TENTATIVE DRAFT
CONFIDENTIAL

WHITE LEAD TECHNICAL COMMITTEE

New York, N. Y. September 28, 1950

A meeting of the White Lead Technical Committee was held on September 28, 1950 in the offices of the Lead Industries Association. The following persons were present:

Present	Representing
Mr. C. H. Adams	Sherwin-Williams Company
Mr. A. C. Coats	Eagle-Picher Company
Mr. C. F. Shobe	The Glidden Company
Mr. J. P. St. George	National Lead Company
Mr. Alex Stewart	National Lead Company
Mr. E. L. Zimmermann	National Lead Company

Mr. Robert L. Ziegfeld, Secretary, Lead Industries Association, Meeting Chairman
Mr. C. J. Vander Valk, Lead Industries Association, Meeting Secretary

CONSIDERATION OF OUTLINE OF BOOKLET ON WHITE LEAD PIGMENTS IN HOUSE PAINTS

The Chairman opened the meeting by asking for comments on the outline of the proposed booklet on the subject of white lead pigments in house paints that had been previously circulated to the committee. The committee was told that a telegram had been received from Mr. A. P. Pahl of the W. P. Fuller Company approving the outline and that a letter had been received from Mr. C. H. Adams containing several suggested changes in the outline. Copies of these communications are attached to these minutes as Exhibits A and B, respectively.

It was decided to review Mr. Adam's written comments in detail and then ask for the comments of the other representatives present. As a result, several revisions in the text of the booklet outline were agreed upon. These were included in a revised tentative draft which is attached to these minutes as Exhibit C.

The following points were agreed upon concerning the dissemination of information on "lead" in house paints.

1. It was decided to use the term "White Lead" frequently in place of "lead" in referring to lead pigments in both the proposed booklet and in future advertising copy, subject to approval by Mr. S. A. Coolidge, Jr. of the Sherwin - Williams Company.

2. It was agreed that specific house paint formulations be omitted from the proposed booklet. It was further agreed that the section on formulation in the booklet be limited to a general discussion and to reference to the federal specifications for house paint primers (TT-P-25) and finish coats (Proposed TT-P-102).

N 2917

3. It was decided to have several typical formulation sheets drawn up to use as a basis for answering requests for specific formulation data. A sub-committee, consisting of C. H. Adams, O. F. Shobe and E. K. Zimmermann was appointed to draw up these formula sheets for the approval of the entire committee.

It was decided that the newly revised booklet outline be circulated among the members of the White Lead Technical Committee for final review before preparing the finished text.

METHODS OF HANDLING REQUESTS FOR ADDITIONAL INFORMATION AS A RESULT OF ADVERTISEMENTS

Several written requests for additional and more specific information on the use of lead pigments in house paints were called to the attention of the committee. The Chairman asked the committee for guidance in handling such requests.

It was decided to withhold any detailed formulation data until the sub-committee (referred to in the previous section of these minutes) has drawn up typical formulation data and the entire committee has had an opportunity to approve these data.

The committee next considered a letter dated August 28, 1950 from E. I. duPont deNemours and Company requesting the composition of the paints used to obtain the graphical data on tensile strength, elongation and water sorption in the first Lead Industries Association advertisement on the use of "lead" in mixed pigment house paints. A copy of this letter is attached to these minutes as Exhibit D.

Mr. Stewart informed the committee that the data used in the advertising copy was obtained on experimental formulations generally considered impractical for marketable paints. He then said that similar data on more practical formulations were available and that he would furnish these for circulation to the committee membership. It was agreed to hold up release of any formulation data to duPont until the committee members have an opportunity to examine the new data and discuss this matter further.

NEW TECHNICAL MATERIAL FOR SUBSEQUENT ADVERTISING

The committee members were informed that new technical material is needed for use in advertisements for 1951 and were requested to review data established at their respective laboratories and test fences with this in mind. It was agreed to do this.

Mr. Adams suggested the following two themes for future advertisements.

