WHITEWASH & COLD WATER PAINTS

NATIONAL LIME ASSOCIATION
RELY ON LIME TESTED BY TIME

BULLETIN NO. 304-G

THE attractive whitewashed brick and stone residence pictured on the front cover is located at 6036 Oregon Ave., Washington, D. C. Upon construction in 1927 the outside walls of this home were given a two-coat application of whitewash (Formula 4 as described in this pamphlet). Seven years later another coat of the same whitewash formula was applied. Except for an occasional "touch up" of the front entry and such dirty spots as the chimney and window sills, the exterior walls have not required further painting over the past two decades. Careful preparation and application of the whitewash mixture are major factors accounting for this durability.

Whitewash is easily applied. The materials required are inexpensive, yet a good finish can be obtained if the surface is properly prepared and the whitewash applied thin.

WHITEWASH and Cold Water Paints

THERE is nothing so white as whitewash! Many farmers and homeowners prefer to use whitewash for decorative reasons since no other protective coating quite achieves the same extreme "chalky-white" effect or the delicate pastel shades which are possible when pigments are added. There is no question that a freshly whitewashed house, barn, fence, and tree trunks create an impression of freshness, cleanliness, and beauty. Thus, whitewash has endured for centuries, and today is more extensively used than ever. It will always be used because in addition to its eye-pleasing effect, it is and has always been the least expensive and easiest way to cover a surface.

The following recommendations in this pamphlet are largely based upon the results obtained from a comprehensive series of experiments conducted by the National Lime Association on whitewash and cold water paints. *For best results the following directions should be followed closely.*

General Directions for Preparing Whitewash

In general, virtually any type of quicklime or hydrated lime may be used in the preparation of the lime paste with the following formulas. However, generally hydrated lime is preferable, but when hydrate is used best results are obtained from the more highly refined types of commercial hydrates which contain virtually no coarse particles or lumps. Specifically, these more refined types of hydrated limes are known as chemical hydrate, agricultural spray hydrate, finishing lime, and pressure hydrated lime. The use of such limes is particularly important when the whitewash is to be applied with a spray pump or paint gun in order to prevent the nozzle on the sprayer from becoming clogged. Otherwise, it is necessary to strain the lime paste made from quicklime and unrefined hydrated lime through a fine screen in order to remove the coarse particles. In any event, it is always advisable to follow the lime manufacturer's directions on slaking the quicklime or soaking the hydrated lime. Approximately 8 gallons of stiff lime paste are produced by slaking 38 pounds of quicklime with 8 gallons of water, or by soaking 50 pounds of hydrated lime in 6 gallons of water.

After water is added to the mix the final whitewash mixture should be *thin*, resembling the consistency of whole milk.

Preparing the Surface

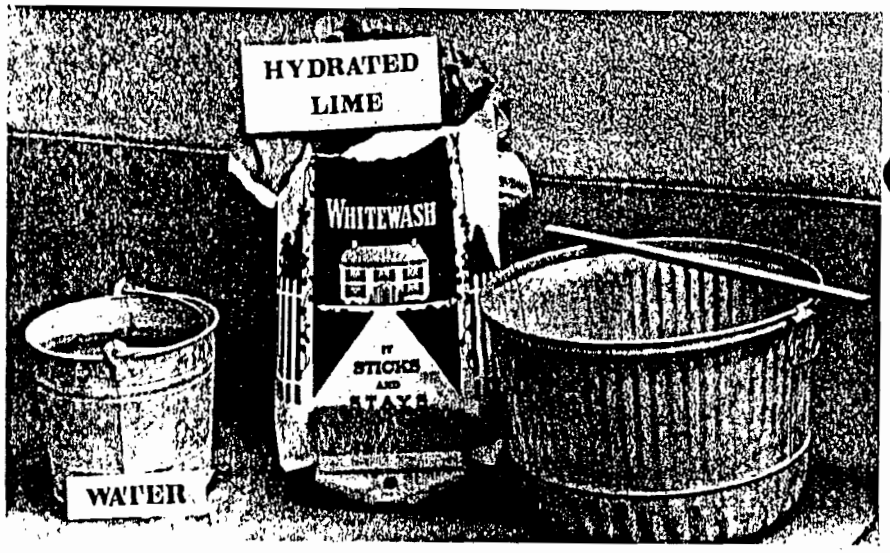
All dirt, scale, or other loose material should be removed from the surface to be painted by brushing well with a clean, stiff brush, or by scraping first and then brushing. This procedure is necessary especially on surfaces that have been whitewashed previously, since there will be no solid surface to which the new coating can adhere if the old whitewash is scaly.

