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SPECIAL REPORT ON LEADED ZINC EXPOSURES

SUPPLEMENTARY TO RC-64 AND RC-68

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ALLIED RESEARCH LABORATORIES

CHICAGO, ILLINOIS

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SPECIAL REPORT ON LEADED ZINC EXPOSURES

SUPPLEMENTARY TO RC-64 AND RC-68

General Statement

These panels were prepared for exposure in the fall of 1940 by C. H. Adams as Problems 1315 and 1316. In general, they comprise tests at Florida, Chicago and Coffeyville of various Sherwin-Williams and competitive leaded zincs both as co-fumed and mechanically-mixed in Rx 471 of 1/4/40, in Rx 375 of 1/5/40 and in a special high lead titanate formula of Rx 375. The panels are all two coat work on cedar bevelled siding, exposed 90° south. Rx 480 Undercoater is the prime coat used on all panels.

The purpose of this report is to supplement Bulletins RC-64 and RC-68 and to bring up-to-date the exposures of the entire leaded zinc series, both white and tinted. The previous bulletins dealt only with the tint series. In order to present the main conclusions in a reasonably short space, the results are given in the form of general statements in a Summary of Results and Supplementary Observations. These panels were studied just recently with C. H. Adams, this being the second such thorough examination given the panels. Mr. Adams is writing a more detailed analysis, supplementary to one written last year, presenting details of special interest in pigment research.

Correlation between the three sets is still good, with the Florida tests at 36 months time far ahead in general weathering, Coffeyville's at 38 months intermediate, and Chicago's at 40 months showing only the earliest stages of failure. The emphasis in this report will be on the Florida panels because they are farthest advanced, but all indications in any way contrary from other sources will be presented. At one

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time it was thought that the Florida panels could be discontinued, but all are being re-exposed.

Composition of Paints Tested

Rx 471, 1/4/40 Basic Formula

Loaded Zinc 44.8% by weight of pigment

Zinc Oxide 29.1%
Basic Lead Sulfate 15.7

Titanium Dioxide, 2030 T 14.3% " " " "
Asbestine 22.8% " " " "
Basic Lead Carbonate 18.1% " " " "

Vehicle - Regular (5091) treated linseed type; 3 gal.
bodied linseed.

The only departure is in a special lead titanate formula (Panels 4536-7), using 53 lbs. or 5% of lead titanate replacing part of 2030 T on a cost basis.

With some exceptions, the tint series tests the same loaded zines, zinc oxides and white leads in the following basic pigmentations:

<u>Material</u>	<u>Lead Titan- ate type</u>	<u>Non-Chalk TiO₂ Type</u>	<u>Special, Panels 4628-9</u>
Basic Carbonate or Sulfate	10%	10%	9.8%
Loaded Zinc, 65/35	45%	46%	45.2%
Asbestine	20%	30%	29.5%
Lead Titanate	25%	-	5.0%
Non-chalking TiO ₂ , 2031	-	14%	10.5%

The special materials abbreviated in the tabulation of results are:

A. Loaded Zincs

Lohigh 635 - 65/35 type, acicular ZnO in a mechanical mix;
N. J. Z. Co.

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- Lehigh 60 - 65/35 type, co-fumed, low oil absorption, N.J.Z. Co.
- Azo 35 L - 65/35 type, probably co-fumed, American Zinc Sales Co.
- E.P. 30/70 - 70% lead sulfate, 30% zinc oxide, Eagle-Picher Co.
- 412 - Ozlo 65/35, co-fumed

B. White Leads

- Nat'l HTS - high tinting strength basic lead carbonate, National Lead Co.
- S-W HTS - high tinting strength basic lead carbonate, our special
- S-W Q.P. - Quick Process, basic lead carbonate, our 18 dry
- 9 dry - basic lead sulfate, non-acicular
- NABLS - acicular basic lead sulfate, National Lead Co.

C. Zinc Oxides

- ZZZ-33 - Azo acicular, American Zinc Sales Co.
- ZZZ-11 - ditto, slightly greater acicularity
- ZZZ-22 - ditto, highest acicularity
- St. Joe - non-acicular, St. Joseph Lead Co. (Green, A-label)
- XX-50 - Horse Head medium coarse particle size, non-acicular N.J.Z. Co.
- XX-503 - Horse Head large particle size, non-acicular N.J.Z. Co.
- XX-92 - Horse Head small particle size, non-acicular N.J.Z. Co.