1. Increased mildew resistance resulting from the proper proportions of white lead pigments and other pigments.

2. Improved appearance (less dirt collection) of paint films formulated with the proper proportions of "lead" pigments.

Photographs of test fence panels supporting these two points were shown to the committee. It was agreed that the two proposed advertising themes were excellent but that efforts should be made to obtain additional supporting evidence for these claims.

METHODS OF HANDLING TECHNICAL PUBLICITY AND PRODUCTION CLUB PAPERS

The subject of handling future technical publicity and Paint Production Club papers was brought up by the meeting chairman. It was decided to reserve any decisions on the procedures to be followed until several more months had elapsed and the reaction of the paint industry to the white lead program was better known.

C. J. Vander Valk
C. J. Vander Valk

EXHIBIT A

COPY OF TELEGRAM

LEAD INDUSTRIES, ATTN ROBERT ZIEGFELD
420 LEXINGTON AVE.
NEW YORK, NEW YORK

SEPTEMBER 21, 1950

YOUR OUTLINE OF LEAD IN HOUSE PAINTS IS SATISFACTORY TO US =

A. P. FAHL
W. P. FULLER AND CO.
SOUTH SAN FRANCISCO, CALIFORNIA

THE SHERWIN-WILLIAMS CO.
115th Street and Cottage Grove Avenue
Chicago 28, Ill.

September 15, 1950

Mr. Robert L. Ziegfeld, Secretary
Lead Industries Association,
420 Lexington Avenue,
New York 17, New York.

Dear Mr. Ziegfeld:

I have reviewed the copy of the manuscript of the "booklet to be used in the White Lead Advertising Campaign to Paint Manufacturers" as per your letter of September 6th and have also discussed the contents with Mr. Van Loo of our Paint Research Department.

I think you are to be complimented for the fine job that you have done in arranging and organizing this paper. There are a few points, however, which I feel should be called to your attention for review. As most of these involve a question of validity, I hope that I may be quite frank but serious in my discussion of the matter in the interest of being realistic in our approach to the promotion of the usage of lead in paints.

My criticism of the paper in general is that I feel that we are overemphasizing lead without giving proper consideration to the importance of the function of lead in conjunction with other active pigments. The paper gives one the impression that we are asking for a revolution or revolt in modern day formulation back to the use of white lead in oil. If the reader, a paint manufacturer or technician, gets this impression, I believe he would immediately lose interest in the paper as not applying to his case anyway since he makes none and uses little, if any, white lead in oil. Shouldn't we be more realistic to promote the use of lead in conjunction with other pigments? Information of this type should immediately attract the attention of paint manufacturers. Lead plays a very definite function in house paints; zinc plays a very definite function in house paints; the proper combination approaches optimum performance.

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May I say again in making the following suggestions and criticisms that I am doing so with a sincere interest in promoting the use of lead in house paints because I feel that it has a definite place and performs a definite function which no other pigment has, as yet, duplicated. Too often just bold statements carry little weight and illustrations, inadequately identified, will be given only a casual glance. From a technical standpoint I think we should avoid both.

Page 1, 1st paragraph, last sentence. I question the validity of the statement that, "In fact, lead adds more desirable qualities to house paint than any other ingredient." A broad statement like this coming in the first paragraph of the article seems to me to type the contents as bordering on propoganda rather than based on facts. I don't believe we want to give the reader the impression that we are just trying to promote lead without merit. Even if we tone this statement down by replacing "ingredient" with "pigment", the statement would still be questionable, in my opinion. I would recommend that the whole sentence be deleted.

Page 2, II-B - Illustration, Paragraph I. Would we weaken or strengthen our story if we gave the pigmentation for (a) and (b)? To me the illustration is too vague to be forceful. To identify (b) as "no lead" throws the field wide open. Couldn't these be typed as to pigmentation without being unethical?

