Atoms Amidst the Cornfields

Pride, Patriotism, and Secret Atomic Research at Ames, Iowa

by Susan Futrell

The young chemist hunches over his workbench, only noticing the time when he looks up to check his experiment. He makes a few notes in a numbered logbook, adds his initials, then crosses the small room to carefully lock it in a cabinet, as he does every night. On his way out, he nods to the security guard before walking back to the apartment he shares with five other graduate students a few blocks from the Iowa State College campus in Ames, Iowa. They are a close-knit group—they cook together, share ration coupons to buy gas for the one guy among them with a car. They put in long days, often 70 hours a week. Some return after dinner to their experiments, which run around the clock. The work is classified as top secret. Their families and friends know not to ask.

It's 1942. News of war is everywhere, and one of the hardest things about keeping the young chemist's work a secret is that even though he's young and healthy, outsiders think he must be 4-F, "unfit for service." They have no idea he's part of one of the most significant, far-reaching U.S. government projects ever undertaken. Although his story is little known in Iowa and even less so beyond, his and others' work in Ames during World War II played an early and crucial role in the Manhattan Project, as the United States raced to develop the atomic bomb.

Today, the Manhattan Project is most often associated with more famous places like Los Alamos, New Mexico; Oak Ridge, Tennessee; Hanford, Washington; and Chicago, Illinois. But critical components of this massive and complex effort also operated at other locations, including Ames, Iowa. By the war's end, the Ames Project, as it was known, employed more than 500 individuals in this top-secret work.

In 2007 and 2008, more than a dozen former employees and their families recounted memories of that time, revisiting the secrecy, urgency, and risks of their jobs. Their oral history interviews reveal ordinary people engaged in extraordinary work.

Just after the attack on Pearl Harbor in December 1941, Frank Spedding, head of the physical chemistry section of Iowa State College's chemistry department, was quietly recruited by the Metallurgy Laboratory at the University of Chicago to be part of the Manhattan Project. Spedding's expertise in spectroscopy and separation of rare earth elements had caught the attention of Nobel physicist Arthur Compton, who headed the new lab. Compton tapped Spedding to lead the chemistry division in Chicago.

Nobel physicist Enrico Fermi also worked under Compton in Chicago, where he was attempting furiously to create the first-ever self-sustained and controlled atomic chain reaction. For that, he needed a large quantity of extremely pure uranium metal. The scientists knew how to purify small quantities of the metal, but the methods were slow and costly. Spedding's first assignment was to find a way to transform bulk uranium ore into highly purified uranium metal as rapidly and cheaply as possible.

Because the lab in Chicago was small and speed was essential, Spedding convinced Compton that the uranium research and production should be carried out at Spedding's Iowa State lab, where he had the equipment and scientific talent already in place. College president Charles Friley gave his permission, even though he did not know the details of the project until he received his own security clearance weeks later.

Spedding spent most of each week in Chicago coordinating the two labs. He enlisted Harley Wilhelm, a fellow chemist at Iowa State, to direct the metallurgy section in

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The Ames Project hired several Iowa State graduate students and other talented, dedicated scientists eager to do cutting-edge research. Front: Henry Lipkind, Bob Nottorf, Oliver Johnson, Amos Newton, and Ray Fisher. Back: Arthur Tevebaugh, Fred Vaslow, Paul Figard, Tom Butler, Jack Powell, and Walter Tucker. Powell and Fisher were interviewed for this article.

Ames. They quickly assembled a team of chemists, physicists, research assistants, and laboratory technicians, starting with their own graduate students and colleagues at Iowa State and recruiting from other universities and industry. Local residents were hired as secretaries, security guards, machinists, shop workers, and maintenance staff. Work was under way by February 1942.