On the interior walls and ceilings old whitewash or calcimine coatings should be washed off with a cloth or sponge and hot water. In some cases it may be necessary to use vinegar or a dilute solution of hydrochloric acid to effect complete removal of the previous coat. Grease, dirt, or old wallpaper should be removed with a scraper, if necessary, and the wall should be thoroughly washed with water. Nail holes and cracks should be filled with a mixture of four parts of hydrated lime or lime putty, and one part of plaster of paris, with enough water to make a thick paste. This paste should be forced into the holes and carefully smoothed off flush with the plaster surface by means of a putty knife or old case knife.

The final results and increased life of the new coating will more than compensate for the time and care required to put the surface in good condition. Before applying the fresh coat the surface should be dampened so that the whitewash will dry gradually. If whitewash is applied to a bone-dry surface, it usually will chalk and rub off rather easily.

Whitewash Formulas

While lime alone with water for whitewashing can be used in some instances, the durability of such a mixture will generally be improved by adding other materials to the mix. The following formulas are divided into two groups: (1) those formulas which are simpler to prepare, but which have produced satisfactory results and (2) more detailed formulas which are satisfactory and may even produce better results than those listed in the first group.



Only the simplest equipment is required for preparing and applying whitewash.

I. Simpler Formulas

1. Salt . . . . . 15 lbs.
   Lime paste* . . . . . 8 gals.
   Dissolve the salt in about 5 gallons of water and add this solution to the lime paste. Mix thoroughly and thin to desired consistency with fresh water.

2. Calcium chloride (dry) . 5 lbs.
   Lime paste* . . . . . 8 gals.
   The substitution of calcium chloride for the salt in formula (1) produces a mixture that does not chalk and is quite durable. The same mixing directions apply.

3. *White* portland cement . . . . . 25 lbs.
   Hydrated lime . . . . . 25 lbs.
   Both the cement and lime should be added together in dry form to about 8 gallons of water. After mixing thoroughly a thick slurry will result. Additional water should then be added until after further agitation the mixture resembles the consistency of heavy cream. Do not mix more than can be used in a few hours.

   Note. The above weight proportions are approximately equivalent to 1 part of cement to 2 parts of lime by volume.

II. More Detailed Formulas

4. Casein . . . . . 5 lbs.
   Household water softener (Trisodium phosphate) 3 lbs.
   Formaldehyde . . . . . 3 pts.
   Lime paste* . . . . . 8 gals.
   Soak the casein in about 2 gallons of hot water until thoroughly softened (about 2 hours). Dissolve the water softener in 1 gallon of water, add this solution to the casein, and allow the mixture to dissolve. Dissolve the formaldehyde in 3 gallons of water. *When the lime paste and the casein solution are thoroughly cool, slowly add the casein solution to the lime, stirring constantly.*

   Just before using slowly add the formaldehyde solution to the batch, stirring constantly and vigorously. Care must be taken not to add the formaldehyde too rapidly as this may cause the casein to form a jelly-like mass, thus spoiling the batch. Do not make up more of this formula than can be used in one day as it may deteriorate.

   This formula is recommended highly for most uses, as the coating is white and is quite weather-resistant.