Page 2, III-A 1. These soaps form "spiney-shaped, microscopic crystals (see photograph) which intermesh to increase the tensile strength ....." It is difficult for me to accept the hypothesis that weak lead soap crystals strengthen the film by reinforcement through intermeshing. I prefer to use possibly a more vague term in this case by saying that "These soaps form spiney-shaped, microscopic crystals (see photograph) which plasticises the film to increase its tensile strength (coherence) and the flexibility (aiding adherence) of the paint film through plasticisation."

Page 3, III-A, 1b. Last Sentence. "It is apparent from this picture how these spiney particles mechanically reinforce the paint film." The inference, here, as stated in III-A 1, is that these soft needle-shaped soap crystals actually make the film tough through reinforcement like steel rods in concrete. Is this possible to do with something that has no cohesion? I would delete the sentence from III-A, 1b, "It is apparent from this picture how these spiney particles mechanically reinforce the paint film."

I believe that lead soaps help to strengthen the paint film but not through mechanical reinforcement under the conditions which they form in a paint film. Maybe I'm wrong because on heating at elevated temperatures lead linoleate becomes hard and tough. Possibly the same action takes place slowly in a paint film but it doesn't seem reasonable to me.

Page 4, III-4c, description of Chart 3, "Note how the flexibility ..... is retained by the mixed pigment paint film in which lead is the reactive pigment." The pigmentation is not stated in the two cases. For emphasis should it not be stated? If lead is the only active pigment in the film, then our position is weakened in comparison to modern formulation with zinc and lead. Unless the composition indicates otherwise, I would prefer to say "in which lead is one of the active pigments" instead of "in which lead is the reactive pigment."

Page 10, VIII, A6. Typographical error in spelling "control". Omit the second "l". I believe this statement that, "Lead makes it possible to control the erosion of the paint film, ..." can be further strengthened based on our exposures by saying that "Lead makes it possible to control the erosion and dirt collection of the paint film, and thus maintains a good surface for appearance and repainting."

Page 10, IX-1. The first sentence in the first paragraph is questionable. Possibly a special interpretation of the meaning of "stand up longer" to exclude appearance might justify such a statement but we shouldn't overlook another function of house painting — decorating and appearance. Possibly to replace "stand up longer" with "give better protection longer" may be more specific and less questionable.

The last sentence of this paragraph coupled with the modification of the first sentence "alone or in combination" just can't be valid by any stretch of the imagination. Compare a white lead in oil exposed film with modern mixed pigment film for appearance and the white lead-in-oil will come out second best in appearance every time. A white lead-in-oil film always looks dirty and gray. I would delete the sentence, "As a result, the paint lasts longer and looks better longer."

Pages 11 to 14-B. Primers. This whole section on primers appears to be too dogmatic largely because of the limits, particularly "absolute minimum" sets. I think the performance based on range of lead is too indefinite to be able to establish such definite limits as given in this section. This weakens the whole story. Furthermore, the statements made as regards to heavy concentration are questionable and I don't believe are supported by either supervised exposure results or practical usage.

This whole section on Primers should be reviewed toward revision but the following suggested changes are specifically offered for considerations

Page 12, B-2. Delete "especially when the lead is introduced in heavy concentration, up to 100% lead." This is a very questionable statement and not supported by our exposure results.

Page 12, C-1. I suggest that the first sentence be revised so as to replace, "..... formulation generally calls for a lead content of from 60% to 90% of the pigment total, with 50% as absolute minimum, ..." with "..... formulation generally calls for a lead content of 50% to 90%, and the balance .....". In other words, delete the 50% minimum and change the range to 50-90%. Even this 50-90% range is liberally high.

Page 12, C-2. Delete, "..... but should never be less than 50%". The statement, that "the lead content can be as much as 100% of the pigment content, ..., to provide the desired priming advantages" is rather far-fetched cost-wise and performance-wise. Of course, the "three-or-more-coat" modification covers up some of the disadvantages of such high lead and precludes that cost is not a factor.

Page 13, C-3. About the same thing applies here as in C-2 as to limits. The minimum 50% lead is questionable.