Ray Fisher was one of the first young men to join the project. Fisher was a chemistry graduate student and an acting lieutenant in an ROTC field artillery unit. While working at the lab, he received his draft notice and was advised to report to Camp Dodge in Des Moines for a physical. "I got a letter . . . saying I was to report in two weeks for . . . active service. Well I took the letter in to Dr. Spedding and showed it to him, . . . and he puffed on his cigar, and said, 'We'll see about that.' So he made a few phone calls, and he called me in the next day and he says, 'Fisher, you're staying with us—you're more important here than you are out as cannon fodder.'"

Norman Baenziger, also a grad student, recalled, "I got my notice, I got on the bus, went down to Camp Dodge. . . . And they said I was supposed to go and wait in the Colonel's office. . . . He says, . . . 'I've got this telegram here from Major General Hershey [the director of Selective Service], telling me I am not to draft you. What are you doing?' I said, 'Well, I can't tell you what I'm doing.'"

Fisher wasn't told what the project was about until six weeks after he was hired. "[The FBI] came to Anamosa, Iowa, which was my hometown. And they did a thorough check on my background. People there wondered what I'd done wrong. And then when we went back [home], and we weren't in uniform—they thought we were draft-dodgers. Well that was the hardest part of it, yes. Because you were just busting over with news and couldn't reveal it to anybody."

Fisher remembered the space where they worked: "We walled up the two floors of the chemistry building, put in doors, and had a guard at one of the doors, which was right near the main entrance to the building. . . . There was a guard there stationed all the time, twenty-four hours a day. . . . They had a full-time FBI agent assigned to this area, and they kept a close guard on things."

Fisher's friend Jack Powell also joined the project early on. "I was recruited by Dr. Spedding and the physical chemistry department to work on a mysterious war project. And essentially I was told I would be working with a heavy metal. I asked, of course, if it was dangerous, and they said, 'Well, probably no more toxic than barium and things like that [that you work with] in chemistry.' For the first week that I was hired, I didn't get to attend seminars . . . but I did start analyzing for impurities in uranium. And of course, at that time, the light-bulb dawned on me,

The uranium reduction process at the Ames Project yielded "biscuits" that could be cast into ingots.

because some articles had appeared in the *Science Digest* and [other] places, that it might be possible to make an atomic reactor using uranium as a fuel."

Powell remembered, "We kind of were looked on as draft-dodgers, because we were perfectly healthy men in the right age group. . . . It was kind of embarrassing at that time, that we couldn't say what we were doing, which we considered many, many times more important than firing a rifle, because we knew what the goal was."

The work was painstaking, but Fisher found camaraderie and excitement in the knowledge that they were doing something important. "We worked twenty-four hours a day. . . . We had little cots set up along some of the experiments, so we could monitor them, because we had to take samples or write down data every hour on some of the work we were doing."

Spedding commuted between Ames and Chicago by train every week for reports and briefings. Every Thursday night the Iowa team gathered to hear the latest. Week after week, their fundamental research added to the larger project, but they still needed a breakthrough on uranium purification.

Late one night in September 1942, Wilhelm made his way to the train station in Ames, boarded a special car, and rolled through the darkness to meet Spedding in Chicago. He carried an unassuming travel bag. Inside was a cylinder about 16 inches long and 2½ inches thick—an 11-pound ingot of pure uranium.

On his arrival the next morning, Wilhelm took the ingot—so heavy that the bag had torn, and it had to be carried under his arm—directly to Spedding's office. They proceeded to the Metallurgy Lab and presented it to an amazed Compton. Some of the most brilliant scientists in the world stared at it, held it, tapped it, and wondered if it was too good to be true. Wilhelm reported later that "Compton's eyes bugged out when he saw one 11-pound piece, and said, 'I bet there's a pipe or hole inside.'"

To prove that it was indeed what they claimed, Spedding and Wilhelm insisted on having it sawed in half. Not only was it solid, it was the largest block of pure uranium metal that had ever been manufactured.