Summary of Results

Part I - Mechanical Mixtures

There is no doubt that St. Joseph zinc oxide is the poorest of those tested in durability. Azo-ZZZ-33 appears to be the best zinc oxide for mechanical mixtures. Azo ZZZ-11 and ZZZ-22 (only one sample of

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each tested) are equivalent and appear to show somewhat poorer durability than ZZZ-33. Horse Head XX-503 is slightly superior to XX-50 in four out of five cases; both are quite clearly inferior to ZZZ-33 and superior to St. Joseph.

It is obvious that the mechanically-mixed leaded-zinc paints are inferior to the co-fused in general durability; the latter show no serious checking or cracking at Florida, while many of the former soon nearly ready to flake off.

The white leads used in mechanical mixes are more difficult to distinguish, but one, National's acicular basic lead sulfate is obviously poorest. One might give a slight edge to our 18 dry over our HTS lead, 9 dry and National's HTS, but the differences are slight and vary with the zinc oxides used.

There are no important differences in general appearance except as a result of serious visible cracking.

Tint Series

The tints, in general, do not show the marked differences between co-fused and mechanical-mix formulations as shown in the whites; the outstanding differences are between the 1895 type and the 2031 type. Durability differences probably require no serious consideration at present. Chicago panels show no checking or cracking, Coffeyville very little, mostly microscopic; and Florida considerable to bad, much less than the whites. Since many combinations were not exposed at Florida, it is difficult to fit the slight differences in durability into the general order based on the white series, and no attempt is being made at present. The

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2031 T type seems to have considerably more resistance to checking and cracking than the 1895 type.

The main variations in the tint series are in tint retention and dirt collection, and these are not great except for the contrast between the two formula types, lead titanate and non-chalking titanium dioxide. At this particular stage, the Chicago and Coffeyville panels are of more value in judging these characteristics than the Florida panels, because the latter have been chalking seriously for a long enough time to approach a maximum of fading and a minimum of dirt collection. However, the Chicago exposures are not particularly good at this time for showing either of these characteristics because most of them are holding a great deal of chalk, resulting in very bad fading of the "chalk-mask" type.

The 2031 type of formula shows more fading and less dirt than the 1895 type, in general. The lead sulfates, National acicular and 9 dry, apparently have chalked most and now show less dirt and more fading than the other white leads. This does not show up with the 2031 type; in fact, there are practically no differences due to the various zinc oxides and white leads used in this type. Though they hold a heavy mask of chalk, the amount of dirt held is not serious at present. Only a few cases of difference due to zinc oxide are noticed. The Azo acicular oxides are possibly a bit better in color and cleaning than the others, with XX-503 and XX-50 just slightly poorer and St. Joseph intermediate. (See also General Observations.)

Part II - Co-fumed Loaded Finishes

A. Regular types, White

The Florida results, fairly consistent but not entirely

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conclusive, indicate a definite order of durability for these materials. In a few instances, the Coffeyville panels show enough failure to be of some significance, and they do not agree particularly well with the Florida indications.

National's acicular basic sulfate is clearly poorest of the white leads and 412 best of the leaded zincs, but these are the only materials tested which are outstanding at present. The following order is indicated, based on Florida tests, with certain Coffeyville exceptions noted:

412 best leaded zinc (in resistance to checking and cracking)

Lehigh 60 next best

Azo 35 L, third, but very close to Lehi 60, especially at Coffeyville

Lehigh 635 poorest, but only in two out of four cases, doubtful in another.

S-W Quick Process the best white lead by a slight margin

S-W H.T.S. a very close second, even slightly better at Coffeyville

National H.T.S. a rather poor third

National Acicular sulfate a poor fourth

B. Special Type Formulas, White

The panels testing a 5% lead titanate substitution are good in both durability and appearance at all three locations. 412 and Lehigh 635 seem equal in this formula, which seems to be one of the very best of all the whites.

The Eagle-Picher 30/70 formulations (with zinc oxide added to match the lead-zinc content of the other co-fused materials) show up fairly well but seem to develop checks more than the orthodox leaded zincs.

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XX-92 zinc oxide is poorest in this formula and ZZZ-11 and ZZZ-22 perhaps slightly better than ZZZ-33.

