Episode 1
Room 225: Uncovering a Decades-Old Danger

Frist Campus Center sits in the heart of Princeton University, in Princeton, NJ. Students play pool, nap on couches while reality TV flickers in the background, grab a meal at the food gallery and sip iced coffee from the in-house café. The Center also hosts classes, conferences and student organizations, and is the home of the McGraw Center. It's a busy place at all hours.

Every student at Princeton knows that Frist was once called Palmer Hall, and before that, the Palmer Physical Laboratory, and for decades was home to the Department of Physics. Albert Einstein trod these halls—there is even a classroom on the third floor preserved just as it was when history's most famous theoretical physicist taught here. The basement once housed a 50-ton cyclotron, parts of which today sit in Jadwin Hall, the Physics Department's current home.

The Palmer Physical Laboratory once housed something else, too—radioactive materials. It was this fact that brought Sue Dupre, a health physicist from the University's office of Environmental Health and Safety, to an unlikely spot outside the building one day in 1999. Dupre had knowledge of something few others then living were even aware of: a chaotic accident which had occurred in the lab more than 60 years earlier, releasing potentially dangerous amounts of radiation.

But what exactly happened in Palmer? Why was Dupre searching *outside* for something that had occurred inside? Why had no one before ever thought to investigate this particular spot? And what did her hunch mean for the future of this high-profile building, then in the middle of a multimillion-dollar conversion into what we now know as Frist Campus Center?

We'll investigate these questions, and more, in this inaugural episode of **EHS Stories: Dramatic Tales From the 50-Year History of Environmental Health and Safety at Princeton University**. I'm your host, Jim Sturdivant. Please join me as we dive into the colorful and sometimes shocking annals of the ever-evolving effort to mitigate hazards, prevent illness and injury, prepare for the unexpected, and keep people safe at one of the world's great research universities.

Part One: Toxic Dust

As we mentioned in the introduction, Frist Campus Center today is Princeton University's bustling heart. Eighty-five years ago, the building was bustling in a very different way. Important research was being conducted here that would in a few years prove vital to the Manhattan Project, the effort to build the world's first atomic bomb.

No-one knows this history better than Sue Dupre.

"I'm Sue Dupre. I arrived in the office of Occupational Health and Safety, the pre-EHS designation, in January of 1978, as the Assistant Health Physicist for the University."

A self-described child of the Cold War, Dupre grew up fascinated by the promise and peril of radioactivity. Despite being told by her grandmother that girls didn't pursue careers in science, Sue earned a B.S. in physics from Northeastern and an M.S. in bioneucleonics from Purdue. She joined what was then known as Princeton OHS for her first job out of graduate school.

Soon after her arrival, the young health physics officer was given a file containing a January 1971 transcript of the recollections of Walter Bleakney, former head of the Physics Department. In it, Bleakney recounted the story of a lab accident that occurred in May 1936 when a large amount of Radium 226 was released on the second floor of Palmer.

"We know what we do know about this incident from a transcript that is in the files. The university undertook an extensive decontamination of Palmer Hall, where this incident occurred, in 1970 and 1971. And at the time, they were able to speak to the professor who was involved in the cleanup of this radium spill. And he produced a tape recounting his memories. And then a transcript was produced from that tape and placed in our EHS files.

"I read the transcript when I first arrived because I think my bosses at the time thought it was a piece of history I should know about."

What Sue read that day stayed with her for the rest of her career.

The professor involved in this particular incident was Rudolph Ladenburg, along with a lab assistant, C. C. Van Voorhis.

"Everybody who was around at the time I started, knew him as Rudy and called him Rudy, but his name was Rudolph."

Ladenberg, born in 1882, was an eminent scientist in Germany when he accepted a visiting professorship at Princeton in 1931, becoming a full professor the following year. In addition to his pioneering work in gas dispersion, fluid dynamics and research into supersonic airflow, he played a pivotal role in the 1930s helping fellow Jewish scientists escape Nazi Germany and find positions at American Universities.

Dupre never met Rudy—he died in 1952 at the age of 69, not quite two years after retiring from Princeton. His friend Albert Einstein said he was, quote, "caught suddenly by illness."