5. The addition of 1 to 2 pounds of calcium chloride to formula (3) will improve the results slightly. The calcium chloride should be dissolved in a small amount of water and added and stirred into the cement-lime mix just before using.

*Directions for preparing lime paste are given on page 5.

6. Glue (animal)..... 3 lbs.
   Lime paste*..... 8 gals.
   Dissolve the glue in about 2 gallons of water. Add this solution to the lime paste, stirring constantly, and then thin to desired consistency.

7. Skimmed milk..... 7 gals.
   Formaldehyde..... 3 pts.
   Lime paste*..... 8 gals.
   This formula is a favorite of some dairy farmers for whitewashing the walls and ceilings of barns. Here, skimmed milk largely replaces water as the solvent. After mixing the skimmed milk thoroughly with the lime paste, add the formaldehyde slowly, stirring vigorously. Add water until desired consistency is obtained.

8. Casein..... 5 lbs.
   Borax..... 3 lbs.
   Lime paste*..... 8 gals.
   Soak the casein in 4 gallons of hot water until thoroughly softened (about 2 hours). Dissolve the borax in 2 gallons of water and add this solution to the casein. When both are cold, slowly add the borax-casein solution to the lime paste, stirring constantly and vigorously. Thin to desired consistency. Do not prepare a larger quantity of this formula than can be used in one day as it may deteriorate.

9. The addition of 1½ to 2 pounds of titanium dioxide or zinc sulfide (opaque white pigments) to any of the above formulas will improve the appearance of the whitewash when it is wet as well as help to retain the "dead" white effect for longer periods. The opaque white pigment should be mixed thoroughly with the lime paste.

The quantities cited in the above formulas may be reduced proportionately to one-half, one-fourth, or whatever is required for the job at hand.

Recommended Colors for Whitewash

There are three factors to be considered in connection with colors used to tint whitewash and cold-water paints: first, that they shall not react chemically with the lime; second, they shall be insoluble in water; and third, the mixing shall be as nearly perfect as possible.

The following pigments may be purchased as dry powders and added to any of the whitewash formulas listed in this pamphlet. The amount of pigment necessary will depend upon the shade of color desired. To be sure that the desired shade will be obtained, it is always advisable to prepare a small sample and allow it to dry before mixing any considerable quantity.

Blacks—Magnetic black oxide of iron is safe. Ivory black and carbon black are non-reactive with lime, but they are lacking in strength.

Blues—Ultramarine, cobalt blue, and copper phthalocyanine blue are the only blue pigments recommended.

Browns—Pure precipitated brown oxide of iron or mixtures of the magnetic black oxide of iron with turkey or Indian red are highly recommended. Sienna and turkey umber are lacking in strength, but may give good results.

* Direction for preparing lime paste are given on page 5.

Greens—Chromium oxide (opaque) or chromium oxide (hydrated) are recommended. These are known as chromium or chrome oxide greens and should not be confused with mixtures of chrome yellow and prussian blue, known as chrome greens, which are not lime-proof. Copper phthalocyanine green can also be used as a pigment.

Reds—Indian red made from pure ferric oxide is highly recommended. Madder lake and toluidine vermilion are alkali fast but have little strength and are fugitive to light.