C. Regular Types, Tinted

The previous general remarks as to evaluation apply here also. durability indications are slight; Chicago and Coffeyville results, especially the latter, are best suited for basing general conclusions at present as to appearance characteristics. First, the co-fumed formulations show less instances of serious dirt than the mechanical mixes, although in almost half the cases there is no difference, and the co-fumed show more instances of extreme fading. Second, within the co-fumed group of tints, only the Coffeyville exposures show any differences in dirt or fading and, rather surprisingly, all these differences are in the 2031 type formula. The dirt differences are insignificant; the fading varies from slightly better to slightly worse than the 1895 type.

The main differences in fading due to loaded zincs in the 2031 formula may be summarized as follows:

1. With 18 dry as the supplemental white load, 412 shows slightly worst fading; Azo 35 L, Lohigh 635 and Lohigh 60 equal.
2. With S-V H.T.S., Lohigh 60 is slightly poorest, others equal.
3. " National H.T.S., all are equally poor in fading.
4. " " Acicular basic sulfate, 412 is poorest, the others equal and definitely better.

The last group, probably because of very slow chalking, is best as to color, while group 3 is slightly worst. Incidentally, the Chicago exposures verify the good color of National Acicular sulfate

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in practically the only case where they show a difference among the co-fumed samples.

D. Special Formulas, Tinted

The Eagle-Picher formulations show up as well in tint retention as the average of the regular groups just cited, except that with XX-92 and possibly ZZZ-11 zinc oxides, it is not quite as good. Incidentally, XX-92 in this instance also shows notable microscopic cracking.

The special 1/3 1895, 2/3 2031 blond shows excellent durability and fair self-cleaning, but the tint retention is nearly as poor as the poorest of the co-fumed formulations just mentioned. Lohigh 635 and 412 dry perform equally well in this formula.

4015	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4016	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4017	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4018	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4019	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4020	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4021	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4022	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4023	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4024	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4025	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4026	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4027	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4028	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4029	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4030	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4031	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4032	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4033	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4034	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4035	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4036	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4037	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4038	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4039	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4040	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4041	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4042	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4043	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4044	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4045	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4046	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4047	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4048	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4049	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4050	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4051	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4052	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4053	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4054	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4055	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4056	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4057	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4058	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4059	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4060	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4061	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4062	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4063	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4064	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4065	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4066	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4067	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4068	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4069	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4070	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4071	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4072	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4073	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4074	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4075	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4076	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4077	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4078	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4079	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4080	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4081	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4082	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4083	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4084	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4085	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4086	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4087	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4088	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4089	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4090	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4091	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4092	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4093	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4094	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4095	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4096	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4097	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4098	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4099	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)
4100	1/3 1895 + 2/3 2031	(S)	(S)	(S)	(S)

Examination at 36 months Florida Exposure, Whites

Panel No.	Test Materials	Chalk	Check	Crack	Mildew	Dirt	Gen. App.
Part I - Mechanical Mixtures							
4500 F	ZZZ-33 & Nat. HTS	B	A	(C) m	(B)	S	P
4501	St. Joe & Nat. HTS	VB	A	VB	C	S	VP
4502	XX-503 & Nat. HTS	B	A	B	C	(S)	P
*4541	XX-50 & Nat. HTS	B	A	C	S	S	(G)
4503	ZZZ-33 & S-W Q.P.	B	A	S	C	S	P
4504	St. Joe & " "	B	A	VB	(B)	S	VP
4505	XX-503 & " "	B	A	(S) m	C	(S)	(F)
*4542	XX-50 & " "	B	(S) m	(C)	S	S	(G)
4506	ZZZ-33 & NABLS	B	A	(B)	(B)	S	VP
4507	St. Joe & " "	VB	A	VB	S	(C)	P
4508	XX-503 & " "	B	A	VB	C	(C)	P
*4543	XX-50 & " "	B	A	VB	C	S	(F)
4509	ZZZ-33 & 9 dry	B	A	S	C	S	(F)
4510	St. Joe & " "	B	A	VB	S	C	P
4511	XX-503 & " "	B	A	(C)	C	S	P
*4544	XX-50 & " "	B	A	B	C	S	(F)
4512	ZZZ-33 & S-W HTS	B	A	C	(C)	S	(F)
4513	St. Joe & " "	B	A	VB	C	S	P
4514	XX-503 & " "	B	A	(B) m	(B)	S	P
*4545	XX-50 & " "	B Ten.	A	B	(C)	S	F
4515	ZZZ-11 & Nat. HTS	B	A	(B)	C	S	(F)
*4517	ZZZ-22 & Nat. HTS	B	A	(B)	C	S	(F)
4518	412 & S-W Q.P.	B	A	VS m	C	(C)	(F)
4520	Lehi 635 & S-W Q.P.	B	A	(C)	C	(C)	(F)
4521	Lehi 60 & " "	B	A	(S)	(B)	(C)	(F)
4522	Azo 35 L & " "	B	A	(S) m	C	S	F
4523	412 & S-W HTS	B	A	tr	(C)	S	F
4524	Lehi 635 & S-W HTS	B	A	tr	(C)	S	F
4525	Lehi 60 & " "	B	A	(S) m	(C)	S	F
4526	Azo 35L & " "	B	S m	(C)	C	S	(F)
4527	412 & Nat. HTS	B	S m	S	C	S	F
4528	Lehi 635 & Nat. HTS	B	S m	(B) m	C	S	F
4529	Lehi 60 & " "	B	S m	(B) m	(C)	S	F
4530	Azo 35L & " "	B	S m	(C)	(C)	S	F