Page 13, C-4. The statements are still questionable even when limited to the undesirable low 28-30% PVC. It would appear that more up-to-date exposure data are desired.

Page 14, D-1b. The 44% minimum limit is open to severe criticism and, I feel, can't be substantiated. I also question the validity of the high ranges for severe exposure conditions.

(The above references apply to the Tentative Draft, dated August 17, 1950, of "Outline for Booklet on Use of Lead in House Paints.")

I should like to suggest that we give serious consideration to the role that lead plays in conjunction with zinc in reducing mildew collection. Our exposure data are piling up too fast and consistent to ignore the beneficial effect of lead in conjunction with zinc in controlling mildew.

Sincerely yours,

THE SHERWIN-WILLIAMS CO.

C. H. Adams
Auxiliaries Research Laboratory

CHA:af

TENTATIVE DRAFT
September 27, 1950

OUTLINE FOR BOOKLET ON USE OF WHITE LEAD PIGMENTS IN HOUSE PAINTS

I - FOREWORD

White lead pigments have held a high place in the paint industry since paint was first used. This position has been due to the many excellent properties - the many obvious advantages - that only "lead" provides in exterior house paints.

The purpose of this book is to bring to paint manufacturers in condensed, yet relatively complete form, information and data covering general characteristics, chemical and physical properties, and formulation, which help to show

- why white lead is vitally needed in mixed pigment house paints, and
- how white lead pigments should be used to obtain optimum results in a wide variety of mixed pigment house paint formulations.

The present day concept of the use of "lead" for its beneficial chemical reactivity in paints will aid materially in the production of more durable protective and decorative coatings for modern American homes - better paints which produce greater consumer satisfaction and larger sales.

A man's property - his home, his factory, barns and outbuildings or whatever else it may comprise - is his largest investment. It deserves the best protection obtainable, and that is obtainable only through the use of white lead in the paints he uses.

II - THE STABILIZING EFFECT OF WHITE LEAD PIGMENTS

A - The life of outside house paint would be relatively short were it not for a reactive pigment in the paint film. White lead as the reactive pigment performs a very beneficial chemical reaction right in the paint

film as it slowly weathers. Although the quantity of materials involved at any one time is minute, these reactions are highly significant in prolonging the life of the protective film.

1. White lead pigments inhibit premature chemical breakdown of the paint film by preferentially reacting with the organic acids resulting from the normal breakdown, due to oxidation, of the vehicle. If a non-reactive pigment were substituted for the "lead", these acids would accelerate film deterioration.

a) The combination of sunlight, oxygen and water causes a slow breakdown of the vegetable oil vehicles, composed of glycerides of long chain fatty acids, to lower molecular weight acidic compounds, such as formic, hydroxyacetic, propionic, and related acids, which tend to liquefy or soften the film.

b) "Lead" reacts chemically to slowly neutralize these acidic decomposition products of the vehicle by the formation of relatively stable salts, which materially help to prolong the life of the film, and improve its water resistance and other properties.

B - Illustrations:

1. Photograph of two self-primed painted panels, (a) lead pigmented, and (b) no lead, after 30-months, south vertical, exposure in Florida. (Describe as: Conventional White Lead-Zinc-Titanium Extender Paint; Conventional Zinc-Titanium Extender Paint; both in oil conservation type vehicle.)

III - PAINT FILMS ARE TOUGHENED BY WHITE LEAD PIGMENTS

A - Paints containing "lead" are toughened by the lead soaps which are formed by the reaction of the lead with the long chain fatty acids in linseed oil.