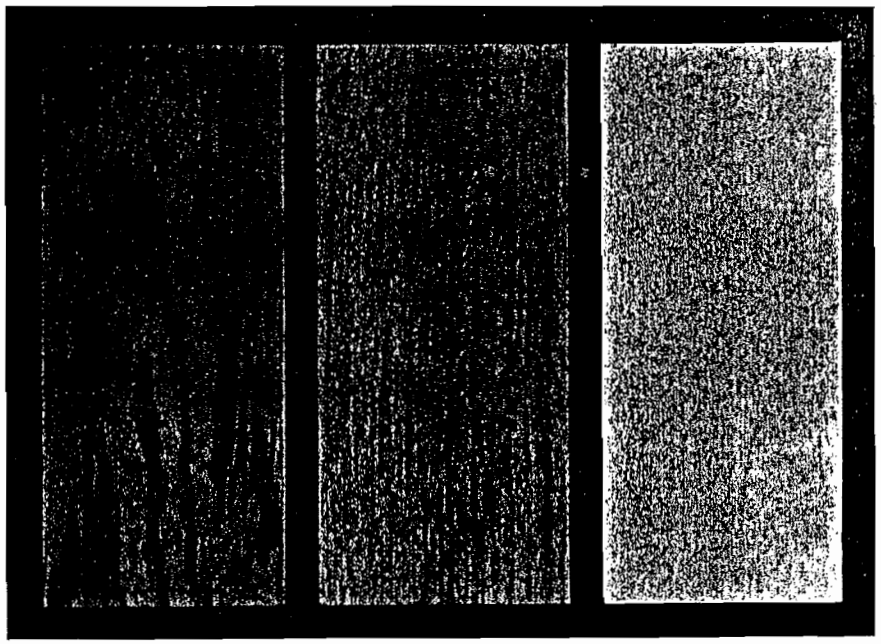
Violets—Cobalt violet and mixtures of the reds, whites, and blues suggested are satisfactory.

Whites—Lime itself is satisfactory. Titanium dioxide or titanium-calcium pigment and zinc sulfide or light-fast lithopones also are used as white pigments.

Yellows—Those made by using precipitated hydrated iron oxides are most satisfactory. Ochre, raw sienna, lemon cadmium, orange cadmium, and golden cadmium are less suitable, as they may change in shade, lack strength, or be affected by light. Chrome yellow is not lime-proof.

Applying the Wash

Whitewashes and lime paints should be applied thin, and the surface should be dampened so that the coating will dry gradually. *In fact, best*



These three panels (left to right) show the appearance of fir plywood before whitewashing, immediately after application, and after the whitewash became thoroughly dry.

results will be secured if the application is so thin that the surface to which it is applied may be seen easily through the film while it is wet. The coating will dry opaque, however, and the thin coat will give better results than a thick one. A second thin coat may be applied over the thoroughly dry first coat if a whiter surface is desired. These cold water preparations can be applied easily and satisfactorily with a large brush. Do not attempt to brush out the coating as is done with oil paint, but simply spread it on as evenly and quickly as possible. The whitewash should be stirred frequently while it is being applied to prevent settling.

Approximate Covering Capacity

The following approximate figures will be of assistance in estimating the amount of materials required and the time needed to cover wood, brick, or plaster surfaces. It is, of course, to be understood that these figures are only approximate, since there are many factors, such as condition of the mortar joints in brickwork, roughness of lumber, and previous treatments, which will have a very decided influence on the covering capacity of the wash or paint.

A gallon will have about the following covering capacity:

On wood, 225 square feet.

On brick, 180 square feet.

On plaster, 270 square feet.

(With formulas (3) and (5) the coverage would be about 20 per cent less than the above.)

It has been estimated that a man with a 4-inch brush should cover the following surfaces per hour:

On rough walls, 22 square yards.

On smooth walls, 38 square yards.

On flat surfaces, 40 square yards.

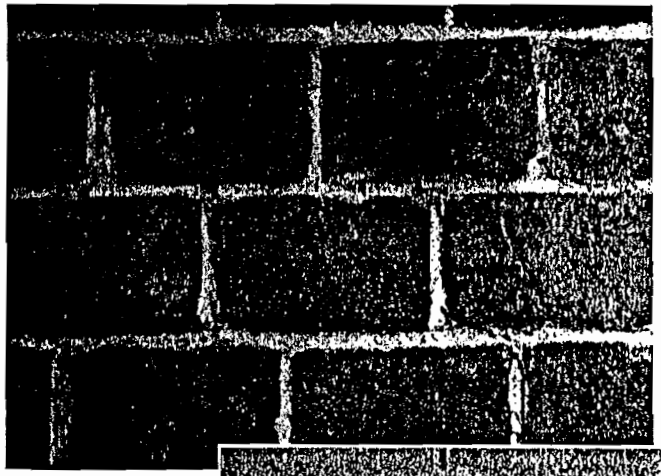
On ceilings, using a stepladder, 25 square yards.

