



Illustration from the New York World, May 20, 1928.

The Radium Girls

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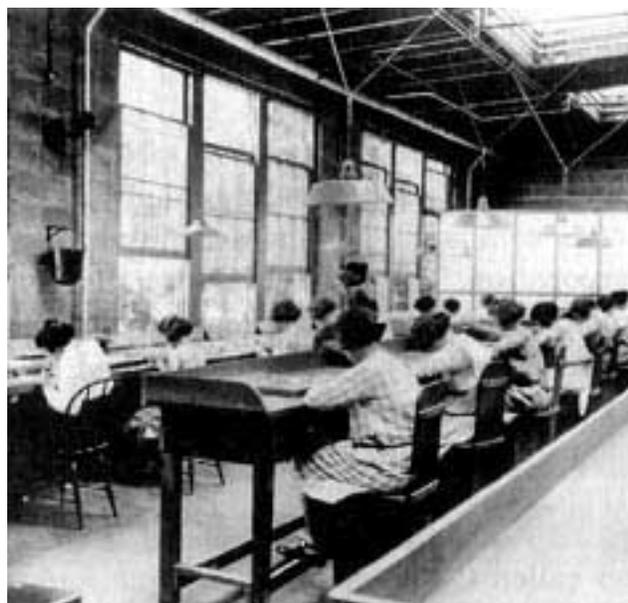
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It was a little strange, Fryer said, that when she blew her nose, her handkerchief glowed in the dark. But everyone knew the stuff was harmless. The women even painted their nails and their teeth to surprise their boyfriends when the lights went out.

Grace Fryer and the other women at the radium factory in Orange, New Jersey, naturally supposed that they were not being poisoned. It was a little strange, Fryer said, that when she blew her nose, her handkerchief glowed in the dark. But everyone knew the stuff was harmless. The women even painted their nails and their teeth to surprise their boyfriends when the lights went out. They all had a good laugh, then got back to work, painting a glow-in-the-dark radium compound on the dials of watches, clocks, altimeters and other instruments.

Grace started working in the spring of 1917 with 70 other women in a large, dusty room filled with long tables. Racks of dials waiting to be painted sat next to each woman's chair. They mixed up glue, water and radium powder into a glowing greenish-white paint, and carefully applied it with a camel hair brush to the dial numbers.

After a few strokes, the brushes would lose their shape, and the women couldn't paint accurately. "Our instructors told us to point them with our lips," she said. "I think I pointed mine with my lips about six times to every watch dial. It didn't taste funny. It didn't have any taste, and I didn't know it was



The Orange, N.J. radium dial factory in the mid-1920s. (Courtesy Argonne National Labs)

harmful." 1

Nobody knew it was harmful, except the owners of the U.S. Radium Corporation and scientists who were familiar with the effects of radium. Those days, most people thought radium was some kind of miracle elixir that could cure cancer and many other medical problems.



*Close-up of the workshop, this one in Ottawa, Ill.
(Courtesy Argonne National Lab).*

Grace quit the factory in 1920 for a better job as a bank teller. About two years later, her teeth started falling out and her jaw developed a painful abscess. The hazel eyes that had charmed her friends now clouded with pain. She consulted a series of doctors, but none had seen a problem like it. X-ray photos of her mouth and back showed the development of a serious bone decay. Finally, in July 1925, one doctor suggested that the problems may have been caused by her former occupation.

As she began to investigate the possibility, Columbia University specialist Frederick Flynn, who said he was referred by friends, asked to examine her. The results, he said, showed that her health was as good as his. A consultant who happened to be present emphatically agreed. Later, Fryer found out that this examination was part of a campaign of misinformation started by the U.S. Radium Corporation. The Columbia specialist was not licensed to practice medicine -- he was an industrial toxicologist on contract with her former employer. The colleague had no medical training either -- he was a vice president of U.S. Radium.²

Grace Fryer probably would have been another unknown victim of a bizarre new occupational disease if it had not been for an organization called the Consumers League and journalist Walter Lippmann, an editor with the New York World. Formed in 1899, the Consumers League fought for an end to child labor, a safe workplace and minimum pay and decent working hours for women.³ Lippmann was a crusading journalist and former muckraker who represented a powerful New York newspaper at a time when New York newspapers were arguably the most influential in the country.

