

PRESERVATION SNAPSHOT

This monthly feature highlights National Register listings and eligible properties, tax act projects & compliance review success stories, as well as outstanding local efforts in New Jersey's history.

Radium Girls **The Story of US Radium's Superfund Site** *Orange, New Jersey*



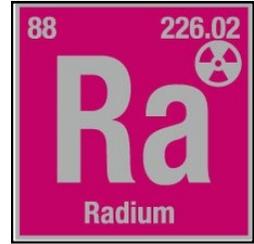
*US Radium Dial Painters, c. 1922, Paint Application Building, 2nd floor
Credit: Argonne National Laboratory*

At peak production during World War I, as many as 300 young women worked as 'dial painters' at their neighborhood US Radium Corporation plant in Orange, New Jersey. Seated at long benches on the second floor of the concrete Paint Application building with its large windows and skylights, they meticulously wielded minute brushes painting luminous paint on the numerals and hands of wrist watches and airplane cockpit dials. Within ten years, many would be dead.

US Radium Corporation produced luminous paints and other radium products for military and medical purposes in Orange, NJ from 1917-1926. However, they operated with a dual set of health & safety standards. Their chemists and scientists were provided protective measures against exposure to the radioactive radium. The dial painters had no such measures in place. Nearly every surface inside their factory buildings sparkled with radioluminescence. Their supervisors told the dial painters the flavorless paint was perfectly safe, and encouraged them to "point" their camel hair brushes with their lips to keep a fine point.

Radium

It was 1896 when Henri Becquerel discovered radium as a new element – Ra. Marie Curie and her husband, Pierre, jointly won the Nobel Prize with Becquerel in 1903 for their work on radioactivity.



The damaging effects of radiation exposure were well understood by the scientists. In a 1903 interview, Pierre Curie describes the hazards of radium saying, “he would not care to trust himself in a room with a kilo of pure radium, as it would doubtless



Marie Curie

Credit: nobelprize.org

destroy his eyesight and burn all the skin off his body, and probably kill him.”

Pierre perished in an accident four years later. However, Marie Curie died in 1934 of radiation-related illness. Her lab notebooks are said to be too highly contaminated to be safely handled, even today, and are stored in lead boxes.

In 1906, a Dr. Sabin von Sochocky studied “all there is to know” about radiation under the Curies in Paris. Back in the States in 1913, he developed luminous radium paint, and was soon hired by US Radium to run their facility. By 1917, he was so heavily contaminated with radioactivity that his presence caused false readings when measuring the levels of purity of radium salts taken in the electroscopes laboratory at the plant. He died in 1928 at age 45.

Dial Painters

US Radium Corporation marketed their luminous paint under the brand name, “Undark.” It was a blended mix of glue, water and radium powder that was applied by the dial painters to watch faces, among many other products. The key ingredient was approximately one million times more active than uranium.

The luminous material was furnished to each dial painter in small tubes (1-2 grams each), one at a time. The mixture ordinarily got on hands when mixing it. Initially, the painter’s fine brush was rinsed in a glass of water and then pointed in the mouth. However, the water was soon taken away, as the company felt it wasted too much material.

At peak, production was nearly 55,200 dials per year, per dial painter. Some of the early dial painters ingested very large quantities of radium.



Dial Painters (location unknown)

Credit: dailykos.com



The Power of Radium at Your Disposal
Twenty-three years ago radium was unknown. Today, thanks to constant laboratory work, the power of this most unusual of elements is at your disposal. Through the medium of Undark, radium serves you safely and surely. Does Undark really contain radium? Most assuredly. It is radium, combined in exactly the proper manner with zinc sulphide, which gives Undark its ability to shine continuously in the dark.

Manufacturers have been quick to recognize the value of Undark. They apply it to the dials of watches and clocks, to electric push buttons, to the buckles of bed room slippers, to house numbers, flashlights, compasses, gasoline gauges, autometers and many other articles which you frequently wish to see in the dark.

The next time you fumble for a lighting switch, bark your shins on furniture, wonder vainly what time it is *because of the dark*—remember Undark. *It shines in the dark.* Dealers can supply you with Undarked articles.