Anyway, back to our story.

Professor Ladenburg and his assistant were studying the emissions from Radium 226, which involved utilizing a radium beryllium source of neutrons stored in a brass cylinder.

"They'd been doing some work with it. And I should say that an alpha particle, which is one of the products of radiant decay, is a helium nucleus. And helium is a gas. And so they have reason to think that there was some leakage of gas from the source."

Ladenburg and his assistant decided the brass cylinder needed to be re-soldered.

"And it turns out that applying heat to a source with a little bit of pressure inside it is not the way to you know, and they did it as best as we can tell on an open workbench. So there was a fume hood in the room. But they weren't working within the fume hood. They were working on a bench in the middle of the room."

"They're attempting to remove the solder, and then to re-solder. And I think they had just started applying heat, okay, to the cylinder when the lid popped. And there was pressure inside the cylinder and so it just blew powder all over the place. Ladenburg the professor was closest to it. So he had radium blown onto him."

According to Bleakney, the powder made a cloud in the air which "settled over everything."

"We're talking billions of atoms of radioactivity being blown out. … So he's had the radioactivity blown onto him and throughout the room, and he and his lab assistant recognize that this is a serious incident. And they, I'm not sure how level headed they were in dealing with this … Professor Bleakney in his recollections of it understands that Ladenburg may have attempted to collect some of the powder and push it back into the brass cylinder. So he took a little bit of time to do that. And then they left the room.

"Evidently, they were going up and down the hallway, trying to see if there was anybody around that they needed to say, 'Get out of here.' It was in the evening. And they discovered there was nobody there in that hallway. He at one point, you know, went to his office and used the telephone, and they know that because the telephone was contaminated. The doorknob of his office was contaminated. You could tell that he had been moving up and down the hallway, because when the initial cleanup started, and they started surveying for contamination, there was lots of contamination approximately every two and a half feet, which is the stride, Ladenburg's stride."

Ladenburg informed the department chair of the incident by phone. He and his assistant closed and locked all doors leading to the hallway outside Room 225 and put up a barricade – a couple of boards across the hall with a sign. Then they went home.

To put it simply, this was a huge—and hugely dangerous—mess.

INTERLUDE WITH THEME MUSIC

The 1930s were a period of rapid advancement in the field of molecular physics. Researchers across the U.S. found themselves handling substances whose hazards had only recently begun to be recognized. Engineering and administrative controls designed to mitigate exposures and prevent accidents in the laboratory were still in the early stages of development, and standards for personal protective equipment were rudimentary, where they existed at all.

While safety measures were, to put it mildly, inadequate by today's standards, there were few radioactive materials whose dangers were better known by this time than those of radium.

Forty-five miles north of Princeton, in Orange, N.J., the so-called "Radium Girls" of the United States Radium Corporation caused a media sensation in 1926 by suing their employer for radiation poisoning caused by exposure to luminous paint. Under pressure from intense newspaper coverage of the legal proceedings—which included wrenching testimony of the crippling effects of prolonged radium exposure—U.S. Radium in 1928 agreed to a substantial settlement.

The Department of Physics at Princeton recognized immediately that what had happened on the second floor of Palmer was a serious situation and held an emergency meeting the next day. Ladenburg was not present—he was already heading to MIT to consult with Robley Evans on a course of treatment for his radium exposure. Evans was at that time perhaps the world's leading expert on the health effects of radium exposure. The bulk of his research involved studying none other than—the Radium Girls.

With Ladenburg and his assistant sidelined, it was decided at that meeting that the job of cleaning up the toxic powder would fall to… Walter Bleakney.

Sue reads from Bleakney's recollections:

"In the course of this meeting, Ladenburg not being in a condition to take much responsibility for further measures, the department turned to me and saddled with the job of cleaning up the laboratory. … I could see no reason for this choice because I had no experience whatsoever in radioactivity. I had never worked with radioactive materials, and I knew little about the technique, but at any rate, something had to be done and we discussed what measures were to be taken and these were informally approved, and I went to work."