The Consumers League

The request of a city health department official in Orange, New Jersey, brought the Consumers League into an investigation of the suspicious deaths of four radium factory workers between 1922 and 1924. The request was not unprecedented, since league officials had been involved in many official state and federal investigations. The causes of death in the Orange cases were listed as phosphorous poisoning, mouth ulcers and syphilis, but factory workers suspected that the dial painting ingredients had something

to do with it.

New Jersey Consumers League chairman Katherine Wiley brought in a statistical expert and also contacted Alice Hamilton, a Harvard University authority on workers' health issues. Hamilton was on the league's national board, and as it turned out, she was already involved in another aspect of the same case. A few years earlier, a colleague at Harvard, physiology professor Cecil Drinker, had been asked to study the working conditions at U.S. Radium and report back to the company. Drinker found a heavily contaminated work force, unusual blood conditions in virtually everyone, and advanced radium necrosis in several workers.

During the investigation, Drinker noticed that U.S. Radium's chemist, Edward Lehman, had serious lesions on his hands. When Drinker spoke to him about the danger in the careless and unprotected the way he handled the radium, he "scoffed at the possibility of future damage," Drinker said. "This attitude was characteristic of those in authority throughout the plant. There seemed to be an utter lack of realization of the dangers inherent in the material which was being manufactured."⁴ Lehman died a year later.

Drinker's June 1924 report recommended changes in procedures to protect the workers, but Arthur Roeder, president of U.S. Radium, resisted the suggestions. In correspondence with Drinker, Roeder raised several points that disputed the physiologist's findings and promised to send along facts to back up the assertions, which he never did. Roeder refused to give the Harvard professor permission to publish his findings about the new radium disease at the plant, insisting that Drinker had agreed to confidentiality. Eventually, U.S. Radium threatened legal action against Drinker.⁵

Roeder was also in correspondence with Wiley at the Consumers League. Wiley wanted U.S. Radium to pay some of the medical expenses for Grace Fryer and the other employees having problems. Roeder said that Fryer's condition had nothing to do with radium, saying it must be "phospho jaw or something very similar to it." He also accused Wiley of acting in bad faith, saying that a small amount of data from the company was shared with the league in confidence, and he claimed Wiley betrayed his confidence.⁶

In April 1925, Alice Hamilton wrote to Katherine R. Drinker, also a Ph.D. and a partner with her husband Cecil in their U.S. Radium investigation. The letter, on Hull House stationery, said:

"... Mr. Roeder is not giving you and Dr. Drinker a very square deal. I had heard before that he tells everyone he is absolutely safe because he has a report from you exonerating him from any possible responsibility in the illness of the girls, but now it looks as if he has gone still farther... [The New Jersey Department of Labor] has a copy of your report and it shows that 'every girl is in perfect condition.' Do you suppose Roeder could do such as thing as to issue a forged report in your name?" ⁷

After this letter, Cecil Drinker realized why Roeder had been stalling him and trying to keep his report from being published. After the Hamilton letter, Drinker sent his original report to the Department of Labor and made arrangements to publish it in a scientific journal, despite U.S. Radium's threats. Meanwhile, a Consumer League consultant trumped the Drinkers by reading a radium necrosis paper at



the American Medical Association conference, while the Drinkers fought Roeder for permission over the data.⁸ The Drinkers finally published their paper later that year, concluding:

"Dust samples collected in the workroom from various locations and from chairs not used by the workers were all luminous in the dark room. Their hair, faces, hands, arms, necks, the dresses, the underclothes, even the corsets of the dial painters were luminous. One of the girls showed luminous spots on her legs and thighs. The back of another was luminous almost to the waist...."⁹

Alice Hamilton, M.D., of Harvard, investigated the case and called Walter Lippmann of the New York World. (Library of Congress).

