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contrary, a large number of companies (going well beyond the six defendants and their predecessors in this case) manufactured these pigments and paints and lead-in-oil containing the pigments. Lead carbonate pigments were manufactured in many grades (not all white lead pigments were the same), for a wide variety of uses (most of them not the interior of residences), by a wide variety of marketing channels and through a variety of marketing approaches. In addition, many other different lead pigments and other lead compounds were used in paints.

2. The concentrated, unitary picture painted by plaintiffs is factually incorrect because:

(A) Hundreds of companies marketed paint containing lead pigments of various types and other lead compounds;

(B) Scores of companies produced and marketed lead-in-oil containing lead carbonate pigments;

(C) Given the wide variety of uses of lead carbonate pigments, significant differences existed among the prices and grades of white lead carbonate that were manufactured;

(D) Fierce brand competition existed among the manufacturers of lead carbonate pigment leading customers to insist on clear identification of the manufacturer of the lead pigment carbonate products being delivered to them.

(E) By the 1930's non-lead pigments, especially lithopone and titanium dioxide, had been found to produce interior paints that were less costly and had greater hiding power and washability than lead pigment containing paints;

(F) Accordingly, by the 1930's, lead carbonate containing paints and lead-in-oil were used almost exclusively in painting surfaces other than the interiors of residences, and the company and trade association marketing practices reflected this use pattern;

(G) The most consistent supporter of use of lead carbonate pigment containing paint and lead-in-oil throughout the 1930's and 1940's and into the 1950's was the United States Government.

(H) Lead carbonate was not the only lead compound used in paint; many companies marketed other lead pigments (including leaded zinc oxide, lead chromate, lead sulfate, litharge, lead titanate) and other lead compounds used as paint driers (e.g., lead naphthenate, lead octoate); these uses persisted after the 1930's and they -- not use of lead carbonate -- are likely to be the source of lead found in paint in NYCHA apartments today.

Qualifications

3. I am currently a Principal Research Scientist for The Paint Research Association (PRA) in the United Kingdom. My work preparing this affidavit has been done at the request of counsel for Glidden, NL and ARCO and represents my personal opinions. I am not speaking for PRA. Prior to beginning work with the Association in 1997, I was employed by ICI from 1959 to 1997. During most of my career at ICI my responsibilities involved the formulation of paint with much of my experience being in the formulation of architectural finishes for wood, but also formulation of coatings for marine vessels and automobiles. I also managed ICI's Paint Knowledge Center, which was the company's information and mathematical services section. During my career, I have worked with scientists throughout the world, including the United States, developing improved paints. In preparing this affidavit, I have also extensively reviewed the available literature on paint and pigment use in the United States. My curriculum vitae is at Exhibit 1.

Paint Formulation

4. Paint is used to cover surfaces; it is typically a mixture of a pigment (or pigments), a binder, the volatile solvents that evaporate after application, and a number of additives including driers. Paint has been defined in several ways, e.g., ASTM D16-47 "a pigmented liquid composition which is converted to an opaque solid film after application as a thin layer." Some of these terms are relative rather than absolute. Pigments, in contrast to dyes, are insoluble in the film form. They confer opacity by either scattering or absorbing light. Scattering is important for white pigments and absorption for dark colored pigments, pastel shades use both mechanisms. Pigments have intrinsic properties, such as density, a refractive index, and extrinsic properties such as particle size, shape and distribution. The latter dramatically modify dependent properties such as opacity, whiteness, gloss, etc. This is important in explaining why different grades of nominally the same material can be promoted against each other and may fill different marketing niches.

5. Although the three principle components of a paint are pigment, binder and solvent, there are numerous additives which carry out specific functions. Catalysts, which speed cross linking of an oil or alkyd resin, are usually described as 'driers' and include cobalt, lead, manganese and other metal soaps. Lead soaps (e.g. naphthenates) are used at a level around 1% based on the non-volatile component of the binder.

6. Developing paint formulations requires many tradeoffs and often takes many years. There is no perfect paint for all uses. The market seeks many different qualities including hiding power, coverage or spreading rate, adhesion, durability, (i.e.

length of time until maintenance is needed and ease of maintenance), gloss, color, fume resistance, drying time, storage stability, application properties, mildew and corrosion resistance, scrub resistance, ease of cleaning and resisting polishing. As a result, changes in paint formulation (including pigment use) often take many years. Once formulations are developed, they must also be tested, another time-consuming step.

