

A NATIONAL HISTORIC
CHEMICAL LANDMARK

KEM-TONE[®] WALL FINISH

THE SHERWIN-WILLIAMS COMPANY
CLEVELAND, OHIO
APRIL 23, 1996



N40025



AMERICAN CHEMICAL SOCIETY
Division of the History of Chemistry and

THESE GLORIOUS NEW



The Sherwin-Williams "Cover the Earth" trademark was introduced in 1905 and, with slight alteration, is still used by the company today. The version above was used at the time of Kem-Tone's introduction.

This booklet commemorates the designation of Kem-Tone® Wall Finish, a product of The Sherwin-Williams Company, Cleveland, Ohio, as a National Historic Chemical Landmark. The designation was conferred by the American Chemical Society (ACS), a non-profit scientific and educational organization of 150,000 chemists and chemical engineers.

On April 23, 1996, a plaque marking the ACS designation was presented to The Sherwin-Williams Company. The inscription reads: "In 1941, The Sherwin-Williams Company introduced Kem-Tone® Wall Finish, the first commercially successful, multi-million-gallon, waterborne interior wall paint with colors that could withstand rubbing or washing. The product was based on the chemical innovation of emulsifying casein, linseed oil and, later, tall oil as binders. This technology led to the development of improved waterborne paints by replacing naturally occurring binders with synthetic ones. The new product, along with the Sherwin-Williams Roller-Koater™ applicator, spurred the World War II development and expansion of 'do-it-yourself' painting. The innovative technology that made Kem-Tone® paint a success permanently changed the architectural painting habits and products of the United States."

TRADE MARK
MIRACLES

Acknowledgments:

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This booklet was compiled by The ACS Office of Public Outreach and The Sherwin-Williams Company. Production Supervisor: Lydia Bazarko.

Cover Illustrations: Inventors (from left to right) James V. Hunn, Nathan E. Van Stone and Donald A. Kohr, Jr.

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THE CHEMISTRY OF WORLD WAR II

During World War II, the paint industry geared up for defense production. Thousands of military items required paints, including camouflage paint for tanks; aircraft, ship, and truck finishes; and coatings for guns and bombs. Every soldier was equipped with many painted items, some of which had their own special finish. In addition, construction equipment, water supplies, and electrical lighting systems necessary to a military campaign also required paint.

Sherwin-Williams, a leading paint manufacturer based in Cleveland, Ohio, worked to accommodate this defense conversion. Plant engineers converted old equipment to new manufacturing uses. Chemists experimented with old, almost forgotten oils and resins and treated them with modern processing equipment. Purchasing agents combed the country for raw materials so that shortages would not halt production.

Shortages affected every corner of life during the war, from women who gave up stockings because silk was unavailable, to paint manufacturers who were required to ration linseed oil, a common paint binder. These constraints led Sherwin-Williams to accelerate their research into new coatings concepts. Their chemists took casein, a milk protein used by the ancient Egyptians for making paint, and emulsified (or suspended) varnish in it. They then added a number of other ingredients, with water as the largest component, to create a water-based paint.

The result was Kem-Tone® paint, a fast-drying emulsion that met with instant public acceptance and would ultimately become one of the best-selling paints in the United States. Kem-Tone® paint became the first widely accepted waterborne interior wall paint with sufficient binding power to allow washability.

Developed by a team of Sherwin-Williams chemists, Kem-Tone® paint did not depend on organic solvents (based on carbon, such as petroleum derivatives), and it reduced the required

amounts of traditional binders, which were in short supply because of the war. Technologically, the chemists at Sherwin-Williams showed that it was chemically and commercially possible for a paint emulsified in water to produce a durable coating.

Kem-Tone® was registered as a trademark on Sept. 23, 1941. In the next three years, more than 10 million gallons would be sold.