Cost of Materials

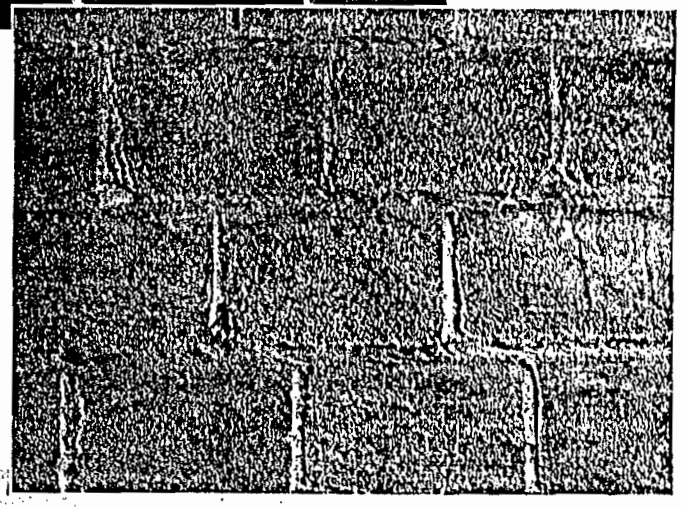
Due to fluctuations in retail prices, exact cost figures for the various whitewash formulas listed cannot be given. However, it is estimated that the material costs would range from about 5c to 25c per gallon of whitewash, with formula (1) the lowest cost and formulas (4) and (8) the highest cost.

General Exterior Uses for Whitewash

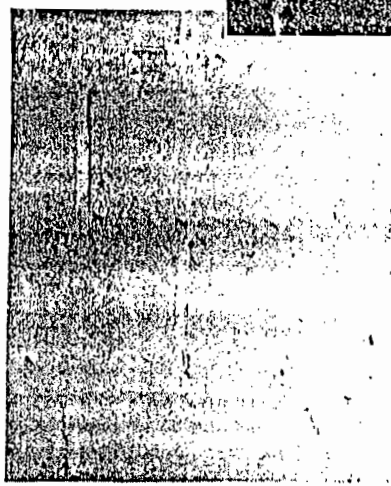
For general utility on wood, glass, or metal surfaces, such as sheds, public service poles, bunkhouses, fences, tree trunks, greenhouse roofs, etc., formulas (1) and (2) are recommended because of ease of preparation.



Cinder block basement wall dampened and ready for whitewash coat.



Same wall immediately after whitewash (Formula 4) was applied. Note transparency of coating at this stage.



Same wall showing opacity and whiteness after drying.

Generally, for most satisfactory results on masonry surfaces such as brickwork, concrete, cinder block, or stone masonry, stucco, for marking safety zones, traffic guide lines, and gasoline station islands, curbings, etc., formulas (3) and (5) are suggested. However, the more complicated formula (4) has produced excellent results when prepared and applied properly. Formulas (3) and (5) should not be applied to wood surfaces.

As a general farm "all-purpose" whitewash, formulas (1), (2), (4), (7), or (9) are satisfactory and a matter of individual preference.

Whitewashing Dairy Barns

Public Health Bulletin 229 contains a milk ordinance and code, approved by the U.S. Public Health Service and the Bureau of Dairy Industry, U.S. Department of Agriculture, that is recommended for adoption by states and communities in order to encourage a greater uniformity of milk-control practice in the United States. At present 1593 municipalities, 418 counties, 34 states, and 2 territories have adopted and are enforcing this code which includes the following requirement:

> "The interior walls and the ceilings of the milking barn, stable, or parlor shall be *whitewashed* or painted as often as may be necessary, or finished in an approved manner, and shall be kept clean and in good repair."