7. Market acceptance of new paint formulations is also often slow. Master painters, for example, were strong supporters of use of lead carbonate and continued to demand lead carbonate even when it was otherwise not very popular. The Association of Master House Painters and Decorators of the United States, for example, strongly supported lead carbonate in a 1921 letter to the International Labor Organization arguing against its proposed ban: "Any general prohibition of the use of white lead in painting would result in less permanent and satisfactory work being done." Exhibit 2 at p. 35. Similarly, the U.S. Bureau of Reclamation (1961) stated: "[M]any paints used 10 years . . . ago are still recommended, and their selection rests upon solidly established service. New materials will be adopted as their superiority to the old ones can be verified." Exhibit 3 at p. iii.

Uses of Lead Carbonate Pigment in the Twentieth Century

The Many Uses of Lead Carbonate Pigment

8. Lead carbonate pigment was used for many purposes. It had significant non-paint applications in many industries to manufacture pottery, ink, paper, rubber,

ceramics and vinyl plastics. Lead carbonate pigment was also used in many types of paint: industrial, commercial, and residential.

Paint Uses of Lead Carbonate Pigment

9. The early twentieth century was an era of greatly expanding use of paint. One important reason for this growth was the call for washable surfaces to replace wall paper inside homes. The century began with white lead carbonate being a widely accepted pigment for paint. The movement over the century away from white lead pigment occurred over many decades. Interior residential use declined after 1920 so that by 1930 such use was much reduced and use during the 1930's was negligible. Exterior residential use began to decline late in the 1930's, but use was not totally phased out until the 1970's. Given the slow advancement in paint technological improvements and consumer resistance to new technologies, most paint and pigment formulations continued to be marketed (albeit in relatively small quantities) after better formulations were on the market.

10. Lead carbonate pigment is a good paint pigment. At the beginning of the century – and indeed for the next 50 years – white lead pigments were widely praised in the paint literature as the most foolproof and versatile paint pigments. White lead in linseed oil was noted to have been considered for a long time as the one paint which is “fool proof” (Matiello Vol. III, p. 274, quoting Broeker J.F. Official Digest No. 153, 59-65 (Feb. 1936)). Toch (1907) (at pp. 28-29) (Exhibit 4) had said: “[A]lthough white lead may have its defects there is no other white pigment which is 100% perfect,

and therefore it is only fair to give that time-honored material is proper due". Thirty-three years later, the U.S. Dept. of Commerce, National Bureau of Standards, Letter Circular LC 603 (1940) (Exhibit 5) said: "If one were called upon to decide between white lead and all brands of ready mixed white paint, the answer would be that white lead paint would be the safest to use." White lead carbonate pigment was used by paint companies to manufacture ready mixed paints. White lead pigment was also marketed in the form of lead-in-oil, which was a coating made of pigment and linseed oil, sold with a consistency of peanut butter that required further dilution before application. Lead-in-oil was primarily marketed to master painters. Consumers would rarely have purchased lead-in-oil because it would require purchase of other materials and knowledge of mixing ratios.

11. Lead carbonate pigments also had limitations in their use in paints (most prominently relatively poor hiding power, and relatively high costs) that explain why, as better pigments and paint formulations were developed, other pigments, first lithopone and later titanium dioxide, displaced lead carbonate. For example, the hiding power of titanium dioxide was seven times the hiding power of white lead (as demonstrated in Exhibit 6). Another reason that lead pigments were displaced in paint during this era was that new oils (oleo resins in the 1920's and alkyds in the 1930's) that were incompatible with lead pigments were being developed and used in paints, especially interior paints. These new interior paints were more washable than lead-based paints. This displacement occurred earlier for interior residential uses where

technologically acceptable substitutes were first able to be developed and marketed than was the case for industrial and exterior (including residential) uses.

12. Another development that led to reduced use of lead pigment in residential paint was the development after World War II of latex, water based paints. Lead carbonate pigment could not be used as the prime pigment in latex paints. These paints were very popular among homeowners because they eliminated the need to use solvents in clean up as was required for oil-based paints.

13. During the era of declining use of lead carbonate pigment for interior residential use, lead carbonate pigment manufacturers were also among the most prominent companies marketing the substitute pigments. The FTC's Proposed Findings (p. 10) (Exhibit 7) note that Sherwin-Williams, Eagle-Picher and Glidden (the largest producer) were major manufacturers and marketers of lithopone; National Lead was the leader in developing titanium pigment, and Glidden also manufactured titanium dioxide beginning in 1933. Eagle-Picher was a major producer and marketer of zinc oxide.