The widespread acceptance of Kem-Tone® paint was accelerated by the simultaneous introduction of the hand-roller (called Roller-Koater™), which made application by do-it-yourselfers very easy. Here, too,

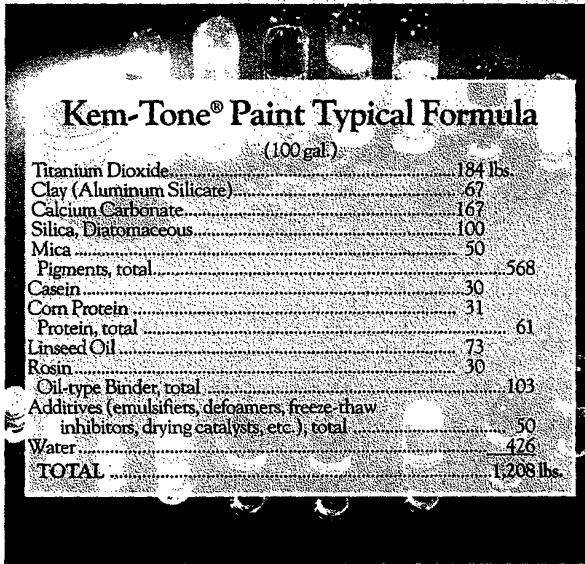


During World War II women took over many of the nation's manufacturing jobs, replacing men who went to war. Sherwin-Williams factories were no exception, as these women running the Kem-Tone® assembly line illustrate.

wartime shortages played a significant role. Richard Adams, an engineer for Sherwin-Williams, invented and patented the roller as an alternative to brushes, which were in short supply because the war between China and Japan restricted the availability of hog bristles.

Kem-Tone® paint and the Roller-Koater™ applicator ushered in a new era in the do-it-yourself paint market, which comprises about 50 percent of the architectural coatings (paints applied to residences) sold today. The innovative chemistry of Kem-Tone® paint also opened the door to continued developments in waterborne paints, which account for approximately 80 percent of all the architectural coatings sold today.

WHAT IS WALL PAINT?



Kem-Tone® Paint Typical Formula (100 gal)	
Titanium Dioxide.....	184 lbs.
Clay (Aluminum Silicate).....	67
Calcium Carbonate.....	167
Silica, Diatomaceous.....	100
Mica.....	50
Pigments, total.....	568
Casein.....	30
Corn Protein.....	31
Protein, total.....	61
Linseed Oil.....	73
Rosin.....	30
Oil-type Binder, total.....	103
Additives (emulsifiers, defoamers, freeze-thaw inhibitors, drying catalysts, etc.), total.....	50
Water.....	426
TOTAL.....	1,208 lbs.

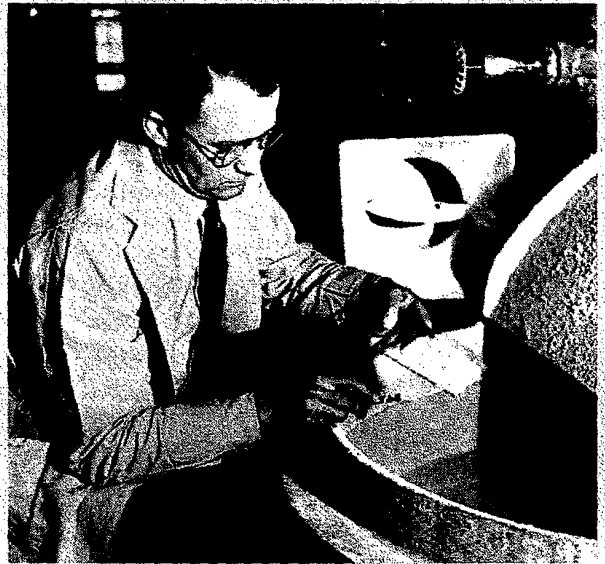
The Kem-Tone® formula set a new industry standard.

The abundance and widespread use of paint in our daily lives makes it easy to take paint for granted. A look at the chemistry of paint leads to a better appreciation of its complexities.