To conform with these regulations, farmers generally prefer to use whitewash because of its extremely low cost and ease of application. On wood or plaster walls and ceilings formulas (1), (2), (4), (6), or (9) are recommended. On masonry walls or ceilings formulas (3) and (5) are recommended. If the walls and ceilings are not subjected to prolonged dampness, the simpler formulas will generally serve the purpose as well as the more detailed formulas.

General Interior Uses

For masonry walls in basements, formulas (3) and (5) only are recommended since the prolonged periods of dampness often encountered in basements adversely affect the other formulas. In addition, formulas (3) and (5) offer increased water resistance to the walls.

For plastered walls formulas (4) and (6) are recommended, the last formula being the easiest to prepare and least expensive. The appearance of interior walls can be greatly improved with whitewash and cold water paints. Tinted washes are particularly popular.

Special Uses

General Sanitation

Lime often is used to reduce odors and promote a more sanitary condition around poultry houses, stables, kennels, and similar structures. Since all of the whitewash formulas discussed in this pamphlet contain lime, they also are of value for this purpose. All dirt and debris should be removed from and around structures to be whitewashed to assure a satisfactory job.

Protecting Trees from Frost Injury

With reference to the use of whitewash for protecting trees from frost injury, Oregon Circular No. 103, published May 1931, under the title, "A Study of Tree Stocks in Relation to Winter Injury and Its Prevention," reports the findings of Childs and Brown at the Hood River Experiment Station. For several winters, starting in 1926, the trunks of young pear trees were protected with whitewash and board shields. During the first two years the percentage of injured unprotected trunks was 79 and 85 per cent. Protected by board shields, 19 and 22 per cent of the trees were injured, and where the trunks were whitewashed only 6 and 10 per cent of the trees were injured.

This experience was checked in 1938 by the North Carolina Experiment Station when peach trees were protected against frost damage by applying a coat of whitewash. According to the results obtained, whitewash keeps the trees from 15 to 20 degrees cooler on sunny winter days, holds them dormant, and guards them against the sudden cold snap sure to come later in the spring. The trees must be kept white throughout the late winter and early spring to be effective.

For frost protection the more durable the whitewash the better, though generally formulas (1), (2), (4), or (9) may be used.

Fire-Resistant Lime Paint

While whitewash cannot be said to make a structure fireproof, formula (8) has been found to be quite effective as a fire retardant. Its use will prevent splinters and rough surfaces from igniting quickly and, when properly applied, a considerable degree of fire-resistance is secured. Best results will be obtained if this mix is applied with a high-pressure spray pump or paint gun so that all crevices and cracks are thoroughly filled.

The Forest Products Laboratory, located in Madison, Wisconsin, has been interested for some time in the possibilities of fire-retardant coatings for checking the spread of fires of small size, and has made many fire tests on the effectiveness of such materials. Its bulletin of December 1941 on "Fire-Retarding Paints" contains data on the results obtained with borax paints, sodium silicate preparations, whitewash, synthetic-resin formulations, and loose-texture compositions.

The whitewash was made by mixing together 10 parts of slaked lime, 1 part of portland cement, and sufficient salt water to give a mixture of rather stiff consistency. This whitewash possesses moderate fire-retarding properties, but on a basis of the amount of material applied, is less effective than the borax paints. Three coats of the whitewash are required to give significant protection.

Rust Prevention

The corrosion of rusting of metal may be retarded or prevented by applying a good coat of whitewash. A lot of trouble on the farm or in a contractor's yard will be prevented if whitewash is applied to all metal surfaces exposed to the weather, such as plowshares, mold boards, scrapers, picks, shovels, structural shapes, reinforcing rods, etc. If the implements or tools are allowed to stand out in the open, formulas (1), (2), and

(4) should be used, but if stored under cover and not disturbed, a simple lime and water mix will answer the purpose.

Rusting of the inside of furnaces will be greatly reduced if the surface is cleaned and whitewashed at the close of the heating season.