**Brand Competition among the Manufacturers
of Differing Lead Carbonate Pigments**

14. Given their many uses and the many methods by which lead carbonate pigments were manufactured (the Dutch, Carter, mild, Euston, and Thompson processes), a wide variety of grades varying in both chemical composition and particle size, distribution and shape were marketed. The amount of lead oxide in lead carbonate pigments varied significantly because it could be made of three different

compounds: (1) $4\text{PbCO}_3 \cdot 2\text{Pb(OH)}_2 \cdot \text{PbO}$; or (2) $2\text{PbCO}_3 \cdot \text{Pb(OH)}_2$; or (3) PbCO_3 (as detailed in Alex Stewart's Federation of Paint and Varnish article on "Lead Pigments and Paints," Exhibit 8). In addition to chemical differences, different white lead carbonate pigments had different specific gravities, bulking values, oil absorption properties, hiding power, and particle sizes and shapes (as detailed in Chapter 13 of Matiello, Carlton H. Rose on "The Lead Pigments," Exhibit 9). As Rose notes (at p. 348), the A.S.T.M. specification for dry white basic lead carbonate in the 1930's allowed the amount of lead carbonate to vary by as much as 10 percent.

15. As National Lead's FTC Brief (at p. 3) (Exhibit 10) noted: "The white leads made by the various respondents are not identical products, but have important differences from the standpoint of quality and performance." National Lead's Dec. 29, 1947, Proposed Findings (§ 4(a) at p. 3) (Exhibit 11) are more specific: "Although most basic carbonate of white lead differs only slightly chemically, the physical characteristics of the material as made by the various methods [Dutch, Leonard, Carter and electrolytic] or by different manufacturers vary considerably, particularly with relation to size of particle, whiteness, hiding power, ease of application or the particular use to which the purchaser may wish to put the product." Similarly, FTC Ex. 649, a Glidden "Official News" newsletter (at p. 2) (Exhibit 12) says: "Euston White Lead in Oil [Glidden's brand] is a much whiter product. It is much finer, than other white lead, will take more oil, and as a result will make 15 to 20% more finishing paint per hundred pounds."

16. Given these distinctive differences among the white lead carbonate pigments marketed by the different manufacturers, each manufacturer used advertising and other marketing methods to develop brand loyalty to their distinctive white lead carbonate products. National Lead, for example, advertised in 1939 (Exhibit 13) through the declaration of its widely recognized Dutch Boy logo stating that he "now [had] 5 to be proud of," his five white lead carbonate pigments that presented a "wide choice" to paint manufacturers giving each "a much better chance to get exactly what he wants" in terms of paint-thickening power, tinting strength and hiding powder. Anaconda (IS&R) advertised in 1935 "three distinct types of electrolytic white lead," and explained why the high, medium, and low absorption qualities of each fitted them to different paint uses (Exhibit 14). Thus, when one painter in another Anaconda advertisement says: "You can't kid me. . . all white leads are alike," the other painter replies: "Oh, yeh?. . . I can see you've never used Anaconda" white lead (Exhibit 15). Each of these firms also emphasized the purity of their pigments; early in the twentieth century many paints were considered adulterated because extenders were used rather than pure pigment.

**Negligible Use of Lead Carbonate Pigments for
Residential Interiors in the 1930s and Later**

17. Given the development of lithopone and titanium pigments, use of lead carbonate for residence interiors was no longer significant during the 1930's. Many sources confirm that, by the 1930's, only negligible amounts of the white lead carbonate pigment were used in residence interiors. This much reduced use of white

lead pigments in interior residences is documented in several bodies of literature as described in the following paragraphs.