* Actual exposure time only 32 months

** Panel 4515 omitted. This panel is identical with 4519 in all respects.

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Examination at 36 months, Florida Exposure, Whites (cont'd.)

Panel No.	Test Materials	Chalk	Check	Crack	Mildew	Dirt	Gen. App.
4531 F	412 & NABLS	B	S m	C m	(B)	S	(F)
4532	Lehi 635 & NABLS	B	S m	B	(B)	S	(F)
4533	Lehi 60 & "	B	A	B	(B)	(C)	P
4534	Azo 35L & "	B	S m	C	C	(C)	(F)

B. Lead Titrate Special Type

4535	412 & S-W Q.P.	B	A	tr	(C)	C	(F)
4536	Lehi 635 & S-W Q.P.	B	A	tr	C	S	F

C. Eagle-Picher Special Types

4537	XX-92 and E.P.	B	A	VB	C	S	(F)
4538	ZZZ-11 " "	B	C m	(C)	(C)	S	F
4539	ZZZ-22 " "	B	S m	C	(C)	S	F
4540	ZZZ-33 " "	B	(C) m	C m	(B)	C	(F)

Guide Paint

4518	Rx 471, C 680	B	A	A to (S)	(C) to C	(S) to (C)	F to (F)
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Examinations

Chicago - 40 months						Coffeyville - 38 months					
Panel No.	Chalk	Check	Crack	Dirt	Gen. App.	Chalk	Check	Crack	Dirt	General App.	
Part I - Mech. Mix.											
4500	C	A	A	(C)	(F)	(B)	A	C	(S)	(G)	
01	C	S m	(C)	(C)	(F)	VB	C m	B	(S)	(G)	
02	C	A	A	(C)	(F)	(B)	A	S m	(S)	(G)	
*4541	C	A	A	(C)	(F)	C	A	(B)	"	"	
4503	C	A	S	(C)	(F)	(B)	A	A	(S)	(G)	
04	C	"	VS	"	"	"	S m	(B)	"	"	
05	C	"	VS	"	"	"	S m	C	"	"	
*4542	"	"	(S)	"	"	"	A	(B)	"	"	
4506	"	"	A	"	"	"	S m	C	"	"	
07	"	"	S	"	"	B	A	B	"	"	
08	"	"	VS	"	"	C	A	(B)	"	"	
*4543	"	"	A	"	"	B	A	B	"	"	
4509	"	"	VS	"	"	C	A	S	"	"	
10	"	"	S	"	"	(B)	A	(B)	"	"	
11	"	"	VS	"	"	C	A	C	"	"	
*4544	"	"	A	"	"	C	A	(B)	"	"	

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Examinations (cont'd.)

Chicago - 40 months

Coffeyville - 38 months

Panel No.	Chalk	Check	Crack	Dirt	Gen. App.	Chalk	Check	Crack	Dirt	General App.
4512	C	A	A	(C)	(F)	C	A	S	(S)	(G)
13	"	"	(S)	"	"	C	A	B	"	"
14	"	"	(S)	"	"	C	A	C	"	"
4545	C	"	A	"	"	(B)	A	B	"	"
4516	"	"	tr	"	"	C	A	A	"	"
17	"	"	(S)	"	"	"	A	A	"	"