Bleakney at this point in his career was doing pioneering work on the mass spectrometer, but he was no stranger to hard physical labor. Born in 1901, he grew up the child of farmers in Oregon. While his parents never finished the fifth grade, he was determined to get an education, traveling 14-miles round trip by horseback to high school and working a year after graduation harvesting wheat behind a team of mules to earn enough money for college.

Still ahead of Bleakney were his days studying ballistics and the physics of shock waves during and after World War II. He would be elected to membership in the National Academy of Sciences and, in the 1960s, serve seven years as chair of the physics department. In 1936, however, he was a young physics instructor with a dirty job to do.

Donning disposable boots and rubber gloves, Bleakney entered the contaminated area with what he described as quote, “a very crude point counter” to detect radiation. The instrument had to be frequently recalibrated and required 200 pounds of batteries, which were dragged along on a cart. But the instrument could detect alpha particles—the main product of radium decay—at close range.

Again, Dupre reads Bleakney ’s words:

“I entered the contaminated area for the first survey, I could find no appreciable activity above background outside of the barrier, the barrier that Ladenburg had placed across the hallway, the end of the hallway. But as I approached the chemistry room, the radioactivity got greater and greater, and was at its height opposite the chemistry room door … I found that the doorknob was highly radioactive, and as I proceeded down the hallway, I could detect spots about every two and a half feet, which I interpreted to be Ladenburg tracks as he went back to his office. His own doorknob was also quite radioactive, and his telephone similarly. The activity seemed to be mostly on the floor, a little on the walls, and nothing I could detect on the ceiling.”

Bleakney, along with two janitors, gathered the necessary scrubbing materials and dressed in what he described as “disposable clothing.”

“They started to scrub the hallway starting where the barrier across the hallway was and they work towards the window at the other end, they scrub the walls and floor very thoroughly with soap and water, and brushes. They pushed everything before them. If you start scrubbing back and forth, you know, if we, if we have spotted dirt on the floor, we'd get a sponge and we'd wipe back and forth across it. You don't do that for radioactive contamination, because you start smearing around. So you just push it in one way. So they pushed it down the hallway, towards the opposite end. They carried nothing back. And when we came to the end, says Bleakney, we threw everything out the window, including our outer clothing, gloves and rubbers. These were gathered up and carried off.”

“And then they went back through and surveyed again, and felt that they had done the decontamination job pretty well.”

As for room 225 itself, it was sealed off with tape. A ladder was used to peer into the second-floor room from the outside to survey the damage, and to seal the windows. The ventilation system was checked, as there was a fume hood in the room, though no one was sure whether it was on at the time of the accident. And the room was left in this sealed-off state through the summer of 1936.

At a department meeting on September 21, 1936, the cleaning of the room was discussed and a plan devised. Sometime shortly after this, the clean-up team tackled the cleanup of Room 225.

"So they entered the room with their scrubbing equipment, they threw out of the window into the courtyard, below all of the loose equipment including all of the chemical supplies."

Sue, reading from the transcript:

"Now, of course, we didn't literally throw all of the chemical supplies out the window. We lowered them with a rope. And all of this was gathered up on a canvas cover. So there was a canvas tarp on the ground that was laid on the ground and carted off to a dump where it was buried. So out the window went all the supplies, equipment, … the hood itself and the benches, all of the piping."

Bottles, assorted chemicals, vacuum pumps, glassware, drains dug out of the floor: it all went out the window and was lowered onto the tarp. Then the scrubbing commenced: ceiling, walls and floor.

"They did this twice, and then the survey with their Geiger counter. And they had stopped most of the remainder of the contamination, they have removed most of the contamination in that area. We still, however, were not satisfied, says Bleakney. And so we gave the ceiling and walls a coat of heavy paint a special paint with lots of lead in it to try to prevent further emanation into the room. Then we installed a new cover and on the floor, a new layer of concrete because we had chipped up with hammers a good bit of the original floor.

One-thousand dollars was allocated at the beginning of 1937 for new equipment and fixtures, including an exhaust that vented directly out through the wall rather than through the building's ventilation system.