Spedding and Wilhelm's staff had successfully converted uranium ore into uranium metal at a fraction of previous costs and with exceptional purity. They moved quickly to scale up production. The research had taken place in the Chemistry Building, but, needing more space, they set up on the east side of campus in a nondescript wooden building that had once been used for women's sports activities. Officially called the Physical Chemistry Annex, the building was nicknamed Little Ankeny—a reference to a war-production facility in the nearby town of Ankeny. According to some, the nickname was an attempt to make curious passersby think that the work inside had to do with ordinary munitions. A machine shop full of equipment was purchased intact from a local machinist (who also came along to run the shop). By December, more than two tons of pure uranium, formed into cylinders, had been produced and shipped to Chicago.

Meanwhile, in a former squash court hidden below the stadium at the University of Chicago's Stagg Athletic Field, Fermi's team continued work to design a "pile," or reactor, that could produce a controlled chain reaction. After many trial versions, they built a large lattice made of alternating layers of pure graphite bricks to contain the reaction, and specially designed bricks containing small spheres of pure uranium. As more layers, and more uranium, were added, the pile came closer and closer to being able to produce a sustained reaction. Control rods, some mechanical and some manually operated, could be moved in and out of the side of the pile to regulate the reaction occurring inside. Fermi, deftly thumbing his slide rule, was able to calculate almost to the exact brick when the reaction in the pile would become self-sustaining.

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Wartime production of pure uranium took place in this small building on the Iowa State campus. It was torn down in 1953.

On December 2, 1942, from a balcony in the squash court, Frank Spedding stood with Fermi and a group of about 40 scientists to watch as the test began (*see above*). As the control rods were withdrawn, the clicks of a Geiger counter indicated with increasing speed that the reaction was under way.

The reactor operated for 28 minutes. It produced only a half-watt of power. But when Fermi gave the order to "throw in the safety rods," the reaction stopped, just as predicted. The scientists toasted the occasion somberly with a bottle of Chianti; a round of signatures on the label was the only written record of who was present that day.

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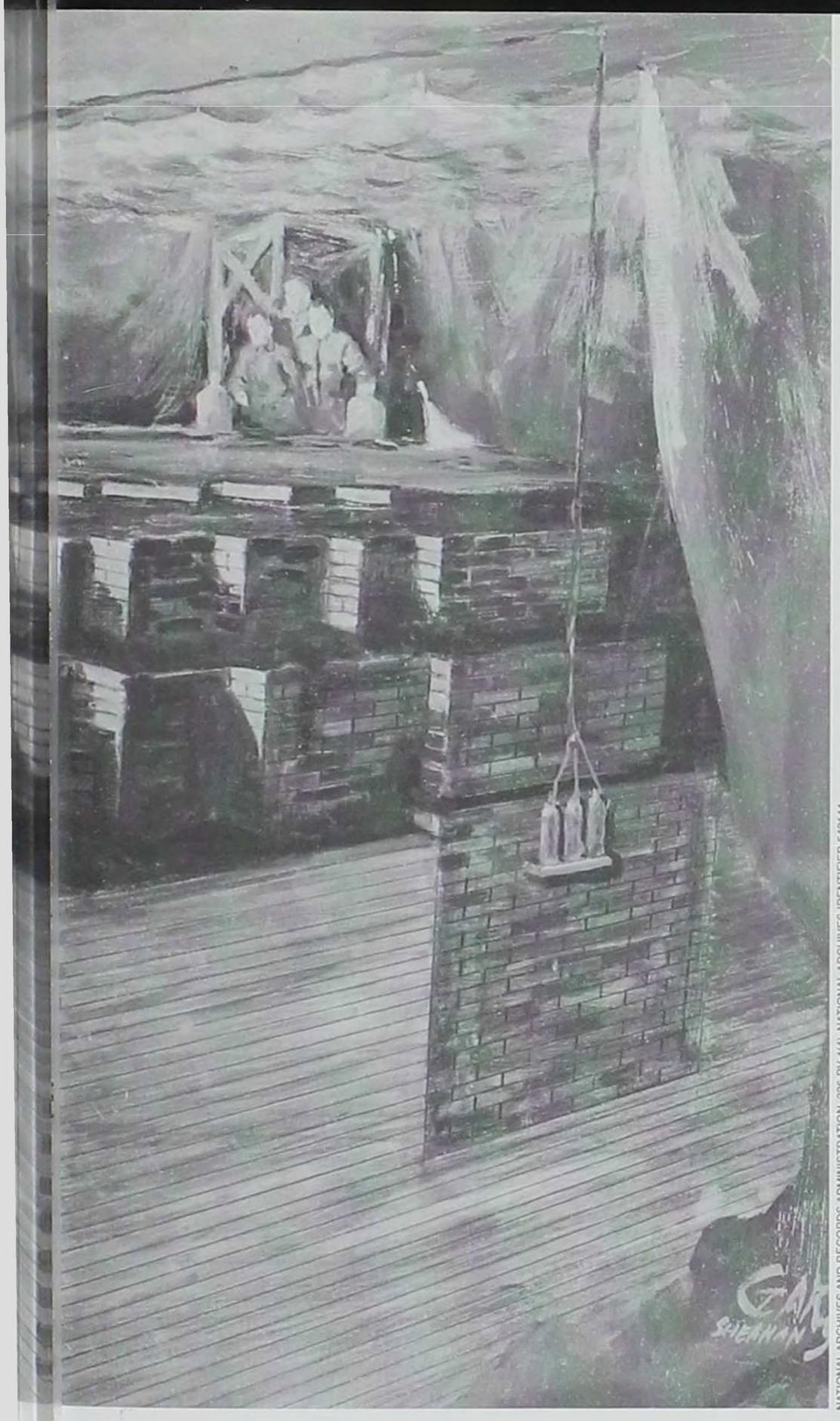