This casual attitude toward the green radium powder was not matched in other parts of the factory, especially the laboratory, where chemists typically used lead screens, masks and tongs. Yet the company management "in no way screened, protected or warned the dial painters," Fryer's attorney, Raymond Berry, charged. The "radium girls," like many other factory workers at the time, were expendable.

Radium's Dangers

The scientific and medical literature contained plenty of information about the hazards of radium. Even one of U.S. Radium's own publications, distributed to hospitals and doctors' offices, contained a section with dozens of references labeled "Radium Dangers -- Injurious Effects." Some of the references dated back to 1906.

Despite the availability of information on the hazards of radium, it was often seen as a scientific miracle with enormous curative powers. The "radium craze" in America, which began around 1903, familiarized the public with the word "radium." One historian said: "The spectacular properties of this element and its envisioned uses were heralded without restraint in newspapers, magazines and books and by lecturers, poets, novelists, choreographers, bartenders, society matrons, croupiers, physicians and the United States government." Stomach cancer could be cured, it was imagined, by drinking a radium concoction that bathed the affected parts in "liquid sunshine."¹⁰ One of the medical drinks sold over the counter until 1931, "Radithor," contained enough radium to kill hundreds or possibly thousands of unsuspecting health enthusiasts who drank it regularly for several years.¹¹ An overview of newspaper and magazine articles on radium in the first decades of the 20th century found their tone strongly positive.¹²

Even when hazards emerged in mainstream press coverage, the benefits usually outweighed the dangers. For instance, the death of French scientist J. Bergonie in November, 1924, provoked a spate of news articles extolling the "martyrs to science" who died experimenting with the element. The New York World counted 140 scientists who, like Bergonie, had given their lives for humanity. The sacrifice had been worthwhile, the newspaper said:

"Nowadays, tested precautions make the manipulation of radium or the use of x-rays as innocuous to both operator and patient as the pounding of a typewriter... The exploration has

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“Standard” Radium Solution for Drinking

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Maximum-equilibrium constant of radium emanation, 5400 maebe units.

PERMANENT



“Standard” Radium Solution for Intravenous Use.

In Ampules of 2 cc. N. P. S. S. containing 5, 10, 25, 50, or 100 micrograms radium element.

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“Standard” Radium Compress

A means of applying radium locally for the relief of pain.

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INDICATIONS

Subacute and Chronic Joint and Muscular Conditions,
High Blood Pressure, Nephritis,
The Simple and Pernicious Anemias.

“The value of radium is unquestionably established in chronic and subacute arthritis of all kinds (goutic and tuberculous excepted) acute, subacute and chronic joint and muscular rheumatism (so called) in gout, sciatica, neuralgia, polyneuritis, lumbago and the lancinating pain of tubes.”—Rowntree and Haejer, Journal A. M. A. Oct. 19, 1913.

<p>For Descriptive and Clinical Literature Address</p> <p>RADIUM CHEMICAL COMPANY</p>	<p>Chicago C. W. Hooper, M. D., 117 1st Nat'l Bank Bldg.</p>	<p>San Francisco Fred L. Liebman, Through Druggist, 505 Butler Bldg.</p>
<p>New York C. Everett Field, M. D., 15 E. 41st St.</p>	<p>PITTSBURGH</p>	
<p>Boston Harriet D. Loom, M. D., 29 Newbury St.</p>		

FIGURE 3 This advertisement for radium preparations to be used *Radithor, a miracle cure for -- and cause of -- cancer.* (Courtesy Argonne National Lab).

cost many lives and untold agonies, but the martyrs would undoubtedly be the first to assert that the gain in knowledge had been worth the price. Both discoveries are now thoroughly established as safe, healing agencies of the utmost value."13