Bleakney reports that later, after World War II, some of the ducts were cut out and taken away, as was the ventilating fan, but he was no longer involved by this time. The Palmer laboratory returned to its normal functions, and the 1936 accident was little thought of for many years.

MUSIC INTERLUDE

Part Two: Cleanup and Conversion, and Sue's Startling Hunch

For many years nothing much was done beyond the initial cleanup to remediate the effects of the 1936 radium release, but the incident was not completely forgotten. By the time the physics department was preparing to move to the newly-constructed Jadwin Hall, in 1970, it was decided a more comprehensive decontamination was in order.

By this time, standards for radiation exposure and laboratory safety, as well as the available technology for remediation, had changed drastically.

“In the 1930s, radioactivity, the use of radioactivity was not regulated. It wasn't licensed by the federal government or the state government. The university did not have a radiation safety program—you just wouldn't have at that time. You know, it wasn't until you get into the 50s that regulation and awareness of the necessity of radiation safety programs became a thing.”

“But by 1970, there was certainly a Radiation Safety Program. The university employed health physicists to manage the Radiation Safety Program.”

Health physics became the first standardized program in research safety at many Universities in the U.S. in the years after the second world war. The term “health physics” was probably a kind of euphemism arising from the fact that physicists were the bulk of the people using radiation. Commented Raymond Finkle, an employee of the Health Division at the University of Chicago: “The name also served security: ‘radiation protection’ might arouse unwelcome interest; ‘health physics’ conveyed nothing."

One of these health physicists, Jack Faust, had come to Princeton as a radiation safety officer in 1963. In 1971, he became the founding Director of the office of Occupational Health and Safety.

We’ll talk more about Faust in a future episode. It was another health physicist, Bob Milwitz, who was told about the 1936 incident by someone in the physics department.

“There were longtime, you know, physicists on the faculty, and they must, people would have traded stories, the story of the 1936 incident, would have traveled within the department as new people came on. So, you know, I suspect all the physicists knew. And somebody just happened to mention it to Bob Milwitz, who then, you know, talked to Jack, and then the, the process of starting to do surveys happened.”

Bob Milwitz and the health physics team conducted a survey and did not find significant amounts of radiation on the surface of the walls and floor of room 225—Bleakney and company seemingly did their job well—but in scraping the lead paint off the walls, higher levels were found. This was also true in parts of the attic, the basement tunnels, and, not surprisingly, the ventilation system. They realized that any comprehensive remediation was beyond the scope of what the University could do by itself, so a company was hired–Atcor Inc., of Elmsford, N.Y.—to do the work.

Cleanup took place that same year. The New Jersey Department of Environmental Protection performed a “post decon” evaluation, the results of which corroborated surveys performed by

Atcor and Princeton OHS. As a result, the affected areas of the building were declared fully decontaminated on October 22, 1971.

And so the story ends here—or does it? It turns out there would be one last twist to this tale, and this is where Sue Dupre takes center stage.

INTERLUDE: MUSIC

“So you'll recall from this fascinating story, the step in which they were lowering contaminated material out of the window onto a tarp on the ground.”

We mentioned earlier how Dupre had been handed a copy of the transcript in 1978. This was a detail that had stood out for her.

“And this was a process that was going on for days, weeks, I'm assuming. I'm guessing that the tarp sat out there for significant parts of time, that there was weather, there was rain, I'm guessing. And so after I read the transcript, and as I thought about it in subsequent years, I kept thinking, Surely there must be radium contamination in the soil where this tarp rested.”

At the time Dupre encountered Bleakey’s transcript, the question was somewhat academic.

“When the radium incident happened, Palmer Hall was its footprint was this shape of a U. And there was a large central courtyard. Not long afterwards, an Annex was built in the central courtyard that occupied pretty much all the space of the former courtyard. And that Annex was used by—when I arrived, that's where Building Services was located, the main offices. And so there was a structure where there used to be open soil.”

University records indicate the annex was built in 1942, six years after the incident.

“And there was only this tiny, oh, my memory is that it was, perhaps at most a foot wide, between the annex, the outside of the annex building and the outside of Palmer Hall. So you couldn't fit bodies into it. And so it was just kind of not relevant.”