1. These soaps form spiney-shaped, microscopic crystals

(see photograph) which plasticize the film to increase the tensile strength (coherence) and the flexibility (sliding adherence) of the paint film. This increases the film's ability to stand up under (a) the stress of the expansion and contraction caused by the relatively large temperature ranges from day to night, and season to season, (b) the differences in the expansion-contraction factors of the paint and the surface to which it is applied and between paint coats, and (c) the degradation of the film due to ultraviolet effects and the adverse effects of water, ice, and snow on the homogeneity of the film. "Lead" also helps to maintain an impervious, unbroken surface to the elements as the film slowly erodes during its life span.

a) Because of the interfacial reaction between white lead pigments and the linseed oil, they cling together with a tenacity that is difficult to break. This close affinity between pigment and vehicle promotes integrity of the paint film, and guards against premature breakdown of the film under normal service conditions.

b) As the films containing the reactive lead pigments age, they increase in toughness to an optimum degree, because the lead soaps that are formed improve the coherence, the flexibility, the distensibility and the other factors that contribute to long life and improved protective ability of the paint film. The accompanying photomicrograph illustrates the physical form of these lead soaps. It is apparent from this picture how these spiney particles reinforce a paint film.

Chart 1 also illustrates this aging factor. The curves show the tensile strength vs. months of exposure as evidence that "lead" films increase in tensile strength up to an optimum as the film ages. At the end of the exposed time the strength of the "lead" film is of the order of 1000 pounds per square inch.

c) Chart 2 compares the tensile strength of a film containing white lead with that of one pigmented without lead pigment. Although the reactive pigment used in each paint helps to impart strength, it is obvious that the film containing white lead as the basic reactive portion of the mixed pigment shows the tensile strength of the film increased at a beneficial rate. This slower rate of increase allows the film to retain the required elasticity and flexibility to avoid cracking and scaling during the life of the film.

Chart 3 shows the percentage of elongation that is retained in paint films as such films age during exposure to weathering. When the percentage of elongation is at a low level, the paint film will rupture as the surface contracts and expands. Note how the necessary flexibility for good durability and long life is retained by the mixed-pigment paint film in which white lead is the reactive flexile pigment.

B. Illustrations:

1. Photomicrograph of lead soap

2. Chart 1. Tensile Strength of Paint Films after one-year's exposure (A longer exposure would be better)

3. Chart 2. Tensile Strength of Paint Films with (a) Mixed Pigment-No "lead," and (b) Mixed-Pigment - with "lead"

4. Chart 3. % Elongation - Stripped Film, with (a) Mixed Pigment - with "lead", and (b) Mixed Pigment - No "lead"

IV - PAINT FILM IS PLASTICIZED BY WHITE LEAD PIGMENTS

A - To provide satisfactory protection a house paint must form a plastic film after it has been applied to a surface. It must adhere tenaciously to the surface, whether it be irregular or smooth, and must not break its bond and flake off, or split or crack under the stress and strain caused by the expansion and contraction of the surface due to

1. As in plastics, flexibility in paint is obtained by the plasticizing effect provided by a material inherent in the components of the paint, or by one added for that purpose, or both. The material added should also insure adequate tensile strength, to provide a film that is not only flexible, but also tough and strong.

a) "Lead" permits the proper formulation of paint to provide films that are flexible not only immediately after application, but throughout the life of the paint. The "lead" reacts with the fatty acids in the organic binders to form lead soaps, which reenforce the film and increase its strength, and also help to plasticize the film and give it flexibility and distensibility, producing a coating that will not crack despite the natural stresses and strains to which it is subjected.

2. The elimination of brittleness in the film results in greater resistance to cracking, better protection due to improved integrity, better appearance during the life of the film, and a much more satisfactory repaint surface.

3. The accompanying photograph shows typical paint films, with and without white lead, which illustrate respectively good and poor flexibility. The center specimen, which contains white lead, has excellent flexibility as indicated by the absence of cracks and flaking. The other two films, which are lead-free, were too inflexible and brittle to withstand the bending of the paint film around the conical mandrel, and have cracked and are flaking off the surface.

4. The second group of photographs shows three specimens of house paint on wood, with the center one containing white lead. Note the absence of cracks and of flaking in this, while the top and bottom panels (without white lead) show severe cracks (top) and excessive flaking

off of the film bottom.

B. Illustrations:

1. Photo of "Paint Film Bent Around Conical Mandrel."

2. Photo of three specimens of paint on wood, with two of them inflexible and brittle, while the one containing "lead" is "ideal".