Many scientists felt threatened by the idea that radium could cause, rather than cure, cancer. "If radium has unknown dangers, it might seriously injure the therapeutic use of radium," Charles Norris, chief medical examiner of New York, wrote Raymond Berry during Fryer's lawsuit.14 An ore agent and former partner in U.S. Radium also wrote to Berry: "Thousands in Germany have been taking radium salts, admixed with bicarbonate of soda, as a vital stimulant," he said. The bone afflictions of the "radium girls" was probably produced by the glue or another ingredient, but "radium could not produce the results ascribed to it."15

The Lawsuit

Although it meant flying in the face of some medical opinion, Grace Fryer decided to sue U.S. Radium, but it took her two years to find an attorney willing to take the case. On May 18, 1927, Raymond Berry, a young Newark attorney, took the case on contingency and filed a lawsuit in a New Jersey court on her behalf. Four other women with severe medical problems quickly joined the lawsuit. They were Edna Hussman, Katherine Schaub, and sisters Quinta McDonald and Albina Larice. Each asked for \$250,000 in compensation for medical expenses and pain. The five eventually became known in newspaper articles carried in papers throughout the U.S. and Europe as "the Radium Girls."

The first legal hurdle was New Jersey's two-year statute of limitations. Berry contended that the statute applied from the moment the women learned about the source of their problems, not from the date they quit working for U.S. Radium. Berry alleged that U.S. Radium's misrepresentation of scientific opinion and campaign of misinformation was the reason that the women were not informed and did not take legal action within the statute of limitations.

While Berry and the company skirmished in court, medical examiners from New Jersey and New York continued to investigate the suspicious deaths of plant workers. Amelia Maggia, a former dial painter and sister of two of the Radium Girls, McDonald and Larice, died in 1922 from what was said to be syphilis

and was buried in Rosemont Cemetery in Orange. She had been treated by a New York dentist, Joseph P. Knef, who had removed Maggia's decayed jawbone some months before she died. "Before Miss Maggia's death I became suspicious that she might be suffering from some occupational disease," Knef said. At first he suspected phosphorous, which produced the notorious "phossy jaw" necrosis common among match makers in the early 18th century. "I asked the radium people for the formula of their compound, but this was refused," Knef said. "After the girl's death so many other persons were sent to me with almost similar symptoms that I became more suspicious, and took up the study of radium with an expert."¹⁶ In 1924, Knef wrapped the jawbone in unexposed dental film for a week and then developed the film. He also checked the bone with an electroscope to confirm its radioactivity and then wrote a paper with the Essex County medical examiner identifying radium necrosis.¹⁷ In the words of a Newark, N.J., newspaper: "Dr. Knef then described how radium, hailed as a boon to mankind in treatment of cancer and other diseases, becomes a subtle death-dealing menace."

An autopsy could confirm Knef's findings, and after a formal request by the Maggia sisters and Raymond Berry, Amelia's body was exhumed on October 16, 1927. An investigation confirmed that her bones were highly radioactive. Clearly, Maggia had not died of syphilis, but of the new and mysterious necrosis that was also killing her sisters.

The Media Coverage

Only after the case of the New Jersey women was legitimized in a courtroom setting -- a formal structure for news gathering -- did the larger media outlets pick up the story. And they did so with a mix of sensationalism and muckraking, accelerating the issue. In the fall of 1927, an enterprising Star Eagle reporter found that U.S. Radium had reached out-of-court settlements with the families of other radium workers in 1926, paying a total of \$13,000 in three cases.¹⁸

Legal maneuvers filled 1927, and the medical condition of the five women worsened considerably. The two sisters were bedridden, and Grace Fryer had lost all of her teeth and could not sit up without the use of a back brace, much less walk. When the first court hearing came up January 11, 1928, the women could not raise their arms to take the oath. All five of the "Radium Girls" were dying.

