.50/1.50/5.80	1.50	3.75	40.9
--/R-610/Acic. ZnO/$CaCO_3$	/1.50/1.50/6.25	1.50	3.59	43.7
--/R-610/Acic. ZnO/$CaCO_3$	/1.50/2.50/4.90	2.50	3.87	38.7

These paints were exposed south and north vertical, with and without 0.2% PMO when straight R-610 was used.

Older series, put out from 1949 through 1951 are simpler series, based on straight FF TiO_2 and calcium carbonate extender, with a few paints at 1-3/4 pounds of zinc oxide.

du Pont's conclusions are that specially selected calcium carbonates may permit marked reduction in zinc oxide or leaded zinc in white house paints, with R-610 TiO_2 giving better resistance to checking and cracking than anatase. As stated in the "General Statement" section, du Pont finds, particularly in the later stages of exposure, that with anatase TiO_2 and calcium carbonate acicular zinc oxide gives much better resistance to cracking than 35% leaded zinc.

In our observations, when calcium carbonate replaces Mytal 300 with TiO_2 combinations of 2/1 FF/R-610, the color is yellower with 4-1/4 pounds of 35% leaded zinc with the carbonate than Mytal. As leaded zinc is reduced to as low as one pound, color actually improves, with no mildew. (Remember - du Pont would now prefer straight zinc oxide.) It is our personal impression that R-610 would not be satisfactory for SWP Gloss White, especially considering some concession in our color due to the use of co-fumed leaded zinc, that we use some manganese drier and do not use bleached oils.

Tint Base Formulas

Because of the rain, it was difficult to get much information from examination of tints and colors. However, I received the definite impression that tint bases with zinc oxide were brighter and cleaner than those with leaded zinc, but both held more color than the non-reactive TiO_2 - extender tint bases. The latter looked "anemic." This is of definite interest to us in both gloss and flat house paints, but must be checked both in northern and southern areas.

There was one particularly interesting series of tints which rather sketchy notes indicate was put out in May, 1955. There were four basic tint base pigmentations:

1. Conventional R-610/leaded zinc/talc oil paint.
2. R-610/acicular zinc oxide/calcium carbonate (2-1/2# ZnO) oil paint.
3. R-610/ " " " / " " (1# ZnO) oil paint.
4. Non-reactive pigmentation R-610/talc alkyd paint.

The paints are exposed as whites and as tints. The tinting pigments included lampblack, phthalo blue, phthalo green, Green Gold, chrome yellow, molybdate orange and Parachlor Red. As general impressions, Paint No. 2 looks the best all around, Paint No. 3 shows a slight increase in mold and dirt over No. 2, while Paint No. 4 in most cases shows fading. Chrome yellow shows bad fading with the non-reactive pigmentation, less in the oil paints. Green Gold looks quite good, but best in the alkyd No. 4. Cadmium yellow also shows bad fading

with the non-reactive pigmentation but is much better with the zinc oxide containing oil paint. Ti-Tint Yellow is better than R-610 tinted. Ti-Cal plus zinc oxide with Green Gold faded badly and was dirty. Vancide 89 showed a brown discoloration with phthalo blue.

du Pont's own conclusions are that acicular zinc oxide with specially selected calcium carbonate gives decidedly better tint retention than leaded zinc with magnesium silicate. (Is this due to the zinc oxide or $CaCO_3$ or both?) They believe that the specially selected ZnO may permit a marked reduction in the zinc oxide content of dark dull colored house paints. Their work suggests the use of the normal amount of zinc oxide for bright colors. (But keep in mind the white chalk face we got with Verdas Greens and blues in Florida with zinc oxide present.)

We have paints ready for exposure comparing leaded zinc versus zinc oxide in rather conventional tint bases. This series should undoubtedly be expanded, including both panel and house tests, and adding Oxide (0.7% Pb) to the 18 M paints now in the series.

du Pont has a supplementary series in which Green Gold was used with various extenders, all substituted at equal oil demands. The extenders and results are as follows:

(a) Suprex Clay - fair tint retention.
(b) ASP 400 - not as good as (a), especially in alkyd.
(c) Asbestol Regular - fair tint retention.
(d) Surfex - good, no film failure yet.
(e) Celite - poor color retention, some mildew.
(Think of use in SWP Flat.)
(f) Mytal 300 - fair tint retention.
(g) Perlite Fines - fair tint retention.

We had reported to du Pont that we had seen some instances where R-110 chloride process (same as R-510 chloride process) showed more tendency toward rutile yellowing than R-110 sulfate process. We had sent them one of our sets of panel exposures to show this, and their laboratory agrees our panels are clear exhibits of our point. Up to my visit they had never seen this on their own panels. However, the humid, rainy weather on the day I was at their farm brought out rutile yellowing. The chloride process R-110 or 510 showed definite rutile yellowing, the R-110 sulfate process did not. This caused considerable excitement among the du Pont personnel as the chloride process offers them the best opportunity to expand their production. They undoubtedly will check into this much more thoroughly, using a larger spread of samples. At least it shows our report was valid.

Blister Resistant Paints

We did not inspect the du Pont "blister house," since Bob Bruhn made a trip in April for that precise purpose. His observations are reported as follows:

du Pont Blister Test House

On Wednesday, April 11, Mr. H. G. Whitcomb, S-W Cleveland Technical Service; G. K. Oxley, Acme Quality Paints; D. F. Householder, John Lucas and Company and the writer visited the blister test house of the du Pont Pigments Department, at Wilmington, Delaware. This year their tests represent a study of paint systems on various repaint surfaces. Prior to our visit each of the exposures had been rated for adhesion and blistering by the du Pont personnel. We inspected these tests and our evaluation of the tests agreed with theirs, which are quoted below. Several conclusions may be made based upon these tests.