The U.S. Bureau of Mines

18. The U.S. Bureau of Mines's 1936 Yearbook highlighted, the dramatic reduction in interior use in an era when exterior use was still increasing. The Yearbook (Exhibit 16) (at 181) noted that white lead production was up 23% over 1935 and went on to say:

"Lead producers attribute this to the growing realization by paint manufacturers that lead is an indispensable ingredient in high-grade exterior paints....[Titanium] products are used extensively in all of the white-pigment-consuming industries, but the principal use to date has been in interior paints....[T]he demand for interior paints since 1932 has been such that the lithopone producers have been able to market increasing amounts of their product in spite of the larger consumption of titanium pigments."¹

Office of Price Administration Formula Collection

19. A comprehensive collection of paint formulas was compiled by the War Production Board's Office of Price Administration (OPA) during the early 1940's as part of the Government's price control activities during World War II. That collection is a unique snapshot of the ingredients in all the paints on the market in the United States at that time. The formulas submitted to OPA indicated whether the paints were for interior, exterior, or other uses, and provided ingredient concentrations for each product. The collection demonstrates the very small number of interior residential

paints containing lead carbonate or sulfate on the market. Of the submitted formulas, only a very small number of the interior or interior/exterior products contained lead carbonate.

20. Based on familiarity with these and other data, WPB Office of Price Administration official W.F. Twombly, Assistant Director Chemicals Bureau, sent a Dec. 11, 1944, memo to Erwin Vogelsang, Director, Tin, Lead and Zinc Division, (Exhibit 17, at p. 1) stating:

“The use of Basic Carbonate of White Lead [B.C.W.L.] in the paint, varnish and lacquer industry for interior paints is negligible. For all practical purposes we can say that the entire consumption of B.C.W.L. is in exterior paints required for the maintenance of property.”

The FTC Investigation

21. The OPA's findings are consistent with information in the FTC investigation of the white lead pigment industry for the period 1930 to 1946:

April 12, 1946 Complaint (§ 5 at p. 803) (Exhibit 18):

“They [white lead pigments] are a principal item used in the manufacture of paint, and the paint produced from such pigments is held in high esteem by builder and users as of the highest possible quality for application to exteriors of buildings, ships and other structures. Such pigments have other important industrial and commercial uses too numerous to mention.”

Footnote continued from previous page.

¹ Emphasis added here and in all other quotations that follow.

Feb. 4, 1953 FTC Findings (¶ 3(c) at p. 821) (Exhibit 18):

“White lead-in-oil...is sold principally to dealers for resale to painters and members of the general public, and its primary ultimate use, after being mixed with additional oil, mineral spirits and dryers, is as an exterior house paint.”

NL's 1947 Proposed Findings of Fact (at pp. 3-4) (Exhibit 11) :

“While formerly basic carbonate of lead was used as one of the principal ingredients in some of the best paints, beginning with 1930 and in subsequent years, basic carbonate of lead in dry form has been used in smaller quantities and in place thereof paint manufacturers have used basic sulphate of lead, lithopone, leaded zinc oxide, titanium dioxide, or a combination of two or more such products with basic carbonate of lead.”

The Industrial Hygiene Literature

22. The movement away from interior use of lead pigments was also well-documented in the industrial hygiene literature. Alice Hamilton, the country's most prominent medical and industrial hygiene authority from 1900 through the 1930's, in extensive studies of all the lead-using industries for the U.S. Department of Labor found:

“Recent Changes in the Painters' Trade,” U.S. Dept. of Labor Bulletin No. 7 (1936) (Exhibit 19) :

Page 6: “The chief use for white-lead paint is in the painting of buildings, the outside work.”

Page 26: “Paints for interior decoration, however, are usually lead free.”

Page 28 in a section specifically on House Painting: "For outside work, lead still maintains its preeminence, but for interior decoration lead paints are giving way to zinc white or, perhaps, leaded zinc."

Paint Literature

23. The professional paint literature also confirms the minimal use of lead pigment in paint for interior uses by the 1930's:

- i. Fred S. Steig, "The Science and Technology of Opaque White Pigments in Coatings," in Applied Polymer Science 250, 548 (J.K. Craver & R.W. Tess, eds. 1975) (Exhibit 20):

"By this time [1926] the introduction of new opaque white pigments having substantially more opacity than the old white lead 'standard' had created considerable interest in practical hiding-power test methods in the coatings industry. White lead was being replaced in almost all interior finishes by lithopone and TITANOX because of lower cost, and methods were needed to assist formulators in matching the hiding power of their modified products with the originals.

- ii. Edward J. Dunn, Jr., "Lead Pigments" in Treatise on Coatings 420 (R.R. Myers & J.S. Long, eds. 1967) (Exhibit 21):

"During the early thirties titanium pigment-extender combinations began to replace lead pigments in interior wall paints as they are more economical to use."

- iii. Carlton Rose, "The Lead Pigments," at 349 (1942) (Exhibit 9):

"[A]lthough used in various types of paint, its [carbonate white lead] principal use is in exterior paints."