For interesting little folder telling of the production of radium and the uses of Undark address

RADIUM LUMINOUS MATERIAL CORPORATION
30 FINE STREET NEW YORK CITY
PATENT OFFICE, N. Y. 300 NASSAU STREET

UNDARK
Radium Luminous Material
Shines in the Dark

To Manufacturers
The number of manufactured articles to which Undark will add increased usefulness is manifold. From a sales standpoint, it has many obvious advantages. We gladly answer inquiries from manufacturers and, when it seems advisable, will carry on experimental work for them. Undark may be applied either at your plant, or at our own.

The application of Undark is simple. It is furnished as a powder, which is mixed with an adhesive. The paste thus formed is painted on with a brush, it adheres firmly to any surface.

Undark Advertisement, 1921

Credit: Wikipedia

Until 1920, the dial painters were allowed to eat at their work stations without washing their hands. For fun, the young women would paint their nails, teeth and faces with the paint.

The dial painters and other workers were aware of their deteriorating health conditions as early as 1917. However, it took the medical profession until the mid-1920s to document the incidences of diseases, in part because US Radium executives urged doctors to attribute deaths to causes other than radiation poisoning. Syphilis was often cited to smear the reputations of the women.



*Illuminated Watch Face with Radium Paint Numerals & Hands
Credit: Ebay*



*American Weekly Sunday Newspaper Illustration
Credit: waterburyobserver.org*

Dentists were among the first to begin seeing numerous problems among the dial painters. “Radium Jaw” was a condition of dental pain, loose teeth, lesions and ulcers, and the failure of tooth extractions to heal.

Dial painters frequently suffered from suppression of menstruation, and sterility. If pregnant, they were prone to stillbirths, or terminations of pregnancy as the doctors “would not permit development” of the fetus.

Additionally, there were extreme deformities in body structure, fractures and shortening of limbs.



Undark Advertisement

Timeline

- ◆ In 1923, the first dial painter died. Her jaw fell away from her skull before death.
- ◆ In 1924, US Radium hired a Harvard physiologist consultant, but prohibited publication of his dire findings when they attributed the dial painters’ medical problems to radium. In fact, US Radium went so far as to issue a fictitious, “positive” report under the scientist’s name to the NJ Department of Labor (which was later revealed as fraudulent).
- ◆ In 1925, an independent statistician from Prudential Insurance Company documented incurable jaw infections and anemia among two dead, and 12 living dial painters.
- ◆ In 1925, the Essex County Medical Examiner noted the “detection of gamma rays from living dial painters, and the exhalation of radon from their lungs.”
- ◆ In 1925, the sister of a former dial painter died from radiation exposure, caused by sharing a bed with her sister.

- ◆ In 1926, US Radium ceased production of radium salts, closed its Orange plant, and moved its remaining operations to New York City.
- ◆ In 1928, the Surgeon General and Public Health Service required rigid and continuous inspection of radium plants; and required hourly allocation of radium, use of hoods, and medical monitoring of employees.
- ◆ In 1929, the US Department of Labor identified 23 fatalities attributed to radium poisoning.
- ◆ In 1931, the *Examiner* reported five deaths from bone cancer among a sample of 18 former dial painters. The other 13 were from various related diseases. The doctor stated this proved that radiation could cause cancer.
- ◆ By 1959, deaths from recorded radiation exposure had reached 45.



Dial Painter (location unknown)

Credit: Messy Nussy Chic

Litigation

In 1927, five years after her symptoms began, a bank teller (& former dial painter) named Grace Fryer filed suit against US Radium. She was joined in the action by four other ill factory workers – Edna Hussman, Katherine Schaub and sisters: Quinita McDonald and Albina Larice. They became known as the “Radium Girls.” At their first court appearance in January 1928, two were bedridden, and none could raise their arms to take an oath. Grace, unable to walk, required a back brace to sit up, and had lost all her teeth.

The women were too ill to attend the next hearing which was pushed to April at US Radium’s urging, at which time the judge adjourned the case until September because several US Radium witnesses were vacationing in Europe. A national outrage over the heartless delay erupted in the media, prompting the courts to reschedule for early June.

Days before the trial, an out-of-court settlement was reached, despite US Radium’s contention that the statute of limitations exonerated them of liability after two years. The women reluctantly accepted the offer, as they were not expected to live much longer. Each woman agreed to not hold US Radium liable; and was given \$10,000, and \$600 per year while they lived, as well as payment for all medical expenses incurred.

Not surprisingly, few of the annual payments were collected.