1. Repaint surfaces even when burned off do not hold paint as well as new wood.

2. Conventional paints with and without zinc oxide perform best when the zinc oxide containing coat is furthest removed from the wood.

3. The best performance on repaint is obtained when the repaint surface is two coats of an aged alkyd type house paint. This is probably due to the complete absence of zinc in both coats. There is no corresponding exposure of a two coat zinc-free oil paint used as a repaint surface.

4. When the old paint is not removed the type of paint used for repaint has little effect upon the degree of blistering or loss of adhesion which occurs on this type of exposure.

5. Aged polyvinyl acetate house paint (as a repaint surface) appears to have better adhesion than does an aged acrylic type emulsion paint system. Manufacturers' recommended formulas were used for this comparison.

Polyvinyl acetate - Elvacet 81-900
Acrylic - Rhoplex AC-33

Ratings of the various paint systems are given below at 4-1/2 months' exposure on the blister house.

Blister Resistant Paints

Paints

Number	Pigment	Pounds per Gallon	Vehicle	Pigment Vol. %
1	FF/R-610/ZnO/Mg Sil.	1.46/0.37/2.76/2.41	75/25-AR/XLO	27.4
2	FF/Mg Sil.	2.00/3.56	Long oil alkyd	30.0
3	FF/R-610/Mica	0.26/2.33/0.29	PVAc/DBP Emulsion	27.0
4	FF/R-610/Mg Sil.	0.50/2.00/0.97	Acrylic Emulsion	25.0
Primer A	R-610/BCWL/BSWL/Mg Sil.	1.15/2.25/2.25/3.35	47/53-Raw/Z-2LO	35.0

Series 14610 Exposed 11/30/55

on the blister test house.

Data at 4-1/2 months

	Average Ratings	
New Wood	Blistering	Adhesion
2 coats ZnO L.O.H.P. (1)	4	0
2 coats Alkyd H.P. (2)	10 -	10
2 coats PVAc H.P. (3)	10	10 -
2 coats acrylic H.P. (4)	10	9
Repaints over Burned-off ZnO H.P.		
ZnO H.P. over zincless primer (a)	2	0
2 coats alkyd H.P.	3 -	0
2 coats PVAc H.P.	9 -	3 -
2 coats acrylic H.P.	9 +	3 -
2 coats PVAc H.P. over non-porous sealer	6	0
2 coats acrylic H.P. over non-porous sealer	5	0
Repaints over 2 coats ZnO H.P., Aged		
ZnO H.P. over zincless primer	4	0
2 coats alkyd H.P.	5 -	0
2 coats PVAc H.P.	4	0
2 coats acrylic H.P.	4	0
Repaints over ZnO H.P. over Zincless primer, Aged		
ZnO H.P. over zincless primer	8 +	2 +
2 coats alkyd H.P.	7 -	0
2 coats PVAc H.P.	7 +	1
2 coats acrylic H.P.	9	5 -
Repaints over Alkyd H.P., Aged		
ZnO H.P. over zincless primer	10 -	10
2 coats alkyd H.P.	10 -	10
2 coats PVAc H.P.	10	10
2 coats acrylic H.P.	10	10
Repaints over PVAc H.P., Aged		
ZnO H.P. over zincless primer	5 +	2 +
2 coats alkyd H.P.	6 +	3
2 coats PVAc H.P.	10	5
2 coats acrylic H.P.	10	7

	Average Ratings	
	Blistering	Adhesion
Repaints over Acrylic H.P., Aged		
ZnO H.P. over zinc-less primer	4 +	0 +
2 coats alkyd H.P.	6 -	2 -
2 coats PVAc H.P.	8 -	1 +
2 coats acrylic H.P.	7 +	2 -

10 - perfect, 0 - complete failure.

A second portion of the du Pont blister house testing is devoted to a comparison of various alkyd vehicles which might be used in the stain resistant type of paint formula. In general there is little to select between the various vehicles from a performance standpoint based on these tests. However, one paint is outstanding from a color and blister resistance standpoint. This paint was made with Spencer-Kellogg oils SP 1003 and 1008 blended 4/1 to accomplish viscosity control. Exposure is being continued separately to test for long range durability.

A third portion of the du Pont blister house testing is devoted to proprietary emulsion paint systems. These are not identified in detail but Dr. Vannoy expressed their conclusion that copolymer PVA paints containing Everflex G or National Starch's 12 K 51 are giving better performance than homopolymer paints containing Elvacet 81-900.

Flat Exterior Paints

During this portion of the du Pont inspection the rain was really a downpour and it was physically impossible to make any notes or even very significant inspections. Since the current series were started in November and December of 1955 and January, 1956 it is obviously too early for any results. Observations will continue next year. The sample of SWP Velvet Flat White du Pont has used seems to have a stronger pink cast than we have seen in regular production.

Exterior Masonry Paints

Because of the weather we had little opportunity to make notes on the du Pont masonry paints, so we quote verbatim from their booklet, starting with the formulations and proceeding to their conclusions.

A) "TI-PURE" R-610/FF/Mica--2.53/0.26/0.29 in 87/13 polyvinyl acetate/dibutyl phthalate at 27% P.V. This is a water-thinned emulsion paint.