V - WHITE LEAD PIGMENTS PROVIDE CONTROLLED HARDNESS WITH NO BRITTLENESS

A - On aging in all climates, paint films continue to increase in hardness which tends to make films brittle, with ultimate cracking and scaling. When "lead" pigments are used as the basic reactive portion of mixed pigment formulations, the hardness of the film after initial drying is comparatively low, and the rate of increase in the hardness as the paint film ages in service is slow. That is particularly true of paint films in temperate climates.

1. This is because (a) the lead soaps, which are formed, retard hardening of the paint film to a beneficial low rate of increase; and (b) the "lead" pigmented film surface gradually and slowly erodes and chalks off, exposing a new surface to the weather.

2. This is illustrated in Chart 4. which shows the hardness levels obtained with the use of two different reactive pigments (of which white lead is one) as the base for the mixed pigment paints. Both the lower initial level of hardness and the lower rate of increase in hardness of the white lead pigmented paints, as the film weathers, add to the durability and the long life of the paint film.

B. Illustrations:

1. Chart 4: Sward Hardness Rocker.

VI - LEAD WHITE PIGMENTS IMPART HIGH WATER RESISTANCE TO PAINT FILMS

A - It is generally agreed that water has many detrimental effects on paint; it decomposes the film to a great extent; it causes paint

additional water to enter the film; and the continued transfer of water even in very small amounts through the film sooner or later breaks not only its cohesive bond but its adhesion.

1. "Lead" improves paint resistance to water by resisting the pickup of water into the paint film and by resisting its transfer through the film. This resistance of white lead pigmented paint films to water is made evident by the appearance of water on the surface of films that have started to weather. On white lead pigmented films water exists only as droplets on the surface, whereas on other pigmented films, water wets the film and spreads uniformly across its surface. (See illustration B-1)

This ability on the part of "lead" pigmented films to resist the penetration of water is due to the strong affinity between "lead" and oil. The simple process used in the final phase of the production of white lead-in-oil pastes is a good illustration of what probably happens. Before this final phase, white lead pigments are in the form of a heavy water slurry. The oil is poured into this slurry. Immediately the water starts to separate, actually forced to separate from the white lead by the entering oil, and the water rises to the top for decanting. The final white lead-in-oil paste contains not more than one-half of one percent of water. (See drawing B-2).

B. Illustrations:

1. Charts 5 and 6 show how "lead" pigmented films pick up considerably less water than non-lead films, especially in the earlier period of life of the paint film. This high repellency of water not only resists surface pickup of water into the film, but also checks

its transfer through the film, thus preventing water's attempts to dissolve and emulsify portions of the paint film. Thus "lead" produces in another way more durable paints.

2. Photograph (if available) showing surface condition of films after exposure to water: (a) white lead films with droplets, and (b) other, with general wetted surface; or a drawing depicting these effects. Pictures of film disintegration.

3. Drawing indicating slurry-paste to oil-paste process in manufacture of white lead in oil: (a) jar of slurry of white lead, (b) slurry of other pigment (zinc), (c) jars after pouring in the oil.

4. Chart 5: Water Sorption; Mixed Pigment - No "lead", Mixed Pigment - with "lead".

5. Chart 6: Water sorption; % by weight, zinc oxide, white lead.

VII - WHITE LEAD PIGMENTS PROVIDE OTHER GOOD PAINT PROPERTIES

A - Weathering Characteristics:

1. Controlled Drying: "Lead" pigments have a beneficial effect on film drying after application. The slow drying, from inside of the film outward, is probably the chief factor in the controlled hardness of the film during its life. This adds to durability.

2. Contribute to Foolproofness: - White lead pigments impart such a high degree of flexibility, film strength and water resistance, that paints containing them are better able to withstand faulty handling and misapplication. Paints containing "lead" are more likely to assure customer satisfaction in spite of use under adverse conditions over which the manufacturer has no control.