**5 POISONED WOMEN
FACE COURT DELAY**

**Hearings on Their Right to Sue
Radium Company for \$1,250,-
000 Adjourned to Sept. 24.**

EX-EMPLOYER TESTIFIES

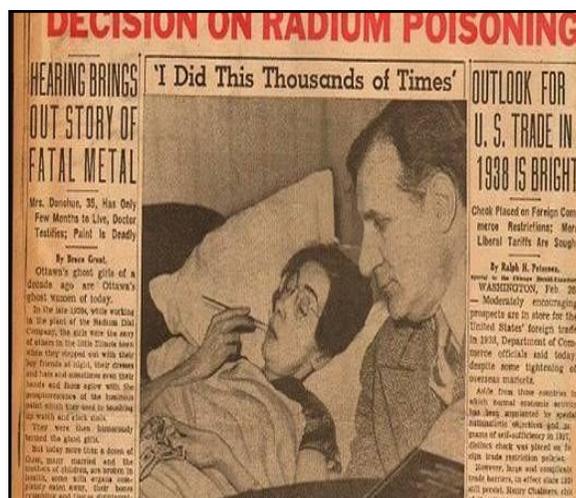
**Admits He Did Not Warn Them of
Danger to Their Lives in Luminous
Paint They Used.**

*New York Times Headline,
April 28, 1928 Credit: NY Times*

Following the court settlement, US Radium’s president, Clarence Lee stated:

“We unfortunately gave work to a great many people who were physically unfit to procure employment in other lines of industry. Cripples and persons similarly incapacitated were engaged. What was then considered an act of kindness on our part has since been turned against us.”

The last of the five Radium Girls died in the 1930s. Later medical research found that the dial painters had ingested between a few hundred to a few thousand microcuries of radium, per year. Today, the maximum safe exposure is considered to be 1/10 of a microcurie.



Catherine Donohue, a Luminous Process Company Dial Painter Testifying at a 1938 Trial
Credit: Chicago Daily News

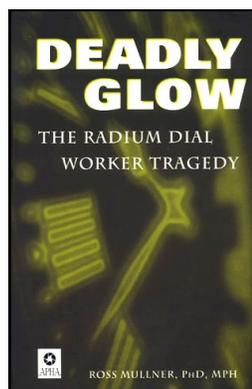
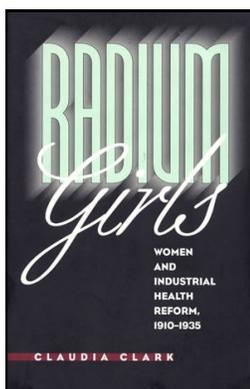
Legacy

The courage of these women to take legal action against their employer, and the subsequent hearings and national media attention, led to changes in regulations governing national labor safety standards. It established occupational disease labor law. It required safety precautions and protective gear for radium dial painters, as radium paint was still used on dials as late as the 1960s.

Congress eventually passed a bill in 1949, making all occupational disease compensable, and extended the time for workers to discover illness and file a claim.

The number of people who were sickened or killed by Undark and similar radioactive pigments over the years is unknown. It is estimated that over several decades, approximately 4,000 women around the country worked as dial painters. Thanks to the Radium Girls’ efforts and the ensuing improvements in industry safety, countless others were spared their dreadful fate.

Their story continues to be told in numerous books, poems, articles, films and plays.



L to R:

Radium Girls Book Cover Credit: waterburyobserver.org

Statue of Radium Girl, Ottawa, Illinois Credit: American Federation of Teachers

Deadly Glow Book Cover Credit: waterburyobserver.org

National Register Listing

The US Radium Corporation site in Orange, NJ was determined significant and eligible for listing in the National Register of Historic Places in 1997. At the time, two of the most significant buildings of the business remained – the Paint Application building and the Radium Crystallization Laboratory. Their criteria for eligibility on the National Register are: association with nationally significant developments in health and safety standards; the ability of woman reformers to secure protection for workers handling radioactive materials; and tools used to detect and measure radioisotopes.