Paint is a liquid composition that dries to an opaque film. It is composed of four basic types of ingredients: pigments, which are powders that give opacity and color; binders, which act like glue to hold the pigments together and cause the film to adhere to the surface being painted; liquids, which make the paint thin enough to spread on a surface, and additives, which perform special functions such as thickening, reducing mildew, and more.

Paints are generally classified as either solvent-borne or waterborne. Solvent-borne wall paints, such as oil paints, use a petroleum derivative (for example, mineral spirits) as the solvent. Waterborne paints use water.

Waterborne wall coatings prevailed from prehistoric cave paintings up to medieval wall paintings. Natural proteins were used as binders for the pigments. Tempera used egg whites as a binder; distemper, a similar waterborne paint, used animal glues from hides and hoofs. Whitewash used milk casein to bind lime (calcium hydroxide) onto Tom Sawyer's fictional fence. But all these exhibited poor washability and durability. Linseed-oil-bound pigments – used by the ancient Egyptians, early Romans and renaissance artists such as da Vinci and Michelangelo – were more durable, but were scarce until the linen industry expanded to provide ample flax seed,



Chemist Donald A. Kohr, Jr., tests the consistency of the paint.

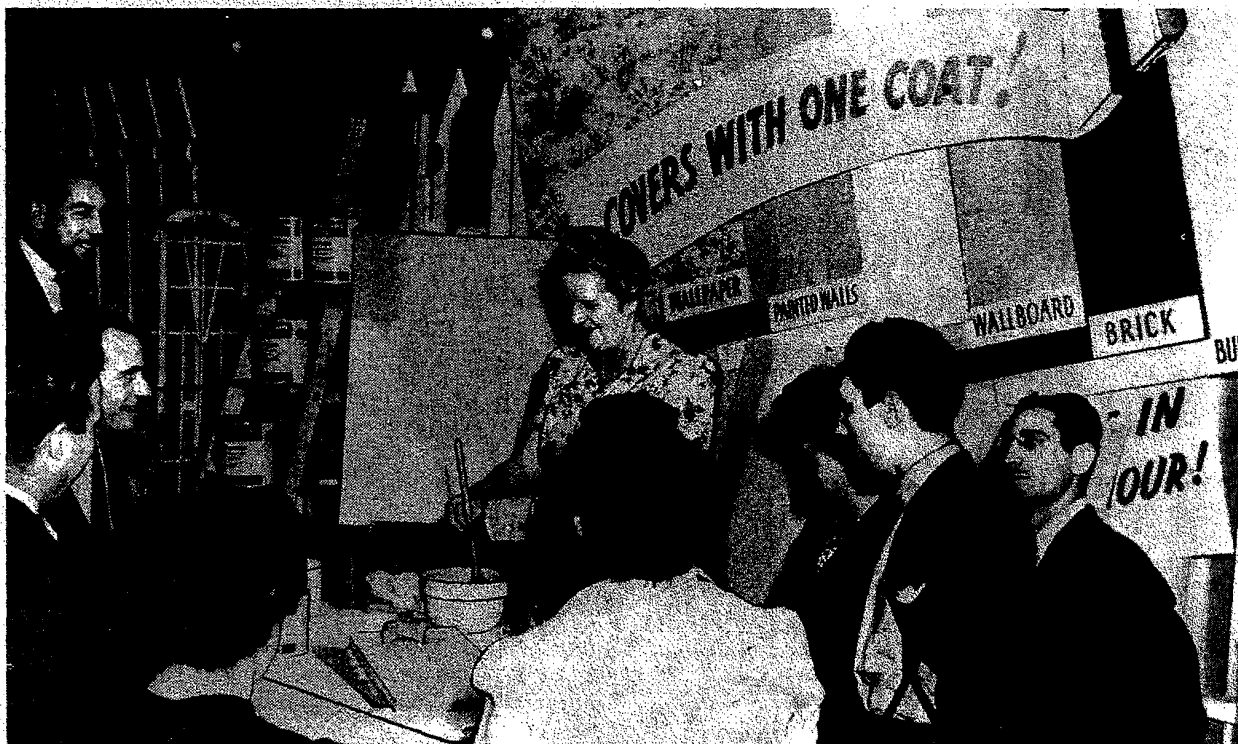
from which linseed oil was pressed. Hardening of the soft linseed oil films by rosin and adding volatile turpentine from the naval stores industry enhanced varnishes for Stradivarius violins, fine furniture and wooden floors. Turpentine was the only historic volatile organic solvent to control paint viscosities until the coke and petroleum industries distilled various naphthas.