24. It is thus not surprising that the LIA White Lead Promotion Program advertisement campaign from 1939 - 1942 predominantly promoted the exterior use of white lead (with the advertisements initially extolling the virtue of 100% white lead in exterior paint and later shifting emphasis to promoting mixed pigment exterior paint).

The same pattern of primarily promoting exterior use is seen in advertisements by the manufacturers of lead carbonate pigment. LIA and the manufacturers recognized that the demand for lead pigments for interior residential use was minimal.

Declining Lead Pigment Production

25. The U.S. Bureau of Mines has collected and published throughout the century production, shipment or sales figures for paint pigments containing metals and other inorganic compounds (almost all paint pigments contain such elements, including lead, titanium dioxide, zinc, sulfur, barium). These data show the dramatic changes over the century in pigment production.² Lead carbonate pigment was the predominant pigment in 1900. Production increased to a peak in 1927, reflecting a period when overall paint sales were rapidly increasing. By the 1920's, lithopone (containing barium sulfate and zinc sulfide) had been accepted as an interior residential pigment and began rapidly displacing lead in the residential interior market; by the late 1920's, titanium dioxide also began displacing lead pigments for interior residential use. The decline in white lead pigment production from 1927 through 1950 is thus largely due to the decline in its use for residential interiors. The following table of U.S. Bureau of Mines data shows these trends. As the data show, there were dramatic reductions in lead carbonate in oil production between 1925 and 1930

² The Bureau of Mines did not collect (and thus never published) data indicating what amount of the various pigments was going into what types of paints. There are thus no
Footnote continued on next page

dramatic reductions in lead carbonate in oil production between 1925 and 1930 (42%), a continuing decline from 1930 to 1940 (28 %), and another dramatic drop from 1940 to 1954 (83 %).

TABLE I
U.S. Pigment Sales/Shipments/Production³

	(in tons)			
	<u>Carbonate Dry</u>	<u>Carbonate-in-Oil</u>	<u>Lithpone</u>	<u>Titanium Dioxide</u>
1910	32,237	111,573	12,655	0
1920	33,678	112,017	89,373	100
1925	43,426	120,479	145,019	2,386
1930	32,548	69,592	164,065	6,284
1935	27,972	68,859	159,486	38,510
1937	32,661	65,552	154,771	55,950
1940	30,115	50,447	151,802	92,339
1945	27,382	23,788	136,161	183,195
1950	27,594	16,778	99,321	347,747
1954	17,359	8,479	39,090	349,857

Footnote continued from previous page
quantitative data on the amount of white lead carbonate pigment that was used in interior paint for any year.

³ Sales for 1910-1944, shipments for 1945-1947, production for 1948-1976. Titanium dioxide pre-1945 data for NL and duPont from exhibits in U.S. National Lead (Exhibit 33).

Companies Manufacturing/Marketing Lead-in-Oil

26. Manufacturers of pigment often marketed lead-in-oil themselves through hardware stores and other distributors to the painter, but lead-in-oil was also produced and marketed by paint companies. As Mr. Sprague of Glidden testified during the FTC proceedings (Tr. at 2525) (Exhibit 22): "Many paint manufacturers purchased dry white lead-in-oil, ground lead-in-oil themselves, and marketed white lead-in-oil under their own brand names." Correspondence in 1934 between the Lead Industries Association and National Lead (Exhibit 23) noted that information collected by the U.S. Census Bureau between 1925 and 1933 indicated at least 81 and up to 104 companies each year were producing white lead-in-oil.

27. In 1935, 1936 and 1937 Thomas' Register of American Manufacturers listed more than thirty companies across the country offering white lead-in-oil. Major companies (other than defendants) producing white lead-in-oil included duPont and Eagle Picher. In New York City, Thomas' listed J. Lee Smith & Co, Inc., Charles and Daniels Whittaker, Inc., and Wishnik-Tumpeer, Inc. Across the river in New Jersey, it listed Hoboken White Lead & Color Works, and J.T. Baker Chemical Co. In Brooklyn, Louis Leavitt Corp. was listed in 1935 and 1936. (Exhibit 24).

28. An illustrative list of more than 50 manufacturer/marketers of lead-in-oil containing white lead pigments between 1925 and 1960 is included in Exhibit 24. These are all companies listed in Thomas' Register of Manufacturers for these years. Other companies marketing white lead-in-oil are included in the Office of Price Administration's 1942 collection of formulas:

Armstrong Paint & Varnish Works

Boydell Bros. Co.