Superfund Site

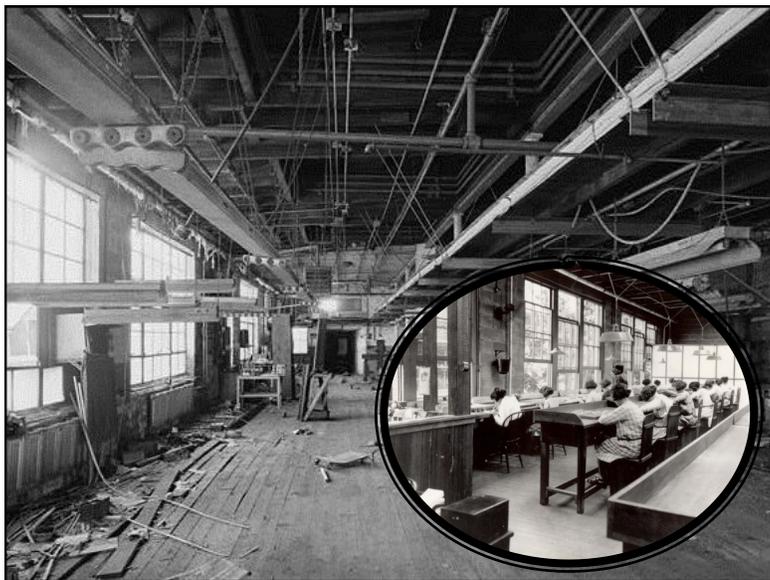
In 1980, the NJ Department of Environmental Protection found radon levels at the site of up to 50 microcuries per liter vs. the normal background level of 0.3 microcuries per liter. In addition, surface testing revealed “highly contaminated soil with 200-300 picocuries per gram, with high nodes of up to 5000 picocuries per gram.”



US Radium Corporation site in Orange, NJ, 1998

Left: Paint Application Building (2-stories); Right: Radium Crystallization Laboratory (1-story)

Credit: HAER



US Radium Paint Application Building, 2nd floor, 1998

Insert: Dial Painters in same room, 1922

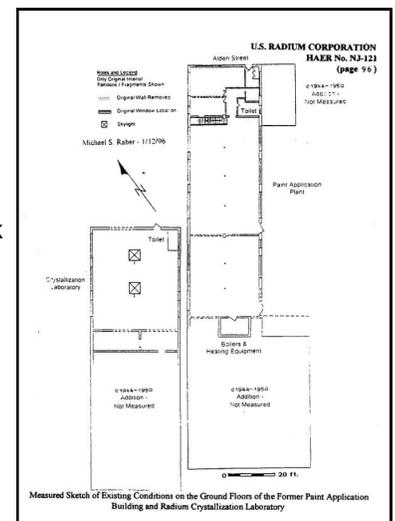
Credit: HAER

In 1983, the US Radium property was designated a Superfund site. Remediation of the site began in 1997 and lasted nine years. During this period, the two remaining buildings were demolished as part of the clean-up to remove radiological contamination, along with soil to a depth of 15’.

The NJ Historic Preservation Office required documentation of the structures before demolition. HAER drawings and photographs were created, however due to health concerns from elevated levels of contamination within the buildings, only limited interior photographic documentation was conducted.

The buildings were plain, concrete-block structures with

simple rectangular floor plans. Both were built in 1917 in a neighborhood of late 19th century worker housing and hat factories. Both were used commercially until the 1980s. Both had been heavily altered by additions, removal of original equipment and most original fixtures.





The saga of the US Radium Corporation site illustrates the importance and origins of environmental protection regulation and workplace safety in the United States. The NJ Department of Environmental Protection, of which the NJ Historic Preservation Office is part, works tirelessly to prevent future environmental hazards and/or violations like the Radium Girls.

Additional Sources: Historic American Engineering Record, "US Radium Corporation" Report, 1999; Radiological Society of America, "Radium Girls" by Richard Gunderman, MD, PhD & Angela Gonda, MD, 2015; "Undark and the Radium Girls" by Alan Bellows, 2006; The Waterbury Observer, "After Glow" by Ann Quigley, 2011.



Actress in "Radium Girls" Production

(Preservation Snapshot Archives appears on next page.)

PRESERVATION SNAPSHOT ARCHIVES

2016

- Trenton's Pottery Industry, Trenton, NJ February 2016
- Art Deco & Art Moderne Architecture in NJ January 2016

2015

- Buildings in the Battles of Trenton, Trenton, NJ December 2015
- Hinchliffe Stadium in The Silk City, Paterson, NJ November 2015
- Harleigh Cemetery and its Famous "Residents," Camden, NJ October 2015
- School's Out at the Boylan Street School, Newark, NJ September 2015
- Catboats ... Jersey Cats ... A-Cats, Barnegat Bay, NJ August 2015
- Lucy, the Elephant, Margate, NJ July 2015
- Mount Tabor Historic District, Parsippany-Troy Hills, NJ June 2015

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New Jersey 350 Archives