These separate crafts came together only in the 1930s, when brilliant exterior waterborne paints enhanced and survived the 1933 Century of Progress Exposition in Chicago and the 1939-40 World's Fair in New York City.

How Was Kem-Tone® Paint Different?

Sherwin-Williams chemists used science to combine two chemical opposites – oil and water. Their chemical innovation was to emulsify, in an aqueous system, traditional solvent-borne binders with casein and other traditional paint ingredients. The binders were casein, linseed oil and, later, tall oil (obtained from wood pulp). This technique set a new standard for the improvement of water-based paints. Eventually, as the product evolved, newly developed synthetic binders replaced the ones used in the original Kem-Tone® paint.

Solvent-borne paints generally contain mineral spirits to thin the paint and make it "brushable." In contrast, Kem-Tone® paint could be diluted with water. The Kem-Tone® paint formulation consisted of many different ingredients.



A Kem-Tone® demonstration at Gimbel Brothers department store, New York City, in 1942.

No Muss, No Fuss, No Bother

Kem-Tone® paint, which augmented Sherwin-Williams' family of "Kem" (standing for chemically evolved material) products, was the first multi-million-gallon, commercially accepted interior wall paint emulsified in water. The flat, interior finish covered with only a single coat, dried in one hour, had greatly reduced paint odor, and could be washed without removing the color. After painting, cleanup was easily accomplished with soap and water. These benefits were summarized in the advertising slogan, "No Muss, No Fuss, No Bother."

Kem-Tone® paint's ease of application was enhanced by the introduction of the Roller-Koater™ paint roller. Inexperienced painters found that the applicator was faster to use than brushes and provided more even coverage. This made it easier for homeowners to become do-it-yourself painters—an attractive alternative during the labor shortages of World War II.

Kem-Tone® paint had another great advantage. It completely covered wallpaper, plaster, and painted walls, without requiring messy primers, sealers or thinners. Soon Kem-Tone® and other waterborne paints supplanted wallpaper as the decorative wall finish of choice in the United States.

Future Inventions

The introduction of Kem-Tone® paint in 1941 was the milestone that showed the viability of durable, washable water-based paint and led the way for future improvements. For example, after World War II, the Dow Chemical Company searched for ways to use its styrene-butadiene polymer (40 parts styrene, 60 parts butadiene), which it had developed for tires during the war. The search led Dow to develop styrene-butadiene latex (60 parts styrene, 40 parts butadiene) as a binder in waterborne paints.

Dow's binder helped to create a new Sherwin-Williams product: latex paint. In the late 1940s, the company introduced Super Kem-Tone® paint, which used styrene-butadiene latex as the principal, but not sole, binder. This significantly improved the adhesion and durability of waterborne paints.

Since the 1940s, paints emulsified in water have passed through several additional phases. Styrene-butadiene latex paints yielded to new improvements, such as vinyl acrylic and acrylic latex binders for water-based paints.

THE KEM-TONE® TEAM

The key players in the development and introduction of Kem-Tone® paint were Nathan E. Van Stone, James V. Hunn, and Donald A. Kohr, Jr., a team of Sherwin-Williams chemists who shared a commitment to finding a new type of paint. Under the leadership of Van Stone, each member of the team successfully built upon each other's individual research in resins and emulsification.