Florman Manufacturing Co.

Hooker Paint and Glass

Jewel Paint & Varnish Co.

John W. Masury & Son

Kuhn Paint & Varnish Works

Steelcote Mfg. Co.

The Groton Co.

Yoder & Gordon Inc.

30. The FTC record contains Milwaukee (WI) Board of Purchase (FTC Ex. 865) (Exhibit 25) lists of bidders offering to sell white lead-in-oil that includes T.C. Esser Co. (Hammar brand), duPont (duPont-Harrison brand), Hooker Glass & Paint (Blue Seal brand), and Wm. F. Zumach Inc. (Zumwach's brand).

**U.S. Government Recommendations for Interior
Use of Lead Carbonate Pigments**

31. The most consistent supporter of use of white lead carbonate pigment in paint was the U.S. Government. The Government strongly promoted lead carbonate pigment use for building exteriors through the 1960's. The Government also continued recommending lead carbonate pigment for interior residences during the post-1930 era when such use had declined dramatically. Most prominently, the

National Bureau of Standards and the U.S. Forest Service continued promoting lead carbonate use on interior residence surfaces through the 1930's and 1940's:

1936: National Bureau of Standards Technical Information on Building Materials (TIBM -33) "Federal Specification Paint Pigments and Mixing Formulas" (Sept. 15, 1936) (Exhibit 26); and National Bureau of Standards Technical Information on Building Materials (TIBM-34) "Federal Specifications for Ready-Mixed Paints, Semipaste Paints and Mixing Formulas" (Sept. 18, 1936) (Exhibit 27) (same sentence in each):

"When painting is done by a skilled painter or under skilled supervision, the straight white lead linseed oil paint, generally mixed on the job is more 'fool proof' and safer to use, as painter generally know more about handling white lead paint than they do about mixed paints."

1937: National Bureau of Standards Letter Circular 489 "Inside Wall Paint for Chemical Laboratories" (Jan. 30, 1937) (Exhibit 28):

"It is well-known that white lead paints, although excellent for other purposes, should not be used for painting chemical laboratories [as they are harmed by chemical fumes]....The usual flat washable wall paints (of the type of Federal Specification TT-P-51a [Exhibit 29, which permits use of "any suitable pigment"] and the usual mill gloss whites (of the type of Federal Specification TT-E-506) are excellent for ordinary interior use."

1938: U.S. Forest Service, "Consumers Guide" (Exhibit 30):

"[Entirely white lead] paint, if used exclusively, remains the best choice for home owners wishing to allow very long intervals...between paint jobs....[This paint] is recommended also for houses in which moisture at times collects behind the painted woodwork."

1945: National Bureau of Standards, "Paint Manual with Particular Reference to Federal Specifications" (Oct. 11, 1945) (at p. 15, 16-18) (Exhibit 31):

"White lead, a component of almost all white and light-colored paints, is one of the most important white and light-colored paint pigments...[For] "Painting interior plaster, wallboard and wood (3 coats), using white lead paste."

The accompanying mixing directions (at p.18) call for "interior plaster, wall board and woodwork" to be covered with "1/2 lead mixing oil" and "1/2 white lead."

Other Lead Pigments and Lead Compounds in Paint and Their Manufacturers

32. White lead carbonate pigments were not the only lead-containing pigments or lead compounds marketed for paint in the twentieth century. Other white pigments include sublimed lead sulphate, leaded zinc oxide, lead titanate and lead silicate. Red lead, molybdate orange, chrome green and litharge were color pigments used for green, yellow, orange and red paint. Additives included lead driers.

33. These other lead compounds continued to be used in paints during the era when white lead carbonate use was declining. The OPA 1942 paint formula collection, notes the presence of such lead compounds in many interior paints, with lead chromate often present for coloring and lead driers often present as additives in modern paint. The collection includes many major U.S. paint companies such as du Pont, Benjamin Moore, Pittsburgh Plate Glass, Sears Roebuck and Valspar that sold paint containing these lead compounds. As noted above, only a few of the interior paints contained lead carbonate pigment, but many interior paints, as well as most exterior paints, contained other lead compounds as pigments or additives. Use of these lead compounds likely accounts for much of the lead detected by NYCHA in its paint surveys over the past ten years because all NYCHA developments were built after 1934. I have reviewed photographs of vacant Williamsburg Houses' apartments

soon to have their paint abated. Those photographs show, for example, many green painted surfaces that likely contain lead chromate.