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The success at Stagg Field meant the pace of work at Ames remained intense. Production of pure uranium continued, while Ames scientists also began teaching the process to industries that would take over. Meanwhile, research continued on a range of other atomic materials and processes, including development of a way to retrieve valuable uranium from the slag and crucial aspects that contributed to projects in full swing at other Manhattan Project facilities in the U.S.

With news of the bombing of Hiroshima on August 6, 1945, the top-secret Ames Project was suddenly all over the airwaves and front pages and was the talk of both the Iowa State campus and the town. The *Des Moines Register* headline on August 8 blared, "Hiroshima Believed Destroyed; Blast Equals 2,000 B-29s." Below it was a story headed: "I.S.C. EXPERTS SPEEDED WORK ON ATOM BOMB." *Register* staff writer George Mills began, "On the peaceful Iowa State college campus, where the campanile plays 'Lead Kindly Light,' scientists have helped created the atom bomb. It can now be disclosed that: 1. Millions of dollars in federal money have been spent on the atom bomb project here. 2. Iowa State research played a major role in speeding the introduction of the bomb in the Pacific war. 3. Scientists, sometimes numbering up into the hundreds, have worked long hours on the campus for more than three years on the well-kept secret project. 4. A new process for making a very critical and scarce material was developed here. 5. Part of the work has been dangerous for the scientists, although there never was any possibility that the town of Ames would be blown to bits."

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During the war itself, the workers' commitment to secrecy had added to the pressure and intensity of the job. Wilhelm's four grown children remember their mother, Orpha, saying that he had trouble sleeping during the war because "he was so afraid he'd talk in his sleep." They also remember seeing him off at the train stop, the train car parked off to the side with a guard at the door. One daughter remembered tinkering with a locked cabinet in his office many times while they waited for him after school, until one day she used her school locker combination and to her surprise, it opened.