Part II - Co-famed - A. Regular Type

4519	C	A	A	(C)	(F)	C	A	(C)	(S)	(G)
20	"	"	(S)	"	"	"	"	A	"	"
21	"	"	A	"	"	"	"	VS	"	"
22	"	"	"	"	"	"	"	(C)	"	"
23	"	"	(S)	"	"	"	"	VS	"	"
24	"	"	A	"	"	"	"	tr.	"	"
25	"	"	"	"	"	"	Sm	S	"	"
26	"	"	tr.	"	"	"	A	tr.	"	"
27	"	"	VS	"	"	"	"	(C)	"	"
28	"	"	A	"	"	"	"	C	"	"
29	"	"	VS	"	"	"	"	(C)	"	"
30	"	"	A	"	"	"	"	VS	"	"
4531	"	"	(C)	"	"	"	"	tr.	"	"
32	"	"	VB	"	"	"	S	(B)	"	"
33	"	"	B	"	"	"	Sm	(C)	"	"
34	"	"	C	"	"	"	Sm	S	"	"

B. Lead Titanate Special Type

4535	C	A	tr	(C)	(F)	C	A	A	(S)	(G)
36	"	"	A	"	"	"	"	VS	"	"

C. Eagle-Picher Special Type

4537	C	A	VB	(C)	(F)	B	Cm	B	(S)	(G)
38	"	"	(C)	"	"	C	A	S	"	"
39	"	"	C	"	"	"	Sm	(S)	"	"
40	"	"	Cm	"	"	"	Sm	S	"	"

Guide Paint

4518	C	A	A to (S)	"	"	C	A to Sm	A to	"	"
								(C)		

General Notes:

1. No flaking on any panels.
2. Dirt rated separately from mildew, as far as possible.
3. All Coffeyville panels show hail marks; no serious failure due to them so far.

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Examination of Tint Series - Florida, 36 months

Panel No.	Test Materials	Chalk	Check	Crack	Mildew	Fade	Dirt	Gen. App.
Guide								
4546 F	Rx 375, C 450	(B) to B	tr. to C	A to (C) m	(C) to C	(B) to B	S to C	F
Part I - Lead Titanate Type								
A. Mechanical Mix								
4547 F	ZZZ-33, Nat. HTS	B	B m	(C) m	C	B	(C)	F
4548	St. Joe, " "	B	(B) m	(C) m	C	B	S	F
4549	XX-50, " "	B	B m	(C) m	C	B	S	F
4550	XX-503, " "	B	B m	S m	C	B	C	F
4551	ZZZ-33, 18	B	(B) m	S m	C	B	S	F
4552	St. Joe, 18	-	-	-	-	-	-	-
4553	XX-50, 18	B	C m	S m	S	B	S	F
4554	XX-503, 18	-	-	-	-	-	-	-
4555	ZZZ-33, NABLS	-	-	-	-	-	-	-
4556	St. Joe, " "	-	-	-	-	-	-	-
4557	XX-50, " "	VB	B	B m	C	(B)	C	F
4558	XX-503, " "	-	-	-	-	-	-	-
4559	ZZZ-33, 9	-	-	-	-	-	-	-
4560	St. Joe, 9	-	-	-	-	-	-	-
4561	XX-50, 9	B	(B)	B m	C	(B)	C	F
4562	XX-503, 9	B	-	-	C	(B)	(C)	F
4563	ZZZ-33, S-W HTS	(B)	C	B m	(C)	B	(C)	F
4564	St. Joe, " "	VB	B	B m	C	(B)	(C)	F
4565	XX-50, " "	B	C	B m	(C)	(B)	(C)	F
4566	XX-503, " "	(B)	C	B m	(C)	(B)	(C)	F
4567	412, 18	C	(B) m	(C) m	(C)	(B)	(C)	F
4570	1526, 18	(B)	C m	(S) m	C	(B)	C	F
4571	Lehi 635, 18	-	-	-	-	-	-	-
4572	Lehi 60, 18	-	-	-	-	-	-	-
4573	Azo 35L, 18	-	-	-	-	-	-	-
4574	412, S-W HTS	(B)	C m	(S) m	C	B	C	F
4575	Lehi 635, " "	(B)	(B) m	S m	C	B	C	F
4576	Lehi 60, " "	(B)	C m	(C) m	C	B	C	F
4577	Azo 35L, " "	(B)	(B) m	C m	C	B	C	F
4578	412, Nat. HTS	(B)	S	C m	C	B	C	F
4579	Lehi 635, Nat. HTS	(B)	(B) m	(C) m	C	B	C	F
4580	Lehi 60, Nat. HTS	(B)	C m	C m	C	B	C	F
4581	Azo 35L, Nat. HTS	(B)	C m	(B) m	C	B	C	F

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Examination of Tint Series - Florida, 36 months (cont'd.)