B) "TI-PURE" R-610/Mica--2.59/0.29 in 87/13 polyvinyl acetate/dibutyl phthalate at 27% P.V. This formula is also a water-thinned emulsion paint.

C) "TI-PURE" R-610/FF/Talc--1.60/0.40/1.85 in acrylic emulsion at 30% P.V. Another water-thinned formula.

D) "TI-PURE" R-610/Talc--2.00/1.86 in acrylic emulsion, 30% P.V.

E) "TI-PURE" R-610/Barytes/Mg Sil./Mica--1.48/4.43/0.74/0.74#/gal. in styrene-butadiene copolymer solution plasticized with chlorinated paraffin at 35% P.V.

F) "TI-PURE" R-610/Acic.ZnO/Mg Sil./Diatom.SiO$_2$--1.77/0.50/2.00/0.70 #/gal. in vehicle (E) at 37% P.V.

G) Linseed oil house paint over a zincless primer such as Federal Specification TT-P-25a.

H) "TI-PURE" FF/High Oil Mg Sil.--2.00/3.00 #/gal. in a long oil, low viscosity alkyd at approximately 26% P.V.

Most of the series are exposed north and south vertical on Western red cedar, south vertical on glazed and cement-coated asbestos shingles and 45° S on yellow pine.

Conclusions

Polyvinyl acetate emulsion paints, acrylic emulsion paints and styrene-butadiene copolymer solution paints such as (E) and (F) aforementioned, are the only compositions tested which showed good performance on new glazed asbestos shingles. Most other systems failed by lack of adhesion.

The polyvinyl acetate and the acrylic emulsion paints also gave good performance on new wood as far as they have been tested, except for staining from Western red cedar and redwood.

On several house tests, it has been observed that where water-thinned paints were used as repaints over old weathered paints, the whole paint system failed by peeling from the wood or stucco substrate, or the new paint peeled off the old paint. More work is required before it is known how to use these paints successfully for repainting.

For porous cement veneer shingles, compositions such as (A) to (H) gave good results.

Standard white house paint compositions as tested show good performance on gray uncoated shingles.

If colors are involved, good initial color uniformity on surfaces of varying porosity is achieved with compositions such as (B), (D), (E) and (F).

Excellent fade resistance in emulsion paints is shown by the following colors:

"Monastral" Blue Paste	BW-372-P
"Monastral" Green Paste	GW-749-P
"Green-Gold" Paste	YW-613-P
Parachlor Red	RT-427-D

We made a few supplementary observations where latex or emulsion paints were part of a larger series. In series 11266 exposed in February, 1954, both acrylic AC-33 and PVA 81-900 paints still look good over both glazed and unglazed asbestos shingles. In another series 14512 exposed in November, 1954, Martin-Senour's Colorsel White is O.K. on unglazed shingles but off the glazed shingles, while PVA 81-900 and AC-33 paints are still O.K. on both. The AC-33 paint is the whitest. In tint series AC-33 shows good tint retention at 28% PVC and 81-900 good at 26.7% PVC.

du Pont House Tests

Insofar as weather permitted observations were made of some of the du Pont house tests. Comments are listed below.

1. "Duneport," Greenville, Delaware (formerly Amy du Pont house)

This house was repainted in August, 1954 over previous oil paint. Prior to repainting effective control of some moisture problem areas resulted from installation of louvers and exhaust fans. Some trouble areas still exist. Blistering still occurs on some areas where the system of a zincless primer followed by a zinc containing top coat is used over weathered zinc containing oil paint, but not where this combination is used over patches of bare wood. An R-610/FF/mica 81-900 PVA emulsion paint over weathered oil paint is now showing some peeling, but it seems to be the answer where used over bare wood patches.

The test paints and test areas are varied and the weather did not favor long examination or notes. However, it may be said that the lead-free zinc oxide paints have a very slight advantage in color over similar paints containing leaded zinc. A lower cost paint carrying 1-1/2 pounds each of zinc oxide and calcium carbonate (actually 1 lb. FF - 0.5 lb. R-610 - 1.5 lb. zinc oxide - 5.8 lb. $CaCO_3$) is fully equal to conventional pigmentations so far. When calcium carbonate is used with one pound of 35% leaded zinc the paint has excellent color due to slightly faster chalking.

2. Clark House, West Haven, Delaware

This house was painted in October, 1953 with two coats of coral tint paint (using red iron oxide). The comparisons are:

(a) R-610/ZnO/$CaCO_3$ primer followed by R-610/BCWL/BSWL in oil vehicle.

(b) Same as (a) but top coat self-primed.

(c) R-610/Mg silicate in alkyd, with 0.2% FMO, self-primed.

The alkyd paint shows better gloss retention and less dirt collection, and less nail head rusting.

3. Summers House, Wilmington, Delaware

This house is shaded considerably. It is a stucco house, previously unpainted. It was painted in October, 1954, using two coats of white paints of the following compositions:

(a) 2.33 lb. R-610/0.26 lb. FF/0.29 lb. Mica at 27.7% PVC in PVA 81-900.
(b) As (a) but diatomaceous silica in place of mica.
(c) 1.8 lb. R-610/0.20 lb. FF/1.86 lb. Mg silicate at 30% PVC in AC-33 acrylic.
(d) 1.6 lb. R-610/0.18 lb. FF/0.51 lb. zinc oxide/2.04 lb. Mg silicate/0.76 lb. silica in Pliolite S-5.