"When pretty Grace Fryer took the witness stand, she said her health had been good until after she had been employed at the radium plant," one news account said. Fryer and the others bravely tried to keep smiling, but friends and spectators in the courtroom wept. Edna Hussman told the court about the financial troubles the medical bills were causing: "I cannot even keep my little home, our bungalow," she said. "I know I will not live much longer, for now I cannot sleep at night for the pains." She was content, however, because her children would be cared for by relatives.¹⁹

The news media suddenly found the story irresistible. Headlines included: "Woman Awaiting Death Tells How Radium Poison Slowly, Painfully Kills"²⁰ and "Would You Die for Science? Some Would."²¹ The newspapers followed the twists and turns in the case, particularly the suffering of the women, the disappearing hope for a cure and the company's defense. One of the macabre fascinations with the "Radium Girls" story was how -- assuming the women won the lawsuit -- one might spend a quarter million dollars with only a year to live. One enterprising newspaper asked 10 randomly selected women what they would do. Most of the responses involved spending sprees and charity donations.²²

By April, the women were not physically or mentally able to attend a second hearing in court. Their attorney was caustic: "When you have heard that you are going to die, that there is no hope -- and every

newspaper you pick up prints what really amounts to your obituary -- there is nothing else," Berry said.²³

French scientist Marie Curie, the discoverer of radium, read about the case and told papers in her home country that she had never heard of anything like it, "not even in wartime when countless factories were employed in work dealing with radium." French radium workers used small sticks with cotton wadding rather than paintbrushes, she said. Although the five New Jersey women could eat raw liver to help counteract the anemia-like effects of radiation sickness, they should not hope for a cure for radium poisoning. "I would be only too happy to give any aid that I could," Curie said. However, "there is absolutely no means of destroying the substance once it enters the human body."²⁴ A local newspaper said Madame Curie had "affirmed the doom already sounded by leading medical authorities who have examined the girls." The predictable reaction, the paper said, was that "some of the victims were prostrated with grief last night when they received the news."²⁵

Curie heard about the reaction and, on June 4, said: "I am not a doctor, so I cannot venture an opinion on whether the New Jersey girls will die. But from newspaper descriptions of the manner in which they worked, I think it imperative to change the method of using radium."²⁶ Curie herself died of radium poisoning in 1934.

Time was running out, and Berry, Wiley, Hamilton and others had long been concerned that legal maneuvering would delay justice until well after the women were dead. As anticipated, U.S. Radium did not hesitate to use delaying tactics. After the hearing on April 25, 1928, the Chancery court judge adjourned the case until September despite Berry's strenuous objections. Berry reminded the judge that the women were dying, and might not live until September. Berry also found lawyers with cases scheduled in less than a month who were willing to take a September court date to give the "Radium Girls" their day in court. But U.S. Radium attorneys said that their own witnesses would not be available as many were going to Europe for the summer on vacation, and the judge insisted on continuing the case until September.

Walter Lippmann and the New York Press

The blizzard of publicity surrounding the case worried some medical consultants. "Can you get the [newspapers] to agree to keep the women out of the paper henceforth?" one doctor wrote Berry. "We all agreed that this should be done and that the publicity has had a bad effect on the patients. One was quoted as seeing her body glow as she stood before a mirror..."²⁷ Another doctor wrote: "I would certainly not like to have anything the matter with me and be told every few weeks that I was going to die... Surely you realize what the psychological effect of that would be."²⁸ Berry protested: "I am absolutely unconnected, in any way, with newspaper articles which are published. I have endeavored to discourage publicity..."²⁹

In spite of the general disdain for the press on the part of the plaintiffs, a moment arrived in the case when the "Radium Girls" needed a champion. Their physical condition was deteriorating and their financial situation was pitiful. Time was running out. Alice



Walter Lippmann, editor of the New York World newspaper.