Panel No.	Test Materials	Chalk	Check	Crack	Mildew	Fade	Dirt	Gen. App.
4582	412, NABLS	(B)	C m	C m	C	B	C	F
4583	Lehi 635, NABLS	(B)	C m	S m	C	B	C	F
4584	Lehi 60, NABLS	(B)	(C) m	(S) m	C	B	C	F
4585	Azo 35L, "	(B)	C m	VS m	C	B	C	F
4586	E.P. 30/70, XX-92	(B)	C m	C m	C	B	C	(F)
4587	" " , ZZZ-11	(B)	C m	(S) m	C	B	C	F
4588	" " , ZZZ-22	(B)	(B) m	(S) m	C	B	C	F
4589	" " , ZZZ-33	(B)	(B) m	S m	C	B	C	F

Part II - 2031 T Type

A. Mechanical Mix

4590	As 4547	(B)	S	C m	C	B	C	(F)
4591	As 4548	-	-	-	-	-	-	-
4592	As 4549	(B)	C	(B) m	C	B	C	(F)
4593	As 4550	-	-	-	-	-	-	-
4594	As 4551	(B)	S m	tr	C	B	C	(F)
4595	As 4552	-	-	-	-	-	-	-
4596	As 4553	(B)	A	(C) m	(C)	VB	(C)	P
4597	As 4554	-	-	-	-	-	-	-
4598	As 4555	(B)	(B) m	C m	C	B	C	(F)
4599	As 4556	-	-	-	-	-	-	-
4600	As 4557	(B)	(B)	(F) m	(C)	B	(C)	F
4601	As 4558	-	-	-	-	-	-	-
4602	As 4559	(B)	C m	VS m	C	B	C	F
4603	As 4560	-	-	-	-	-	-	-
4604	As 4561	(B)	C	B m	C	B	C	(F)
4605	As 4562	-	-	-	-	-	-	-
4606	As 4563	(B)	C m	D m	C	(D)	C	(F)
4607	As 4564	-	-	-	-	-	-	-
4608	As 4565	(B)	C	C m	C	B	C	(F)
4609	As 4566	-	-	-	-	-	-	-
4611	As 4568	(B)	S m	S m	C	B	C	(F)
4612	As 4569	(B)	C	(B) m	C	B	C	(F)

B. Co-fumed

4610	As 4567	(B)	A	(C) m	C	B	C	(F)
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Examinations

Chicago - 37 months							Coffeyville - 38 months					
Panel	Gen.						General					
No.	Chalk	Check	Crack	Fade	Dirt	App.	Chalk	Check	Crack	Fade	Dirt	Appearance
Part I - Lead Titanate Type												
A. Mechanical Mix												
4547	(C)	A	A	(B)	C	F	C	A	tr m	(B)	(C)	(G)
4548	(C)	"	"	"	"	"	"	"	(S)m	"	"	"
4549	"	"	"	B	(B)	(F)	"	"	"	"	"	"
4550	(B)	"	"	"	VB	VP	"	"	A	"	"	"
4551	"	"	"	"	B	P	"	"	"	"	"	"
4552	"	"	"	"	"	"	"	"	"	"	"	"
4553	"	"	"	"	"	"	C	Sm	(C)m	(B)	(C)	(G)
4554	(C)	"	"	"	"	(F)	"	"	"	"	"	"
4555	"	"	"	VB	C	"	"	"	"	"	"	"
4556	"	"	"	"	"	"	"	"	"	"	"	"
4557	"	"	"	"	"	"	C	A	C m	(B)	(C)	(G)
4558	"	"	"	"	(C)	(F)	"	"	S m	"	"	"
4559	"	"	"	"	"	"	"	"	A	"	"	"
4560	"	"	"	"	"	"	"	"	S m	"	"	"
4561	C	"	"	"	C	"	"	"	(S)m	B	S	F
4562	"	"	"	"	"	F	"	"	"	"	"	"
4563	"	"	"	B	B	P	"	"	A	(B)	"	(G)
4564	"	"	"	"	"	"	"	"	C m	"	"	"
4565	"	"	"	"	"	"	"	"	(R)m	"	"	"
4566	"	"	"	"	(B)	"	"	"	(S)m VS m	"	"	"
4568	(C)	"	"	"	"	"	(C)	"	A	C	(C)	"
4569	"	"	"	"	"	"	"	"	"	"	"	"
B. Co-fired												
4567	C	A	A	VB	C	(F)	C	A	VS	B	S	F
4570	"	"	"	VVB	(C)	"	"	"	A	"	B	"
4571	"	"	"	"	"	"	"	"	"	"	"	"
4572	"	"	"	"	"	"	"	"	"	"	"	"
4573	"	"	"	"	"	"	"	"	"	"	"	"
4574	"	"	"	"	C	"	"	"	"	"	"	"
4575	"	"	"	"	(C)	"	"	"	"	"	"	"
4576	"	"	"	"	"	"	"	"	"	"	S	"
4577	"	"	"	"	"	"	"	"	"	"	"	"
4578	"	"	"	"	"	"	"	"	"	VB	"	"
4579	"	"	"	"	"	"	"	"	"	"	"	"
4580	"	"	"	"	"	"	"	"	"	"	"	"
4581	"	"	"	"	"	"	"	"	"	"	"	"