34. Another manufacturer of lead paint in the 1940s was the City of New York. The City operated its own "paint mixing" facility and purchased lead pigment that it mixed to produce paint for various municipal purposes.

35. The Bureau of Mines reported manufacture of these other lead pigments over the years:

TABLE II

U.S. Pigment Sales/Shipments/Production⁴

	(in tons)				
	<u>Red Lead</u>	<u>Litharge</u>	<u>Sublimed Lead</u>	<u>Leaded Zinc Oxide</u>	<u>Lead Chromate</u>
1910	19,801	23,742	9,858	6,823	
1920	34,431	62,329	13,340	30,460	
1925	41,669	86,546	16,086	31,750	
1930	32,941	72,578	11,527	17,279	
1935	28,776	79,930	8,299	29,976	
1937	33,931	83,902	8,622	40,343	
1940	42,200	89,841	6,200	45,632	
1945	47,381	138,798	3,895	62,598	
1950	34,066	178,225	*	63,194	
1954	26,906	140,084	*	34,318	24,000 ⁵

⁴ Sales for 1910-1944, shipments for 1945-1947, production for 1948-1976.

In addition, zinc oxide, another common paint pigment (whose production exceeded 100,000 tons per year throughout this period) could contain up to 5% lead without being considered leaded zinc oxide by the Bureau.

36. According to the Bureau of Mines, there were several producers of leaded zinc oxide from 1930 to 1960 including:

American Chemet Corp.

Eagle-Picher Co.

Empire Zinc Co.

Mineral Point Zinc Co.

New Jersey Zinc Co. of PA

37. In addition, a number of producers of zinc oxide were also likely to have produced leaded zinc oxide after 1930 (although the Bureau did not specifically indicate such production) including:

American Zinc Co.

American Zinc Oxide Co.

Graselli Chemical Co.

Superior Zinc Corp.

St. Joseph Lead Co.

Footnote continued from previous page

⁵ Patton (1973) "Lead Chromate Pigments" 357, 360

38. Producers of red lead and litharge between 1930 and 1960 included:

Andrews Lead Co.

E.I. duPont de Nemours & Co.

Eagle-Picher Lead Co.

Franklin Lead Oxide Co.

Grasselli Chemical Co.

Hammond Lead Products, Inc.

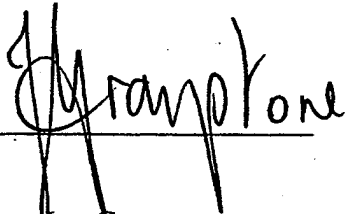
Linklater Co.

IS&R and MacGregor did not produce red lead or litharge.

39. The primary producer of sublimed lead sulfate (white and blue) was Eagle-Picher; National Lead was the only other manufacturer identified by the Bureau, but its production was minimal. NL's Proposed FTC Findings (Exhibit 11) at p. 5.

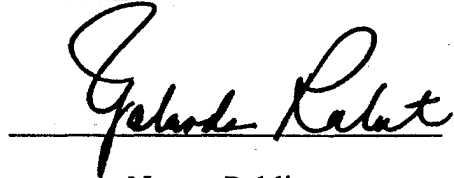
40. Lead chromate was not produced by IS&R, MacGregor Lead, or W.P. Fuller Co. It was produced after 1930 according to Gardner's Raw Materials Index at 498-509 (1939) (Exhibit 32) by Imperial Paper & Color Corp., Krebs Pigment and Color Corp., Western Dry Color Co., The A. Wilhelm Co., John Lucas Co., Kentucky Color and Chemical Company, United Color and Pigment Co., Inc., Ansbacher Siegle Corporation, Fred L. Lavanburg Co., and Mineral Pigments Corp.

41. Lead compounds were also used as through driers in paint. The lead compounds employed for that purpose included lead tallates, lead linoleates, lead naphthenates and lead octoates. Driers are indispensable in alkyd paints. These lead compounds are organic salts that are manufactured by chemical companies distinct from the producers of the metallic pigments.


Jon Graystone

Sworn to before me

this 30th day of March 1999



Notary Public

NOTARY PUBLIC
Notary Public, State of New York
No. 6-4020362
Qualified in New York County
Commission Expires July 14, 1999