In other words, the area where the tarp would have rested was rendered inaccessible by a later building, the foundation of which would have shielded occupants from any potential exposure.

“But in the 1990s, the University started considering you've decided to renovate Palmer Hall, tear down the annex building and turn it in the Frist Campus Center and … I was really certain we were going to find radioactivity.”

This was surely not something people wanted to hear.

"And, of course, nobody really wanted to contemplate that this, you know, that Palmer Hall, the hall [the] Frist Center, renovation was going to involve this extra project before they could even start, but I was pretty insistent. And at the first opportunity we could once the annex was cleared away, we walked back with survey instrumentation. And we stood on the ground outside the window of 225. And we surveyed and yes, there was radioactivity in the soil. It wasn't a huge amount, but it was there."

JS: "So the contamination levels were high enough that it couldn't be ignored."

"That's right. And radium because it's an alpha emitter—alpha emitters are once if they're taken up internally, you know, through inhalation of airborne dust or contamination that seeps through the soil. You know, if it's taken up internally, it's a significant radiation hazard. And so radium is very carefully regulated, it has very low permissible levels."

I should mention here that the residual contamination in the soil presented a very low level of risk to anyone walking in or near the area, both before the annex's construction and after its demolition. With radioactive materials, however, safety professionals operate on the principle of ALARA—As Low As Reasonably Achievable. This means avoiding exposure to radiation that does not have a direct benefit to you, even if the dose is small. By this measure, any amount of measurable contamination in the ground around Palmer Hall was too much.

The surface soil survey confirmed Dupre's findings. As they dug deeper, they continued to find radioactivity. Rainfall and snowmelt before the building of the annex would have allowed the radium to seep deeper into the soil.

"I have a vague memory that they went at least 12 feet. So there was a lot of soil that was taken. And the company, you know, we did it right. You know, the company was a highly reputable company. And they knew how to do—their sampling techniques were beyond reproach, their approach to cleaning it, you know, so they looked, they removed more soil than they needed to because they were looking for where had the plume of radioactivity, how far had it spread through the soil?"

"And of course, we had notified the state when we first did this, and the state didn't fault us. Because, you know, it was it this happened in the 1930s. They knew people weren't worried. And we took action as soon as the soil was exposed again … and it would have been a problem, if afterwards, after the Annex was removed, people started digging up the soil as they would have for the Frist building."

In my mind, I imagine Dupre walking through the recently cleared building site, stepping among bits of demolition debris, instruments in hand, and stopping to look up at the window of room 225, the first person in decades to walk this patch of ground and stare up at the side of Palmer Hall as Walter Bleakney would have done in 1936, eying the Collegiate Gothic windows with fascination, picturing lab equipment dangling perilously as it is lowered down to—it must have been right here! Holding out the survey meter and seeing the needle jump, a bit of alpha--wave archeology akin to putting a spade in the ground right where an ancient temple or statue is said to lie.

Too dramatic a comparison? Well, a treasure hunter might find something that only benefits themselves, but Dupre that day accomplished something that would benefit the Princeton campus community from that day forward: the elimination of an unknown hazard that would have needlessly exposed construction workers and others to radioactive residue.

The annex was replaced with a new structure as part of the creation of the Frist Campus Center, which opened in 2000 to much fanfare. Today, visitors to the building can rest easy knowing their environs are safe—thanks to Walter Bleakney and those who assisted them in 1936; thanks to Bob Milwitz and Jack Faust in 1970; and thanks to Sue Dupre.

MUSIC

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There you will find photos, a media player, a transcript of this episode, and links to sources. You will also find information and resources related to the 50th anniversary of the Princeton University Office of Environmental Health and Safety.

You've been listening to **EHS Stories**, a production of the Princeton University Office of Environmental Health and Safety.

This show is produced, written, edited and narrated by me, Jim Sturdivant. The theme music was written and recorded by me, Jim Sturdivant. Our logo was designed by Chelsea McDonnell.

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Thanks so much for listening! And join us for the next episode of EHS Stories, coming soon to your favorite podcast platform.