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Examinations (cont'd)

Panel No.	Chicago - 37 months						Coffeyville - 38 months					
	Chalk	Check	Crack	Fade	Dirt	Gen. App.	Chalk	Check	Crack	Fade	Dirt	General Appearance
4582	C	A	A	VVB	(C)	(F)	C	A	A	VB	S	F
4583	"	"	"	"	"	"	"	"	"	"	"	"
4584	"	"	"	"	"	"	"	"	"	"	"	"
4585	"	"	"	"	"	"	"	"	"	"	"	"
4586	"	"	"	"	"	"	"	"	"	"	"	"
4587	"	"	"	"	"	"	"	"	"	B	"	"
4588	"	"	"	"	"	"	"	"	"	VB	"	"
4589	"	"	"	"	"	"	"	"	"	"	"	"

Part II - 2031 Type

A. Mechanical Mix

4590	C	A	A	VVB	C	P	C	A	A	B	S	(G)
4591	"	"	"	"	"	"	"	"	(C)m	"	"	"
4592	"	"	"	"	"	"	"	"	A	"	"	"
4593	"	"	"	"	"	"	"	"	"	"	"	"
4594	"	"	"	"	"	"	"	"	"	"	"	"
4595	"	"	"	"	"	"	"	"	Cm	"	"	"
4596	"	"	"	"	(C)	F	"	"	"	"	"	F
4597	(C)	"	"	"	"	(F)	"	VS m	A	"	"	(G)
4598	S	"	"	VB	"	VB	"	tr m	A	B	S	"
4599	(C)	"	"	"	"	"	"	VS m	(C)m	B	"	"
4600	"	"	"	"	"	"	"	"	"	"	"	"
4601	"	"	"	"	"	"	"	(S)m	(S)m	"	"	"
4602	"	"	"	"	"	"	"	A	A	"	"	"
4603	"	"	"	"	"	"	"	(S)m	(S)m	"	"	"
4604	"	"	"	"	"	"	"	A	S m	"	"	F
4605	"	"	"	"	"	"	"	"	A	"	"	"
4606	"	"	"	"	"	"	"	"	"	(B)	"	(G)
4607	"	"	"	VVB	"	"	"	S	(C)	"	"	"
4608	"	"	"	"	"	"	"	"	"	B	"	F
4609	"	"	"	"	"	"	"	A	Sm	"	"	"
4610	Key to Designations:						"	"	"	"	"	"
4611	"	"	"	"	"	(P)	"	"	A	"	"	(G)
4612	"	"	"	"	"	"	"	"	"	"	"	"

C - Chalk
 S - Slight
 A - Abundant
 VVB - Very
 (C) - Considerable
 (F) - Fair
 (P) - Poor
 (G) - Good
 (B) - Bad
 (S)m - Slight
 (C)m - Considerable
 (F)m - Fair
 (P)m - Poor
 (G)m - Good
 (B)m - Bad
 (S)m - Slight
 (C)m - Considerable
 (F)m - Fair
 (P)m - Poor
 (G)m - Good
 (B)m - Bad

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Examinations (cont'd)