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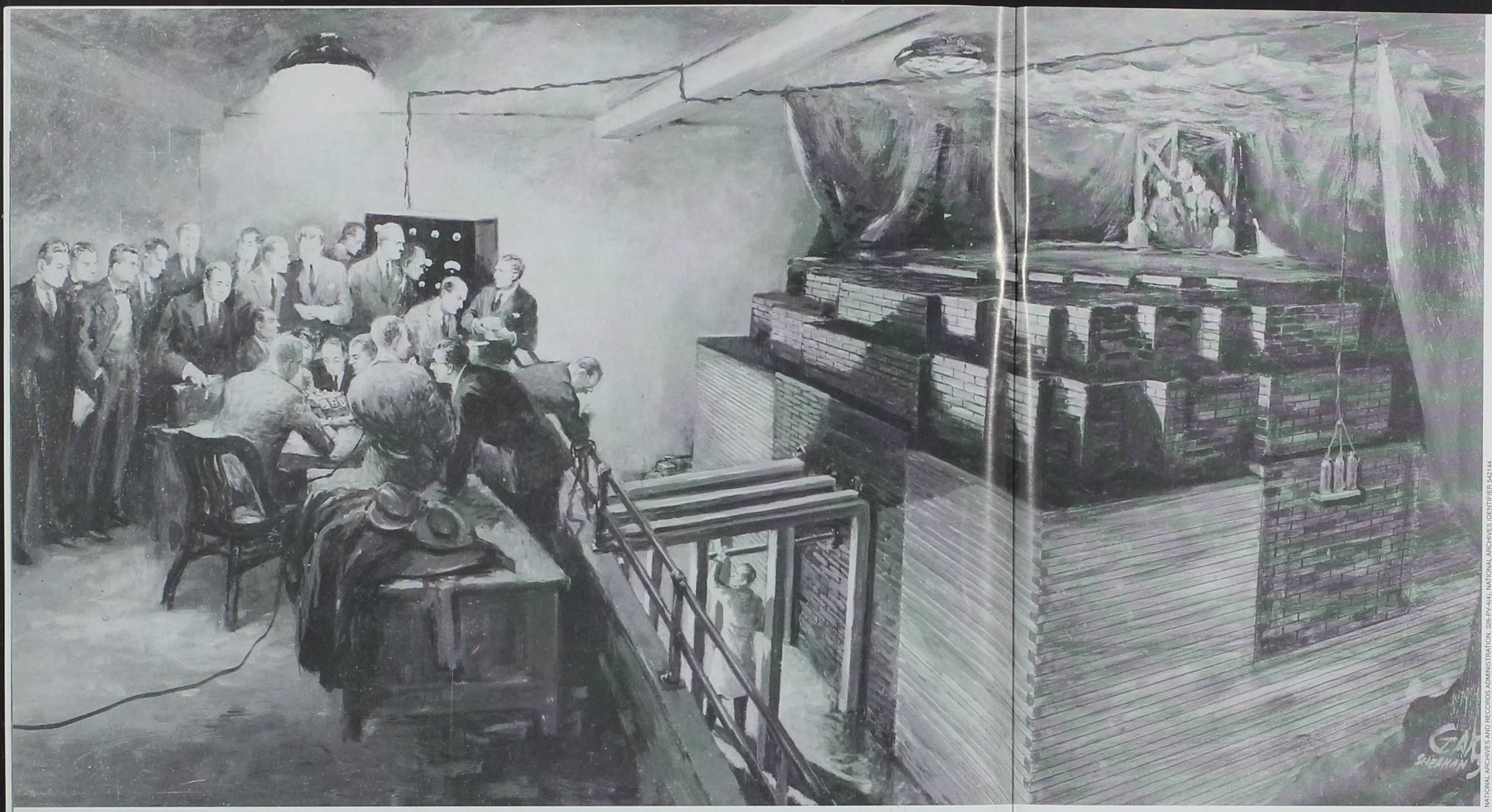

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had a full-time FBI agent assigned to this area, and they kept a close guard on things. I think they visited the one bar we had in town, which was downtown, just to be sure that none of our workmen were spilling any information at all—although most of the workmen, the production people didn't know what it was they were doing, or why."