The research into new coating concepts that led to Kem-Tone® paint began as early as 1930, when Sherwin-Williams established a central research laboratory in Chicago known as Allied Research. In 1933, it established an additional research department called Resin Research. It was there that James Hunn began to investigate innovative binders for paints such as new alkyds (synthetic polymers formed from complex alcohols and acids) and phenolics (synthetic polymers made from aromatic organic compounds containing OH groups). Hunn's chemical innovations included a development of the linseed oil-limed rosin varnish that was eventually used in Kem-Tone® paint. This represented an important transition from simple waterborne protein paints, to oil-in-water modified protein paints.

In 1938, Van Stone was promoted from Sherwin-Williams' operations in Chicago to Vice-President and Director of Paint Manufacturing in Cleveland. This move was the beginning of the specific research and development that led to Kem-Tone® paint, for Van Stone had the foresight to realize that Hunn's resin research and further emulsification research could lead to significant breakthroughs in water-based coatings.

Van Stone brought with him 20 years of experience in the Dry Color and Chemical Products Departments, where pigments prepared in a water system were "flushed" (mixed with emulsifiers and oil-type binders), creating non-water, liquid, color concentrates. These were formulated into both solvent-borne coatings and into the textile industry's waterborne printing colors used for patterns on cotton fabric. This technology extended logically into both Kem-Tone® paint and the camouflage paints that were used in large volume in the latter years of World War II.

It was this vision and understanding of chemical research that led Van Stone to appoint Donald Kohr as section supervisor of emulsion and waterborne paint research for the company. Van Stone served as the crucial link between Hunn's resin and polymer research and Kohr's application of this research to produce emulsion paints.

While directing waterborne paint research, Kohr employed Hunn's formulations of linseed oil/rosin varnish. Kohr also applied Hunn's work with refined polymerized tall oil to reinforce casein and corn protein as binders. The result was the introduction of Kem-Tone® paint and eventually the evolution of more durable waterborne paints.



Mr. Kohr (above, right) on the production line. Dr. Van Stone (below, far right) accepts the two millionth can of Kem-Tone® on Oct. 1, 1942.



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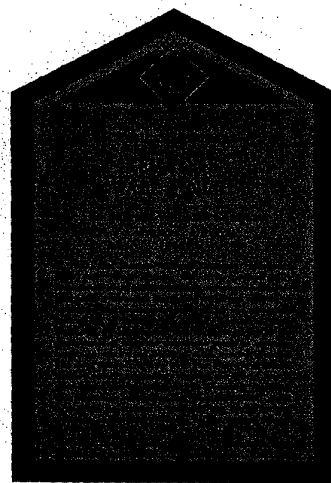
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THE NATIONAL HISTORIC CHEMICAL LANDMARKS PROGRAM OF THE AMERICAN CHEMICAL SOCIETY

The ACS National Historic Chemical Landmarks Program recognizes our scientific and technical heritage and encourages the preservation of historically important achievements and artifacts in chemistry, chemical engineering, and the chemical process industries. It provides an annotated roster to remind chemists, chemical engineers, students, educators, historians, and travelers of an inspiring heritage that illuminates both where we have been and where we might go when travelling the diverse paths to discovery.

An ACS Historic Chemical Milestone designation marks a landmark step in the evolution of the chemical sciences and technologies. A Site designation marks the location of an artifact, event, or other development of clear historical importance to chemists and chemical engineers. An Historic Collection designation marks the contributions of a number of objects with special significance to the historical development of chemistry and chemical engineering.

This program began in 1992, when the Division of the History of Chemistry of the ACS formed an international Advisory Committee. The Committee, composed of chemists, chemical engineers, and historians of science and technology, works with the ACS Office of Public Outreach and is assisted by the Chemical Heritage Foundation. Together, these organizations provide a public service by examining, noting, recording, and acknowledging particularly significant achievements in chemistry and chemical engineering. For further information, please contact the ACS Public Outreach Office, 1155 16th Street, N.W., Washington, D.C. 20036; 1-800-ACS-5558, press 954.



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