B - Non-Weathering Characteristics:

1. Mixing and Grinding: It has been long recognized that white lead aids in mixing and grinding of other pigments in a mixed pigment paint. This is because each "lead" particle is thoroughly wetted quickly, which aids in the wetting and dispersion of particles other than "lead" to form a uniformly smooth mixture.

2. Brushing: Good brushing has always been known to be a quality of lead paints, due principally to the ideal pigment structure of a paint system which contains white lead as one of the mixed pigments. The particles of white lead pigment being well wetted and dispersed insure good, easy spreading under the brush.

3. Package Stability: "Lead" pigments commonly used in house paints, even without suspending agents in the formulation, settle out but gradually, and the resultant settling is soft and easily remixed by simple mechanical stirring (with a paddle, as an example). Even after exceptionally long storage, lead pigmented paints do not harden in the package.

C - Illustrations:

1. Brushing photos, with and without brush marks.

2. Perhaps also mixing and grinding time charts, if available.

VIII - WHITE LEAD PIGMENTS PROVIDE GOOD APPEARANCE

A - A review of the different properties of a lead pigmented paint which insure continued good appearance:

1. "Lead" stabilizes paint film, retards decomposition.

2. "Lead" plasticizes paint film, retards cracking, and other serious defects.

3. "Lead" toughens and hardens paint film, without brittleness, providing good film surfaces for long life.

4. "Lead" imparts water resistance, and contributes to resistance to peeling, flaking, blistering, and other defects.

5. "Lead" provides good adhesion and cohesion characteristics, makes film smooth and uniform.

6. "Lead" makes it possible to control the erosion and dirt collection of the paint film, and thus maintains a good surface for appearance and repainting.

IX - FORMULATION DISCUSSION

A - It is a generally accepted fact that no exterior house paint will give better protection longer under average exposure conditions than a paint in which the chief reactive pigment is white lead, alone or in combination. "Lead" improves the paint formulation by providing durability by plasticizing and stabilizing the film, and by strengthening and toughening the coating and by increasing the water resistance.

"Lead" imparts these desirable characteristics to a high degree and results in added reliability under many abnormal conditions of handling and application. The manufacturer can never be sure that the label instructions will be heeded and paints are often applied under adverse conditions over which the manufacturer has no control. Painters, both amateur and professional are often prone to add excessive thinners or violate other instructions. The difficulties, often traceable to faulty handling and misapplication of paint, can thus be minimized by the inclusion of the proper proportion of white lead pigments in house paint formulations.

Specialty paints are designed to meet certain specific conditions or requirements. Such paints include sash and trim colors, fume-proof paints, porch and floor enamels. These are not intended for use as general house paints and are therefore excluded from this discussion.

B. Primers:

1. The main requisites of a paint to be used on unprimed wood are: (a) it must provide a flexible, elastic film that has strong adherence and excellent coherence under the stress and strain of the expansion and contraction of the underlying material and the difference in such a movement factors between various woods and other building materials and the paint film; (b) it must produce a film that retains an optimum oil content to provide a good water-resistant seal for the surface; and (c) it must establish an ideal repaint surface to receive the finish coat or coats. The moisture content of the paint, and the amount of water soluble pigment, must necessarily be kept low.

2. It has long been recognized that white lead provides the best characteristics and properties for the prime coat, especially when the "lead" is introduced in substantial amounts.

C - Primer Formulations

1. For paint that is to be used as the undercoat in an exterior paint system, the formulation generally calls for a white lead content of 40% to 60% by weight of the pigment total. This type of paint is usually formulated with a pigment-volume ratio (PV) of the order of 35 to 40 and applied at a spreading rate of about 450 square feet per gallon. Typical formulations are represented by paints meeting the requirements of Federal Specification TT-P-25 (December 9, 1942). The broad composition requirements for both the pigment and vehicle are given below. No attempt has been made here to give the requirements of this specification in full.