Virginia Carlson was a young war widow when she came to Ames in 1945. She began a courtship with a chemistry graduate student, Norman Carlson, who worked for the atomic project. He sometimes visited her while wearing his dusty lab coat, or she would stop by the chemistry building, knock on a specially guarded door, and he would come out, again in his dusty lab coat, to greet her. He couldn't tell her what he was working on—only that it was for the government, and it was top secret.

Ardis Johnson, a local resident who hired on at the lab after the war, recalled a wartime story told to him by Primo Chiotti, an Italian scientist on the project: "Because it was secret," Johnson recounted, "you couldn't wear your uniforms, they had to wear regular work clothes. And Dr. Chiotti, being a single fellow, . . . he rented a room from an older widow lady. And so he put his uniform clear at the back of his closet, and all of his civilian clothes out in front. Well, one day, she came to clean his room, and she thought, 'Well, I'd better give the closet a cleaning.' She found this uniform of his, stuck clear back in one corner of the [closet] on the wall. And she called the police. And of course that had to be squelched right away, and they said, 'No, no, no, he's working on a project and he just doesn't wear his uniform.' She thought he was a deserter. They had a laugh about it many years afterward."

Security measures sometimes resulted in comical situations. Norman Baenziger recalled, "My boss . . . always wrote a section reporting the x-ray work that was being done. . . . One summer he was gone . . . and it came time for that report to be written. He wasn't around to write it. So they asked me to write it. So I wrote it. As soon as I wrote it and turned it in, it was classified. . . . I didn't have enough clearance to read a report I wrote!"

Fisher remembered that one of their code names for uranium was "tubealloy," and for thorium, "mernalloy," in tribute to the movie star Myrna Loy. He also laughed about another challenge of keeping a secret in the midst of a public institution. "We were on the state payroll, and we had to be named—'cause the state yearly put out a listing of all of our names and our positions. So [in the paper] we were all janitors. Ray Fisher, janitor."

Accidents were a job hazard for anyone working with extreme heat and materials like magnesium, uranium, and beryllium—and accidents did occur. When there were fires and explosions, the local fire department had to manage from the yard outside because they didn't have security clearance to go inside.

Powell described what happened when a device they were testing exploded. "The top blew off. It . . . was filled with uranium-tetrafluoride, which we called green salt, and there was green salt all over the place. . . . And the walls and the roof of the building on the north side were blown loose. The bottom was put out about two feet, and the roof kind of went with it. So we just had a group of our production people—they went out with two-by-fours and hammers, and they pushed up the roof, and they pushed the wall back in and nailed it—and that was done in just a short time, an hour or so. Well, that happened three times, and the third time was the charm, I guess, because we had an office down there, we had three secretaries, you know, three stenographers. And they survived the first two blasts, but after the third one, they all came in and resigned. Which nobody blamed them [for]." He made sure to add that "no one was ever hurt, in any of the explosions."

Fisher recounted another mishap: "We had a man down there who we called the Green Hornet. He would grind this uranium-fluoride through the biggest coffee grinder—-commercial coffee grinder—we could buy during the war. He'd grind this uranium-fluoride down to a really fine size so we could mix it and make it more efficient in the reduction process. He'd come out of that place—it was only about six by eight feet, and it was closed tightly—and he'd come out spitting and sneezing green—and that's the reason we called him the Green Hornet. His clothes were always green and everything, and of course we had our own laundry service, and a shower down there—but we were concerned about him. Well, the concern for him kind of evaporated later on. . . . He [lived] to be eighty-three or eighty-four years old."

Humor helped take the tension out of the work—for some. "Well, you were apt to get practical jokes played on you," Powell recalled, describing one that unfolded "down in the area where they were storing the uranium turnings and such things. . . . The guards would have to go around and feel the barrels, which they stored the turnings in, because they would oxidize and catch fire. . . . There's almost no danger. But [feeling the barrels] was one of this guy's jobs. And somebody down there got the idea of wheeling out a barrel of hot water and putting it in the area. I guess the [guard] about had a heart attack. He thought it was the uranium turnings heating up."