Hamilton had carefully laid out a strategy in the previous months with the editor of one of the nation's most powerful newspapers of the time, the New York World. An avowedly liberal newspaper founded by Joseph Pulitzer, the World championed public health causes as part of its mission to "never lack sympathy with the poor [and] always remain devoted to the public welfare."³⁰ Hamilton's long-time friend was World editor Walter Lippmann; he had already worked with Hamilton, ensuring that coverage of the Ethyl leaded gasoline controversy in 1925 included both sides of the story, including large amounts of copy from university scientists critical of Standard Oil.³¹

Hamilton had written to Lippmann in 1927 as she formulated strategy. "There is a situation at present which seems to me to be in need of the sort of help which the World gave in the tetra-ethyl affair," Hamilton wrote.³² She got a response. Lippmann wrote to Berry, "Dr. Hamilton has asked The World to interest itself in this case and has told me that you have the necessary documents. I should appreciate it if you could let me see them."³³ When the judge continued the case until September, Lippmann stepped out of his normally cool and sober editorial pulpit. This, he said in a May 10, 1928 editorial, was a "damnable travesty of justice... There is no possible excuse for such a delay. The women are dying. If ever

a case called for prompt adjudication, it is the case of five crippled women who are fighting for a few miserable dollars to ease their last days on earth..."³⁴

At this point, Frederick B. Flynn, the Columbia University consultant for U.S. Radium, called a press conference and proclaimed that the women could survive and that he found no radioactivity in his tests. Berry refused to comment, saying he would "prefer to try the case in court."³⁵ Lippmann was furious. "To dispute whether they can live four months or four years while lawyers wrangle over technicalities is to make the case more stupendously horrible than ever. The whole thing becomes a legal nightmare when in order to obtain justice five women have to go to court and prove that they are dying while lawyers and experts on the other side to go the newspapers to prove that they may live somewhat longer." Noting that it was U.S. Radium that was holding up proceedings, Lippmann said: "This is a heartless proceeding. It is unmanly, unjust and cruel. This is a case which calls not for fine-spun litigation but for simple, quick, direct justice."³⁶

Lippmann's editorials, Berry's maneuverings, the behind-the-scenes public relations work of Hamilton and others, and the accumulating outrage as represented in headlines convinced the New Jersey court system, and a trial was rescheduled for early June 1928.

Thousands of sympathy letters and quack remedies arrived at the women's homes and the office of their attorney. Inject tannin, said one. Drink Venecine health juice, said another. Drink "mazon," an old world cure-all, said a third, but the author did not include the recipe for the potion. The New York Graphic wrote to offer the services of the famous nature healer Bernarr MacFadden in exchange for publicity rights. "Since the medical doctors have given you up, you have nothing to lose and much to gain by trying natural methods... Of course, we would expect you to be willing to cooperate with us to

the fullest extent and to allow us to give full publicity to the case."37

The Settlement and Its Aftermath

With Lippmann and the newspapers outraged and the legal system shifting in favor of the victims, pressure to settle the case built on U.S. Radium. In early June, a federal judge volunteered to mediate the dispute and help reach an out-of-court settlement. Days before the case was to go to trial, Berry and the five "Radium Girls" agreed that each would receive \$10,000 and a \$600 per year annuity while they lived, and that all medical and legal expenses incurred would also be paid by the company. The agreement also stipulated payment for all future medical expenses, which would be determined by an impartial panel of physicians.

Berry was not entirely happy with the settlement, feeling that "the corporation gets a great advantage," although he knew that the women's situation had grown desperate. He was also skeptical of the mediator, U.S. District Court Judge William Clark. "He is, I am sure, a very honorable man and genuinely interested in social problems," but he is "a man whose circumstances in life place him in the employer's camp." Berry was informed that Judge Clark was a stockholder in the U.S. Radium Corporation.³⁸

Meanwhile, the national president of the Consumers League, Florence Kelly, wrote to Alice Hamilton saying she was "haunted" by the "cold blooded murder in industry" that was taking place in the radium case. Kelly led other state chapters of the Consumers League in checking other radium dial plants, including those in Pennsylvania and Illinois.