The acrylic paint (c) showed mud cracking within a week while the PVA paints showed very little, but the mud cracking has not progressed. All the paints still look good. No differences are observable whether mica or diatomaceous silica is used with PVA. The acrylic paint (c) has a slight gray cast on the northeast side, the Pliolite S-5 paint (d) a slight yellow cast.

4. Humphrey house, Wilmington, Delaware

This is a brick and wood house previously painted with oil paint. It was painted with two coats of white paint in May, 1954. Two paint systems were compared, a more or less conventional FF/R-610/nodular zinc oxide/Mg silicate oil primer followed by an R-610/leaded zinc/Mg silicate oil top coat, and self-primed PVA 81-900 paint at 27% PVC using 2.07 lb. R-610/0.52 lb. FF/0.29 lb. mica.

The PVAc paint showed definitely better appearance and freedom from dirt, but had started to peel from the oil paint on the bottom board on the northeast side. There was also some peeling of the entire paint system where PVAc was applied over old oil paint on the wood on the southeast side. The same paint system on the brick is starting to show intercoat peeling on the bricks next to the ground. The peeled sections have been touched up (10/21/55) by removing the paint down to the wood and applying two coats of the PVAc emulsion paint.

Dr. Vannoy feels very strongly that his future polyvinyl acetate paints will be formulated at 20% PVC. This will put pressure on opacity and counters commercial practice, but his panel tests (on wood) point to rapid failure for high PVC paints.

5. Kiser House, New Castle, Delaware

This house had siding of porous buff asbestos shingles, not previously painted. In July of 1954 two coats of light green (P.C. Green) paints were applied, as follows:

(a) R-610/Mica in PVA 81-900 at 27.8% PVC.
(b) R-610/Mg silicate in AC-33 at 30% PVC.
(c) R-610/ZnO/Mg silicate/silica in Pliolite S-5 at 57.1% PVC.
(d) Oil paint tint base over oil primer.

The comparison test area is on the rear or north side of the house. The Pliolite S-5 paint (c) is showing the most fading, the PVA paint (a) seems to have faded some but has good general appearance. The oil paint is doing well. The AC-33 paint seems to have darkened some, and it collected more dirt in the early stages of exposure.

6. Heckman House, New Castle, Delaware

This is a previously unpainted but weathered buff asbestos shingle house, which was painted in October of 1955 with two coats of emulsion paints tinted with phthalo blue. The comparison test area is on the south or rear side. The paints used are:

(a) R-610/Mica in PVA 81-900 at 26.7% PVC.
(b) R-610/Mg silicate in AC-33 at 25% PVC.
(c) R-610/calcium silicate/mica in copolymer PVA Polytex 600 at 31.6% PVC.
(d) R-610/ZnO/mica/silica in styrene butadiene emulsion at 30% PVC.

The rest of the house is done with paint (a) and looks very nice. On the test area, the styrene butadiene paint (d) has already faded badly. The PVA 81-900 homopolymer paint 81-900 shows slight fading and some water spotting. The other PVA paint (c) using the copolymer Polytex 600 (Jones-Dabney) shows only very slight fading and no water spotting. The acrylic paint (b) has darkened slightly and shows no water spotting. The TiO_2 content of these paints should have been reduced for best results.

7. Allen House, New Castle, Delaware

This house, located directly across from the Heckman house, was not listed as a regular test, so only a limited amount of data was available. It also was an unpainted, weathered asbestos shingle house painted in June of 1954 with test paints in gray. A PVA 81-900 emulsion paint shows some fading, an acrylic AC-33 paint is in good condition with slight darkening, a conventional oil paint is in good condition and a Pliolite S-5 paint shows fading.

In September, 1955 a repaint of each paint was applied in horizontal rows over the vertical test areas. This eventually will give a good compatibility study.

8. Powell House, Wilmington, Delaware

This is a porous asbestos shingle house which had a heavily chalking oil paint on the front end on the foundation only. It was first test painted in June of 1954 with a PVA 81-900 emulsion paint two coats, and with an oil paint primer-topcoat system. The oil paint over oil paint adhered well but the PVA paint peeled badly from the chalky oil paint on the front of the house. The peeling paint was removed by steaming and scraping. In August of 1955 after this removal of the peeling paint Sears tung oil surfacer conditioner reduced to 30% solids was applied on these areas. Then two coats of the PVA paint were applied on the front dormers and porch gable, three coats elsewhere on the repaired areas. The PVA paint crawled in one spot over the conditioner suggesting that conditioners must be absorbed or they might cause trouble.

The PVA repaint is still holding well except on the painted cement foundation where no conditioner was used. Here peeling has started once more. Dr. Vanney is still withholding judgment as he has had cases where an emulsion paint has done well for a time and then failed rather suddenly.

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Titanium Pigment Corporation, Sayville, N. Y.

Titanium Pigment Corporation has no house tests so all exposures examined at Sayville were panels.

Quality Control Titanox RANC

Each three months TPC puts out a series of automotive alkyd enamels in which they expose four production lots of Titanox RANC, two lots each of the corresponding competitive non-chalking rutile titanium oxides R-610 and OR-640. Standard lots of Titanox RA, RA 50 and Titanox RANC are repeated in each group. Some lots of RA 50 are compared with R-510 and OR-540. Exposures are at 45° south, all enamels tinted, with tinting colors varied from group to group.

There are variations in comparative quality from one group to another. As was said earlier, by selection one could show superiority for any one of the oxides in each class. Rather consistent trends are shown for superior color and gloss retention for RA 50, confirming TPC's previous claims. Most of the Calco OR-640 panels show a yellow undertone. The du Pont R-610's are consistent at a good level of tint retention, although exceeded by most of the RA 50's, some RANC's and one OR-540. There are some inconsistencies in all of the groups. Usually RA 50 is superior to R-510 or OR-540 in that order but there are some reversals. A much broader evaluation would be necessary to prove comparative qualities on a sound statistical basis.