Chicago - 37 months								Coffeyville - 38 months					
Panel No.	Test Mat.	Chalk	Check	Crack	Fade	Dirt	Gen. App.	Chalk	Check	Crack	Fade	Dirt	Gen. App.
B. Co-umed													
4610	As 4567	C	A	A	VVB	(C)	F	C	A	A	VB	S	F
4613	As 4571	(C)	"	"	VB	"	(F)	"	"	"	B	"	"
4614	As 4572	"	"	"	"	"	"	"	VS m	"	"	"	"
4615	As 4573	"	"	"	"	"	"	"	VS m	"	"	"	"
4616	As 4574	"	"	"	"	"	"	"	tr m	"	"	"	"
4617	As 4575	"	"	"	"	"	"	"	(S) m	(S) m	B	S	F
4618	As 4576	"	"	"	VVB	"	F	"	VS m	A	VB	S	F
4619	As 4577	"	"	"	"	"	"	"	A	A	B	S	(G)
4620	As 4578	C	"	"	"	"	"	"	"	"	VB	"	F
4621	As 4579	"	"	"	"	"	"	"	"	"	"	"	"
4622	As 4580	"	"	"	"	"	(F)	"	"	"	"	"	"
4623	As 4581	"	"	"	"	"	F	"	"	"	"	"	"
4624	As 4582	"	"	"	"	"	"	"	"	"	"	"	"
4625	As 4583	(C)	"	"	B	(C)	"	"	"	S m	(B)	"	(G)
4626	As 4584	"	"	"	"	"	"	"	"	"	"	"	F
4627	As 4585	"	"	"	"	"	"	"	"	S m	"	"	"
4630	As 4586	C	"	"	VB	"	(F)	"	"	C m	B	S	"
4631	As 4587	C	"	"	"	"	"	"	"	A	"	"	"
4632	As 4588	(C)	"	"	B	"	"	"	"	"	"	"	"
4633	As 4589	"	"	"	"	"	"	"	"	"	"	"	"

C. Special Formulas

4628	412-18	C	A	A	VB	(C)	(F)	C	A	A	B	S	F
Using 1/3 of 1895, 2/3 of 2031													
4629	Same, but Lehi 635-18	C	A	A	VB	(C)	(F)	C	A	A	B	S	F

Key to Designations:

A - Absent	V - Very
S - Slight	E - Excellent
C - Considerable	G - Good
B - Bad	F - Fair
P - Poor	(-) - Less than
m - microscopic	

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Supplementary Observations

A number of comments, difficult to place prominently in the General Statement and in the Summary of Results, should be stated. First, the Florida exposures at three years did not show, in general, enough extremes of failure to justify final conclusions. Therefore, the Florida panels will be exposed at least another year and the Chicago and Coffeyville panels several more years, and special studies will continue.

The general pattern of failure for both co-fumed and mechanically mixed leaded zincs seems to be that of cracking. Most of the checking observed is of two types: (a) microscopic, which will probably develop into cracking, perhaps even before it becomes visible to the unaided eye, and (b) visible defects which look like checking, but which on close examination are seen to be either short cracks or checks which are apparently expanding and deepening to form cracks.

Little mention of chalking is necessary now. On all the Rx 471 type paints at Florida it is very heavy, at Chicago moderate and at Coffeyville moderate to heavy but with no particular relation to the other characteristics. About the same is true of the tints, except that the general level is lower. St. Joseph zinc oxide and National acicular sulfate are associated with excessive chalking, while the 1895 type tint formula, in general, has not exceeded (except on some of the Florida panels) the "considerable" level.

The Coffeyville panels, in general, are obviously cleanest. The difference, in this respect, as compared to Chicago is very striking.

A number of special materials and formulations require some special mention. For instance, the use of 5% of lead titanate in the

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0007-SWP-000114074

Rx 471 co-fumed formula seems to result in unusually good durability and appearance at all three locations. The Eagle-Picher 30/70 formulations, with the better zinc oxides, are above average in both durability and appearance in both whites and tints at this stage. This is the only group, apparently, with a tendency to check rather than crack. St. Joseph zinc oxide, condemned as responsible for serious early cracking in the Rx 471 formulations, shows up quite favorably in durability in the tints. It is also quite satisfactory in appearance characteristics now, although not so good at certain earlier stages. National acicular basic lead sulfate, also notably poor in the whites, looks good as to color-retention in Rx 375 and is up to the average in durability. At Chicago, it appears that this is due to a rather slow chalking rate, plus the fact that the chalk formed is not very adherent. This condition is also generally true of St. Joseph zinc oxide and is quite different from their behavior in Rx 471.

It should be noted that the appearance of the Chicago series may change greatly in a few months, whereas the Florida and probably the Coffeyville panels have passed the stage of major changes in dirt and fading.

April 25, 1944

J. W. Chapin

0007-SWP-044705

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