Whitewash for Decreasing Illumination

According to the British Building Research Board, whitewash decreases drastically the solar illumination of glass roofs. Tests revealed a decrease in illumination of 75 per cent with one coat of whitewash and 92 per cent with two coats.

Whitewashing Coal

Spraying the top of a carload of coal with whitewash to enable dealers to detect thievery during transit is a practice which is being followed by a number of coal companies. It is reported that coal thieves and bootleggers have helped themselves to as much as several tons of coal while the cars were in the yards, with the result that dealers were certain the gondolas' cargoes were not of the contents stated in the way bill.

The spraying method is simple and economical. All that is necessary is to give the coal a top coat of lime whitewash (lime and water), after loading and weighing, and then to notify the dealer to that effect.

Whitewash on Asphaltic or Coal Tar Pitch Coatings

Whitewash frequently will be found of great assistance in connection with mop coats of asphaltic preparations such as are used frequently for waterproofing walls, reservoirs, slabs, etc. Where the black surface is exposed to direct sunlight, and particularly in hot climates, trouble sometimes is experienced because of the asphalt softening, which causes the coat to sag and wrinkle, or even to melt and run. This difficulty may be entirely stopped, or at least greatly reduced, by applying a coat of whitewash to the black surface. The formula to be used will depend upon the durability desired. If the exposure is short, a plain lime and water mix will be good, while for longer exposure formulas (1) and (4) are recommended.

In connection with the treatment of enameled pipe lines whitewash serves several purposes. It seems that many soils when thoroughly watered and puddled around the pipe, tend to adhere closely to the enamel and cause considerable damage when the soil shrinks upon drying. Whitewash acts as a padding between the enamel and clay soil to minimize the damage caused by such shrinking.

The Barrett Company of New York advises that the use of whitewash over protective coatings on steel pipe was developed with the idea of reducing the structural temperatures which would permit more favorable pipe-laying conditions, lessen the effect of expansion and contraction on welded joints, and reduce the possibility of loosely coupled joints where expansion couplers are used. At the same time, the whitewash provides for a sufficient reduction in temperature susceptibility of the coatings to be well within any danger zone because of high temperatures which might cause sagging or sloughing of the coatings. In other words,

whitewash reflects light and heat which might produce a damaging effect on enamel coatings.

Included in the Standard Specifications adopted by the Bureau of Water Works and Supply of Los Angeles, California, is the following clause on whitewash.

> "The outside enamel surfaces of all pipe and specials shall be given a coat of whitewash immediately following a satisfactory outside inspection. The whitewash shall consist of a mixture of quicklime, water, salt, and a vegetable oil plasticizer which shall be furnished and applied by and at the expense of the contractor, and shall be subject to the approval of the engineer."

White Paint for Swimming Pools

The following specification used by the Milwaukee County Regional Planning Department calls for lime as an important ingredient in the preparation of a white paint for concrete swimming pools.

> All interior concrete surfaces are to be scraped clean of foreign matter and washed down with a hose. The surface is to be damp or wet at the time of application. Then make a mixture consisting of 100 pounds of hydrated lime, 50 pounds white Portland cement, and 10 pounds of common table salt; this mixture to be stirred in with water until it has a gravy-like or paint consistency and the salt is fully dissolved. Apply this to the wet surface, using a heavy whitewash brush. A two-coat application can be given one day apart. Allow 24 hours' drying after the final coat has been put on. Then turn the water back into the pool.

Insulating Value of Whitewash

Every year in June the Vogt Manufacturing Company (textile products), Rochester, New York, sprays the roof (120,000 square feet) of its factory with waterproof whitewash. This treatment has resulted in the lowering of the temperature in the factory about 10 degrees during the hottest part of the day, which has increased the comfort of its 400 employees.

This is an important consideration in a number of industries. While whitewash and cold water paints containing lime are not as weather-resistant as other types, their economy stimulates their further use for insulating purposes.

National Lime Association

Washington 5, D.C.