Again as stated before we were concerned about the inferior performance of one lot of Titanox RANC, which performed at about the RA level. This shows too tolerant acceptance of chalk level for shipment, and even though rare, could cause serious customer complaints. TRC states that this was called sharply to the attention of their production department and this error should not be repeated.

Commercial Paints

One set of these paints was prepared in June of 1952 as three coats self-primed on cedar and white pine and exposed north and south vertical. Lead in oil, of course, is badly eroded with bad checking in what film remains. 60/30/10 lead-zinc-extender paint is checked and worn as would be expected. A "Ti-Sil" type of pigmentation, 50% 35 leaded zinc/50% titanium magnesium is in much better condition but flaking at the lower edges of the panels. A paint with 55% leaded zinc, 14% Titanox AMO, 13% Titanox AA and 18% magnesium silicate is still better.

Among the commercial paints SWP Gloss White is in good condition except on the one bad pine board which has been mentioned in previous years. Devoe's paint is very yellow and does not present a good appearance. Patterson-Sargent's white is good on the south but mildews badly on the north exposure. Benjamin Moore's is fair, with some erosion. National Lead's #110 white is whiter than SWP 471 on the north but is showing slit cracking, not evident on Rx 471.

The same series were put out in June, 1953 on the same surfaces. Both the lead and oil and the 60/30/10 are behaving as expected, with much less failure than was shown by the additional year of exposure of the 1952 series. The 60/30/10 paint is much better on cedar than on white pine, behaving as expected from the classification of woods. The 'Ti-Sil' type of paint shows slight edge flaking on the south and is thinner on the north than the commercials discussed below.

In the 1953 series of commercial paints SWP Gloss White is in perfect condition south and north, except for the slight yellow cast on the north. Benjamin Moore paint is in very good condition, as is Patterson-Sargent, except that the latter again shows mildew, this time slight on both south and north. National Lead's #110 is quite good on the south and good on the north, but shows a few cracks on the south exposure.

White House Paints - Addition of Rutile Titanium Oxide

These paints are applied as two coats self-primed on cedar and white pine siding exposed in June, 1952. The series is divided into two groups, the first carrying 50% leaded zinc and 30% magnesium silicate, with the 20% of titanium as indicated below. The second group is a lead-free formulation with 35% of zinc oxide, 22% magnesium silicate and 23% of calcium carbonate. In all cases the north verticals are simply in somewhat better condition than the south and therefore the results will be reported only for the south exposures as they vary with the titanium oxides used.

Leaded Zinc Group

(a) 20% Titanox AMO. Eroded.
(b) 7% Titanox AMO and 13% Titanox RA 10. More film remaining than on (a) but rutile yellowing.
(c) 10% Titanox AMO/10% Titanox RA. Slight rutile yellowing.
(d) 15% Titanox AMO/5% Titanox RA 50. Whiter.
(e) 15% Titanox AMO/5% Titanox RAHC. White.

Lead-free Group

(f) 20% Titanox A 168. Cracking.
(g) 7% Titanox A 168/13% Titanox RA 10. Cracking.
(h) 10% Titanox A 168/10% Titanox RA. Cracking less than (g).
(i) 15% Titanox A 168/5% Titanox RA 50. As (h).
(j) 15% Titanox A 168/5% Titanox RAHC. As (h).

In the second group there is still cracking on the north and the general condition of the lead-free group from the standpoint of film integrity is not as good as the leaded zinc group. This does not agree with du Pont's findings. We checked another series put out in June of 1951, representing at this time five years of weathering. The pigmentations were varied as shown below and the present conditions of the panels are reported:

(a) 15% Titanox AMO/38.5% PbZn (35% leaded)/13.7% BCWL/30.8% Mg silicate. Slight cracking.
(b) As (a) but remove leaded zinc, using zinc oxide ZZZ-35. Slightly more cracking than (a).
(c) No BCWL but using 50% leaded zinc. Condition as (a).
(d) As (b) but extender equal parts of magnesium silicate and calcium carbonate at equal bulk. Best of series.

While this confirms to some degree Dr. Vannoy's ideas, the real improvement is an association of removal of lead and the use of some carbonate. The use of both magnesium silicate and calcium carbonate seems a good practice.

White House Paints - Effect of Reducing Reactive Pigment Content on Appearance and Durability

This series was put out in June, 1953 as two coats self-primed on cedar and white pine. Basically the pigmentation carries 310 pounds of Titanox RCHT and 85 pounds of Titanox AMO. The variations are in the amount of 35% leaded zinc and in the extender. The current condition of the panels will be reported in relation to the amount of leaded zinc and type of extender for both south and north exposures.

(a) 350 pounds 35% leaded zinc/130 pounds magnesium silicate. Good on south, with slight flaking at lower edge of white pine siding panels. Good on north.

(b) 260 pounds 35% leaded zinc/175 pounds magnesium silicate. This and (a) are the best paints in the series, with (b) showing slight cracking on white pine and slightly thinner on the north.

(c) 130 pounds 35% leaded zinc/220 pounds magnesium silicate. Bad mildew on the south and very bad mildew on the north.

(d) 135 pounds 35% leaded zinc/215 pounds calcium carbonate. Poor color on the south, slight cracking on white pine south and slight dirt and very slight mildew on the north.