Pigment Ingredients	Percent by weight	
	Maximum	Minimum
White lead	----	50
Titanium Dioxide	----	10
Barium sulfate, white siliceous mineral pigments (containing no lead or titanium compounds) or any mixture thereof	40	----
Matter soluble in water	0.8	----
Vehicle Ingredients		
Linseed oil, raw	29	----
Bodied linseed oil (minimum viscosity Z4 on the Gardiner-Holdt Scale)	----	26
Resin (pale colored coumarone or ester gum)	4	3
Thinner and drier	42	----

The white lead content specified above provides a good, flexible, water-resistant coating, and the best possible surface for recoating.

2. House paints are formulated so that the finish coat paint, thinned suitably may be used as the prime coat. Modern formulation concepts recognize the practicableness of such systems only when the finish coat of paint contains enough "lead" in the primer or primer and body coat to provide the strong, flexible, water-resistant bond to hold succeeding coats of paint to the surface of the new wood. This is

particularly true in the case of specialty paints, which provide special properties to meet specific conditions but sometimes do so at the sacrifice of ultimate durability. If such paints, containing no "lead", are used as the prime coat as well as the finish, the durability may be reduced materially.

D - Exterior Finish Paints

1. Two classes of ready-mixed exterior house paints usually are formulated; (a) white paints to be used for their whiteness; and (b) straight color paints, tinted paints or a white base for tinting. Formulation concepts may vary widely, depending on conditions of application, of exposure in use, and of cost.

a) White house paints should be long lasting; relatively resistant to moisture, to weather, and to too easy soiling; and preferably free chalking that a clean and bright appearance is maintained until repainting for protection becomes necessary. The paint should brush easily, it should have high hiding power, and it must dry slowly to a desirable gloss. Its spreading rate should be approximately 550 sq. ft. per gallon, for two-coat systems, and 600 to 700 sq. ft. per gal. for 3-coat systems.

An example of a general purpose, white exterior house paint providing these properties, over a suitable primer is illustrated by one meeting the requirements of the Proposed Federal Specification TT-P-102 Class A, as outlined below.

Pigment Ingredients	Percent by weight	
	Maximum	Minimum
White Lead	----	21
Zinc Oxide	26	25
Sum of white lead and zinc oxide	----	58
Titanium dioxide, anatase type	16	15.5
All other pigments	28	----
Matter soluble in water	0.8	----
Vehicle Ingredients		
Raw, boiled, or refined linseed oil	----	68.6
Bodied linseed oil bodied tung oil	16.0	8.0
Thinner and drier	15.4	----

Tinted, ready mixed, paints or white base paints for tinting, generally have the properties of all-white paints and in addition require high chalk resistance to prevent faded, blotchy colors after weathering. The high hiding white pigment must be of the chalk resistant type. A desirable formulation would be one meeting the requirements of Proposed Federal Specification TT-P-102, Class B as outlined below.

Pigment Ingredients	Percent by weight	
	Maximum	Minimum
White lead	----	21
Zinc Oxide	26	25
Sum of white lead and zinc oxide	----	58
Titanium dioxide, rutile, chalk resistant type	12	11
All other pigments	32	----
Matter soluble in water	0.8	----
Vehicle Ingredients		
Raw, boiled, or refined linseed oil	----	68.6
Bodied linseed oil or bodied tung oil	16.0	8.0
Thinner and drier	15.4	----

EXHIBIT D

E. I. DUPONT DENEMOURS & COMPANY
Incorporated
Wilmington, Delaware

August 28, 1950

Lead Industries Association
420 Lexington Avenue
New York 17, N. Y.

Gentlemen:

Your advertisements in the "American Paint Journal" dated July 17, "Paint, Oil and Chemical Review" dated July 20 and several other journals give some curves and exhibits showing the effect of lead on reducing water sorption, increasing tensile strength and increasing film elongation in house paints. Quantitative data are given, but the compositions used in these tests are not specified. I wonder if you can give us details as to the composition of leaded and lead-free paints used for the determination of the data reported.

Very truly yours

J. B. BULLITT
Assistant Director

JBB:dhg