Along with investigating other plants, Kelly and Hamilton agreed that another step needed to be taken. In a meeting in New York City, the medical examiners for New York and New Jersey sat down with Hamilton, Kelly and Berry. The group agreed on a strategy for proposing a general conference on radium factory safety standards to Surgeon General Hugh Cumming of the U.S. Public Health Service. The medical examiners signed a letter proposing the conference, and the New York World supported it editorially. Kelly and her colleague, Josephine Goldmark, visited Lippmann and Goldmark wrote this account of the meeting:³⁹

"The day we visited him in his small office high up in the dome of the old World building was not wholly propitious for detailing our plans. The political campaign of 1928 was in full swing and just at the moment when we reached his office, Mr. Lippmann, as I recollect it, was receiving the first wires from the Democratic National Convention in Chicago. He listened to us with interest, nevertheless, and promised his full aid as soon as the letter to the surgeon general had been sent. But he counseled delay... [as Kelly put it] Lippmann agreed to help us in every way possible, but warned us that we should injure our case if we attempted to present it publicly before July 4th, after the close of the second presidential convention."⁴⁰

All agreed to wait for Hamilton's signal, and Hamilton and Lippmann stayed in close touch during those weeks in July 1928. On July 16, as the letter went out, Lippmann wrote in an editorial: "In many aspects the disease is surrounded by mystery which only an expert, impartial and national agency can remove... clearly this is a task for the Public Health Service."⁴¹

Other endorsements followed, including one from Mrs. Franklin D. Roosevelt, a board member with Hamilton on the National Consumers League. Surgeon General Cumming agreed to the conference and called interested parties together on December 20, 1928.

The conference agreed that two committees should be set up: one to investigate existing conditions and a second to recommend the best known means of protection for workers. A Public Health Service official, James P. Leake, commended the Consumers League and others who had worked on behalf of public health and worker safety. "By focusing public attention on some of these horrible examples," Leake said, "the broader problems of disease prevention... can be greatly reduced. It was so in the tetra-ethyl lead work." He added: "The martyrdom of a few may save many."⁴²

CONCLUSION

The five "Radium Girls" died in the 1920s and 1930s. Their sad fate was sealed when they dipped paintbrushes into radium paint and sharpened the bristles with their mouths. There was a resistance to warnings about the dangers of radium in society -- highlighting the importance in the relationship between ideas and social structure. In addition, radium was seen as part of the arena of science and medicine and as such enjoyed a certain legitimacy that made it almost beyond criticism. Science was seen as having all the answers, and people were reluctant to question it. It was not until Lippmann and other mainstream media outlets became involved in the story -- and that involvement was accelerated by the legitimization of the legal system -- that the Radium Girls finally settled their lawsuit, albeit for \$10,000-plus, much less than the \$250,000 they had hoped to receive.

The Consumers League and the news media as represented by Lippmann may have served the democratic process. Other dial painters from the era survived, and those who worked at radium paint factories in later years were better protected. Goldmark said, "The hazards of another lethal industrial poison were overcome, and the democratic process of government by informed public opinion was again justified."⁴³ The newspapers, with their preference for dramatic events, also served up the victims as part of a daily fare of murder, mayhem and monstrosities. There exists an interesting parallel to the investigative journalism of later in the century. In the book *Journalism of Outrage*, the authors note a "coalition building" process between journalists and government officials and/or interest groups in the 1980s.⁴⁴ In one case, journalists from a Philadelphia newspaper coordinated their efforts with Congressional staff from the very beginning of a project. The interactive nature of the process in the 1920s was evident when Walter Lippmann and Alice Hamilton used each other for their own ends. Lippmann's newspaper was considered "liberal" and catered to a working class audience, which would appreciate a story like the Radium Girls; Hamilton needed Lippmann and other journalists to meet her goals, including public awareness of workers' safety issues.