Paint (d) of course, was much thinner in viscosity than paint (c) because of the lower oil demands of calcium carbonate. However, (c) versus (d) does show the advantage in mildew control for calcium carbonate.

High Hiding One Coat House Paints

These paints were applied in November of 1953 as one coat of high hiding paint over one coat of primer on cedar and white pine siding. At this time SWP 476 One Coat White is in perfect condition on both south and north vertical exposures. The same is true of Jones Blair. Pittsburgh Plate Glass one coat house paint looks thinner on the south but the film condition is good both south and north. Devoe one coat house paint has the poorest appearance of the commercial one coat paints, having a gray color and bad brush marks on the south and definitely more dirt on the north. Sooony's one coat house paint shows some dirt on the south and definite mildew on the north. Incidentally, the one coat house paints were also applied one coat on bare wood, although it was understood that this would not be the supplier's recommendation. Actually, these one coat films looked very good for 2-1/2 years' south exposure.

TPC experimental paints in this series include the following:

(a) 30% Titanox A 168/25% Titanox RCHT/30% zinc oxide/15% magnesium silicate at 33% PVC in 75% refined linseed/25% Z_g bodied linseed. This film looks good both south and north exposure, but has some brush marks.

(b) As (a) except that the titanium is 15% Titanox AMO and 15% Titanox RA. This paint would be ruled out because of rutile yellowing from the RA.

(c) This is a non-reactive pigmentation in an oil modified alkyd vehicle with chlorinated paraffin at 33% PVC. The films look quite good on both south and north at this point. We should watch this series for ultimate behavior of the films. Also, it should be noted that TPC favors the inclusion of 25% of chlorinated paraffin in the paint vehicle because of better retention of film in the latter stages of exposure.

Non-reactive Pigmented House Paints

This series was put out as two coats self-primed on cedar and yellow pine siding south and north vertical in October of 1952. The purpose was to check the durability and appearance of lead and zinc-free paints compared with more conventional paints carrying lead and/or zinc. The formulations involved and their current conditions are as follows:

(a) Reactive Pigmentation

10% Titanox AMO/10% Titanox RA/35% Leaded Zinc/16% BCWL/ 25% Magnesium silicate in bodied linseed/refined linseed vehicle. In good condition, but yellow on both south and north.

(b) Non-reactive Pigmentation

28% Titanox AMO/28% Titanox RA/44% Magnesium silicate in oil modified alkyd with 25% Chlorowax 70. The films of this paint look thin, both south and north on yellow pine. Probably should have used Titanox RA 50 to control erosion.

(c) Reactive Pigmentation

10% Titanox AMO/10% Titanox RA/50% Leaded Zinc/ 30% Magnesium silicate in bodied oil/refined linseed. Flaking on yellow pine south exposure, in fair condition on the north.

(d) Reactive Pigmentation

13% Titanox A 168/12% Titanox RA/35% Zinc Oxide/
40% extender in bodied linseed/refined linseed oil vehicle.
In good condition south and north but has yellow cast on north.

(e) Non-reactive Pigmentation

28% Titanox AM0/72% Titanox RCHT in oil modified alkyd vehicle with 25% Chlorowax 70. Again, this non-reactive pigmented paint is thin on both north and south exposures, especially on yellow pine. This formula is not recommended by TPC because of some early experience with color troubles in the wet film. It should be pointed out that in addition to the control of erosion claimed by TPC for Chlorowax 70, they also say it improves or eliminates water spotting. In the (b) paint the erosion has gone to the point where there are some long cracks in the film. Both non-reactive pigmentations carry 20¢ worth of TiO per gallon.

White Cement Coatings

The paints in this series were applied in September of 1951 as two coats without reduction on weathered (6 months) glazed and unglazed asbestos shingles and on stucco. The formulations involved are as follows:

(a) House paint primer
30% Titanox RCHT/40% RCWL/
30% Magnesium silicate.

(b) 50% Titanox RCHT/25% Zinc Oxide/
25% Magnesium silicate in limed oil.

(c) 50% Titanox RCHT/30% Zinc Oxide/
20% Magnesium silicate in a vehicle composed of 67% limed oil and 33% linseed.

(d) 50% Titanox RCHT/25% Zinc Oxide/
25% Magnesium silicate in 80% limed oil and 20% long oil alkyd.

(e) 60% Titanox RCHT/40% extender
in Pliolite S-5.

(f) 57% TiO_2/43% Magnesium silicate
in oil modified alkyd vehicle
with 25% Chlorowax 70.

We list the current results under the surfaces indicated.

Paint	Glazed Shingles	Unglazed Shingles	Stucco
(a)	Flaking, mildew.	Good	Gray, spotty
(b)	Flaking	Good	Mostly off
(c)	Very good	Good	Some flaking
(d)	Very good	Good	Some flaking
(e)	O.K.	Good	Some flaking
(f)	Mostly off	Good; white.	Very good; white.

Tint Base Paints

This series of yellow and green tints was put out in June of 1953 as two coats self-primed on cedar and white pine. The purpose of the test is to compare the tint retention of paints pigmented with rutile titanium oxide against rutile titanium calcium. The basic pigmentation of the first group is 15% Titanox RANC/20% Zinc oxide/65% extender. The present condition of these panels is as follows, rating against the extender used:

Extender	Yellow	Green
Natural dry ground calcium carbonate	Dirty, deep.	Best, more yellow.
Aluminum Silicate	Some fading	Some fading, chalking and blue.
Terra Alba/Natural Calcium Sulfate	Some fading; less than aluminum silicate.	Chalking, blue
Lorite	Average	Some fading and chalking, but more yellow.

In the second group the pigmentation is 50% Titanox RC/20% zinc oxide/30% extender.

Extender	Yellow	Green
Natural Dry Ground Calcium Carbonate	Cleaner than with RANC	No notes
Aluminum Silicate	Some fading	" "
Terra Alba/Natural Calcium Sulfate	As aluminum silicate.	" "
Lorite	As aluminum silicate.	" "

In comparing the two groups the paints based on Titanox RC seem to have a slight edge over those based on RANC, except with the greens. While no specific notes were taken on the greens in the second group, I did make special note of the fact that the greens were prepared using a blend of phthalo green and ferrite. The inferior performance of the greens based on Titanox RC was described by Frank Smith as due to the ferrites. He said ferrites should never be used with "C" pigments. I did not get a further explanation from him on this point. Incidentally, note that terra alba is not showing exceptional tint retention as it did in some series reported last year.

Exterior Tint Base Paints

This series of tint base paints was exposed in October of 1955 as two coat work on asbestos shingles and on cedar siding to determine the best type of coating for use as an exterior tint base. At the present time the most interesting observations are on the asbestos shingles. The paints are all yellow, tinted with chrome yellow, which TPC agrees is a mistake because of the intended use on the alkaline asbestos shingles.

Keeping this in mind, the first paint actually is a fairly standard oil tint base paint formulated with Titanox RANC, zinc oxide, calcium carbonate and the chrome yellow, over the regular TPC MH-1177 Primer. It is mottled over the asbestos shingles, probably due to saponification, and is not particularly uniform over cedar siding. The second paint is formulated with Titanox RC, zinc oxide and the chrome yellow and also is mottled over the asbestos shingles.

The more interesting group consists of two coats self-primed of a flat alkyd exterior paint, an acrylic, an Everflex G PVA copolymer and a butadiene styrene emulsion paint. In this group the flat alkyd pigmented with Titanox RC, calcium carbonate and chrome yellow is the best in the group and uniform. Both the acrylic and PVA emulsion paints show slight fading. The butadiene styrene paint has definitely more fading than the others.

Exterior Latex Paints

This group of paints put out in September, 1954 was described in the 1955 inspection report. These were a group of emulsion paints applied on a variety of surfaces as indicated in the data below in order to determine the durability of different types of emulsion paints over a variety of surfaces. The weathered asbestos shingles were treated on the left one-half of each panel with silicone solution. The pigmentation of all the paints is 70% Titanox RANC/30% Magnesium silicate, at 35% PVC. The current condition of the panels is as follows:

Surface	Butadiene Styrene 512 K	Polystyrene RES 92	PVA Copolymer Everflex G	PVA Homopolymer HC-130	Acrylic AC-33	AC-33 + 25% Glyptal 2503
2 coats on weathered asbestos shingles	O.K.	Peeled off silicone	O.K.	O.K.	O.K. Slightly whiter.	O.K.
2 coats on glazed asbestos shingles	O.K.	Peeled	O.K.	O.K.	O.K.	O.K.
2 coats on weathered stucco	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
2 coats on new cedar siding	Fair, some stain*	Bad flaking, some stain.	Some cracking, some stain.	Some cracking, some stain.	Some cracking, some stain.	O.K. Some stain.
1 coat over W.P. Primer on new cedar	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
1 coat on chalky paint	Peeled	Peeled	Peeled	Mostly gone.	Quite good.	Best
2 coats on cement block	Gray spotting, peeling.	Gray spotting, peeling.	O.K.	O.K.	O.K.	O.K.

*Hard rain previous day.

Exterior Emulsion Exposures

This is actually a comparison of two series of paints, one acrylic AC-33 and the other a polyvinyl acetate copolymer Everflex G, both pigmented to 35% PVC with the combinations listed below. The paints were applied two coats without reduction over unglazed asbestos shingles in November of 1954. The condition of these panels in June, 1955 was described in the last report. Basically there has merely been a progression of chalking since that time so no new readings are included here.

The pigment combinations are as follows:

70% Titanox RA 50/30% Magnesium silicate
70% Titanox RANC/30% Magnesium silicate
100% Titanox RC
100% Titanox RCHT
100% Titanox C 50
57% Titanox RA 50/13% Titanox A 168/30% Magnesium silicate
35% Titanox RA 50/35% Titanox A 168/30% Magnesium silicate
14% Titanox RA 50/55% Titanox A 168/31% Magnesium silicate

The first paint showing visible chalking in the above group, going down the series, is the one in each series pigmented with RCHT. From there on through the remainder of the series chalking increases quite rapidly. It is interesting to note that in the very early stages of these exposures the AC-33 paints were slightly gray. They are now chalking faster than their PVA counterparts and are therefore whiter.

Exterior Emulsion Paints

This entire group of polyvinyl acetate copolymer Everflex G paints was put out in November, 1954 as two coats without reduction over unglazed cement asbestos shingles. This series was also described in the 1955 inspection report. The pigmentation is 70% Titanox RA 50/30% Magnesium silicate, but with increasing PVC's running 15%, 20, 25, 30, 35 and 40%.

Since this pigmentation tends to control chalking there is little difference in these panels to date. TPC points out, however, that had the Titanox RA 50 been modified with 2% of Titanox AA there would have been much greater differences in chalking, increasing rapidly at the higher PVC's.