Footnotes

1 Florence L. Pfalzgray, "Radium Victim Battles Death With Courage," Orange, N.J. Daily Courier, April 30, 1928: 1.

2 Affidavit of Grace Fryer, Fryer et al. v. U.S. Radium Corp., July 6, 1927; Also, testimony of Grace Fryer, Fryer et al. v. U.S. Radium, January 11, 1928. Records of the National Consumers League, Raymond H. Berry files, Manuscript Division, Library of Congress, Washington, D.C.

3 Josephine Goldmark, *Impatient Crusader: Florence Kelly's Life Story* (Westport, Connecticut: Greenwood Press, 1953): 51.

4 See "Blame Odd Deaths on Mesothorium," New York World, June 21, 1925: 3.

5 Josiah Stryker to Cecil Drinker, June 20, 1925, Records of the National Consumers League, Raymond

H. Berry files, Manuscript Division, Library of Congress, Washington, D.C.

6 Arthur Roeder to Katherine Wiley, January 26, 1925, Records of the National Consumers League, Raymond H. Berry files, Manuscript Division, Library of Congress, Washington, D.C.

7 Alice Hamilton to Cecil Drinker, April 4, 1925, Records of the National Consumers League, Raymond H. Berry files, Manuscript Division, Library of Congress, Washington, D.C.

8 Frederick Hoffman, "Radium (mesothorium) Necrosis," *Journal of the American Medical Association*, (September 26, 1925): 961. The first paper to identify radium necrosis was that of Theodore Blum, "Osteomyelitis of the Mandible and Maxilla," *Journal of the American Dental Association*, (September 1924): 802.

9 William B. Castle, Katherine R. Drinker, and Cecil K. Drinker, "Necrosis of the Jaw in Radium Workers," *Journal of Industrial Hygiene*, (August 1925): 373.

10 Lawrence Badash, *Radioactivity in America: Growth and Decay of a Science* (Baltimore, Md.: Johns Hopkins Press, 1979): 25.

11 "A Most Valuable Accident," *The New Yorker*, May 2, 1959: 49. Each bottle contained two picocuries of radium. See R.E. Rowland, *Radium in Humans: A Review of U.S. Studies* (Argonne, Ill.: Argonne National Laboratory, 1994): 7.

12 Spencer R. Weart, *Nuclear Fear: A History of Images* (Cambridge, Mass.: Harvard University Press, 1988): 53.

13 "Bergonie Is Latest of 140 Martyrs to X-Ray and Radium," *New York World*, November 16, 1924, Section II: 1. Also, "Heroes and Martyrs of Medicine," *New York World Magazine*, May 13, 1928: 2.

14 Charles Norris to Raymond Berry, June 7, 1928, Berry Papers.

15 Thomas F.V. Curran to Quinta McDonald, May 24, 1928; Thomas F.V. Curran to Raymond Berry, May 21, 1928, Berry papers.

16 "Exhume Girls Body to Find Death Cause," *Newark Sunday Call*, October 16, 1927: 1.

17 Harrison S. Martland, Philip Conlon and Joseph P. Knep, "Some Unrecognized Dangers in the Use and Handling of Radioactive Substances" *Journal of the American Medical Association*, (December 5, 1925): 1669.

18 "Newark Pathologist Shows Part of Miss Maggia's Jaw," *Star Eagle*, October 18, 1927.

19 "5 Women Smile, Fearing Death, in Radium Case" *Newark Ledger*, January 12, 1928.

20 "Woman Awaiting Death Tells How Radium Poison Slowly, Painfully Kills," *New York Telegram*, May 13, 1928.

21 "Would You Die for Science? Some Would," *New York Journal*, April 28, 1928.

22 "Doomed to Die, They Tell How They'd Spend Fortune," *Newark Sunday Call*, May 13, 1928.

23 Ethelda Bedford, "Radium Victims too Ill to Attend Court Tomorrow," *Newark Ledger*, May 17,

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