Exterior Emulsion Exposures

This series, also described in the 1955 report, compares various emulsions in a basic pigmentation of 70% Titanox RA 50/30% Magnesium silicate, all at 35% PVC. The paints were applied one coat without reduction on weathered painted surfaces which were chalking and as two coat work on weathered asbestos shingles which were wet just before painting. The various emulsions used and their condition at this time on the two surfaces are described below:

Emulsion	Painted Wood	Asbestos Shingles
Everflex G co-polymer PVA	Gone	Good
WC-130 post plasticized PVA	Gone	Coming off
Cal Ink post plasticized PVA	Gone	Coming off
Beechnut EC-101 copolymer PVA	On	Small blisters
National Starch 12 K 51 copolymer PVA	On	Good
Polycrown AX post plasticized PVA	On	Good
Polyco 522 post plasticized PVA	On	Good
TS-22 post plasticized PVA	Coming off	Good
du Pont 81-900 post plasticized PVA	On	Slight failure
Monsanto SC post plasticized PVA	Coming off	Good
AC-33 acrylic	On	Good
512 K butadiene styrene	Off	Starting to fail
762 W butadiene styrene	Off	Good
Saran vinylidene chloride-acrylonitrile	Off	Bad flaking
Hycar 1552 Acrylonitrile-Butadiene	Off	Very bad flaking (worst)
Vinac P-100 copolymer PVA	On	Good
BKS 92 Polystyrene	Off	Bad flaking

Mildew Tests

This series of paints was put out in January of 1953 using a pigmentation of 5% Titanox AMO/35% Titanox RCHT/30% Zinc Oxide/30% Magnesium silicate at 33⅓ PVA in a linseed oil vehicle consisting of 75% refined linseed oil and 25% of Z$_2$ viscosity bodied oil. The paints were applied as two coats on cedar panels and exposed north vertical. The test was to determine the effectiveness of various film preservatives when 10¢ worth of each film preservative was added to a gallon of paint. The amounts were based on the market prices at the time of exposure. The results are reported below, with the original costs per pound of the additives and the condition of the panels.

1.	No film preservative.		Bad mildew.
2.	Super Ad-It di (phenyl mercury)dodecenyl succinate	$1.70 per pound	Starting to mildew at lower edge.
3.	Phenyl Mercuric Octoate	$1.75 per pound	More mildew than (2).
4.	Phenyl Mercuric Oleate	$0.68 per pound	More mildew than (3).
5.	Phenyl Mercury Naphthenate	$1.64 per pound	Bad mildew.
6.	Butrol - Phenyl Mercuric Acetate and Potassium Orthophenylphenate	$0.77 per pound	Slight mildew.
7.	Bufen 30 - Phenyl Mercuric Acetate	$1.25 per pound	Good control of mildew; best in series. Has not shown corrosion in can.

8.	Butrol 8 - Phenyl Mercuric-8-oxyquinoline	$1.75 per pound	Good control of mildew.
9.	Copper-8-quinolinolate	$1.16 per pound	Bad mildew

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National Lead Company - Sayville, N. Y.

There was very little time available to review the National Lead Company exposures. We spent most of the time discussing their inhibitive pigment M 50 basic lead silico chromate. They have just published an excellent brochure entitled, "Defense in Depth" describing the characteristics and properties of M 50, formulations and paint systems, recommended uses and a color card. It is understood that local representatives will distribute copies of this brochure to our interested technical personnel or they will receive it by mail. We suggest that you get one for your files.

The National Lead Company is conducting an active promotional campaign among state and government specification units to show that M 50 will replace red lead in their metal protective paints at a cost saving and with certain advantages. The low tinting strength of M 50 permits shading to all kinds of tints and colors. We saw panels of M 50 tinted with red iron oxide, with lampblack, P.C. Green, Nippon Orange, Mapico Light Lemon, and used with TiO_2 to produce a wide variety of tints. This permits use of different colors in each coat of a multiple coat system, with corrosion inhibition in each coat. This would eliminate the need for spot priming. Incidentally, National states that so far tests of one coat of aluminum paint with some M 50 included for rust control look good on steel.

National will offer specification agencies one gallon of paint for each coat for test purposes. Inquiries for additional amounts will then be referred to paint manufacturers.

Study of Available Active Pigments for Film Stabilization

This series was discussed in our 1955 inspection report. The condition of the panels remains about as reported then except for normal advance due to the additional year of weathering. It will be recalled that the basic formula carried 1.75 pounds of Titanox AMO in a 5 pound oil vehicle with magnesium silicate varied to maintain the PVC at 33%. Various reactive pigments are compared considering the availability of reactivity as follows:

Zinc oxide - 100%
Basic silicate white lead 45 X - 45%
Basic carbonate white lead - 33%
Basic sulfate white lead - 20%

The weight percentage of available active pigment on the oil was varied from 10% to 20, 40, 55, 80 and 100% with obvious omissions.

The condition of these panels rates them about as in 1955. The film performance in the zinc oxide series improves as zinc oxide is increased from 1/2 to 4 pounds per gallon. One pound of zinc oxide was sufficient to control mildew. In the lead sulfate series the films mildewed at low concentrations and eroded at high concentrations. Basic carbonate white lead also showed mildew at low concentrations and gave grayish films at high concentrations. Basic silicate white lead showed mildew at low concentrations but gave clean films at high concentrations, with better film retention.

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Certain details in all these series were omitted to avoid extreme length of the report. If there are questions as to details not disclosed herein I will be glad to try to give them to those interested.

M. VAN LOO

Director of Paint Research

MVL:AR