Barrels figured in another wartime story, too. Purifying uranium produced slag that Spedding wanted kept and reprocessed later. One of the lab workers knew someone at a whiskey distillery down south where oak barrels were left over from aging the whiskey; the empty barrels could be used for storing the slag. An order for a thou-

sand barrels was sent off to Iowa State's purchasing office. "The central purchasing agent wasn't told what we were doing, but he was told he was to honor any order that we placed," recounted Powell. Due to a missing word or comma, "here came an order for a thousand barrels of whiskey. The purchasing agent stormed into the college president's office, to ask, 'Why do they need a thousand barrels of whiskey up there?'"

Powell continued, "And so, that got straightened out and the barrels came in a freight car, and we had to unload them. And we were looking for volunteers, to take them off the flatcar or the boxcar—and you know, we didn't have any trouble finding any volunteers. They fought for the job. There was about a cup of whiskey in every one of [the barrels]—this was when liquor was rationed, and they had just a waiting line to take those barrels and bring them up where we needed them. Oh, they poured them upside-down. . . . They had some good aged whiskey."

The risks experienced by the workers may seem foolhardy today. The urgency of wartime, and the knowledge that their peers were fighting and dying far from home may have made caution in the lab seem less important. Intense curiosity and genuine desire to understand materials and processes on the cutting edge of science also propelled them. And the dangers were not as well understood as they are today. Standards for exposure to radioactive materials were first established in 1934, and they have been questioned, tested, and revised many times since. Protection standards did evolve over the course of the Ames research, and practices changed as the urgency of the war subsided and the properties of the materials were better understood. Ray Fisher recalled, "We weren't worried about it, we were trying to win a war. . . . The whole project wouldn't have been successful under present conditions of secrecy and safety. . . . We did have our x-rays, monthly, and we had urine collection monthly. And so that was analyzed. And it was hot, of course, there was no such thing as air conditioning in those days . . . these guys were running around in shirtsleeves and if they did have special protective equipment, I think they took it off because they were too hot."

Virginia Carlson recounted that just a few weeks after they were married, Norm had a "terrible exposure." Dinner was on the table when he came home, but he was so sick he crawled up the stairs to the bedroom. Frightened, she called an ambulance to take him to the hospital. She recalled several other incidents over the next few years, including one that left him so weak he couldn't walk up the stairs for nearly a year.

"We knew they were working with toxic substances," she said. "The lab at that time wasn't really built for it. But at the time, during the war, this was the best-equipped lab in the country." The men made much of their own equipment right on campus, where they could design it exactly as they needed. They wore lab coats, but a lot of them didn't wear radiation badges, and often the dust and substances that collected on their clothes, skin, and hair were "such a tiny amount you didn't know it was there."

Concerns over exposure to health risks for workers on the Ames Project and other atomic facilities around the country led to the establishment of a health screening and treatment program in 1996 for former U.S. government atomic workers; it was later expanded to include monetary compensation for workers and their families. Many Ames workers have enrolled in this program, operated by the Department of Energy.

Personal risk and secrecy were balanced against the thrill of scientific discovery and the rewards of patriotism and camaraderie. For many, those risks did not detract from their pride. "We were proud of what they were doing, proud they were working on something so important to the government," Virginia Carlson said. "They all were getting their PhDs, really on the cutting edge. . . . It was a wonderful bunch of young men—they came from farms and small towns, mostly Midwestern, and they were very loyal, salt of the earth."

Jack Powell remarked, "I think we were privileged—we fell into one of the most interesting things going on as research. We didn't serve in the Army, people think we didn't do our duty, but we worked with hazardous things."

Although women scientists like Marie Curie and Lise Meitner were prominent in the research that led to unlocking the power of the atom and the atomic bomb, very few women scientists worked on the Ames Project. Women were more likely hired for positions as secretaries, clerks, and support staff, including Wilma Chiotti and Mary Fawcett (both married to scientists), Dorothy Shimel, Doris Wallace, and Leona Wheeler.

In October 1945, the Ames Project received the Army/Navy E Flag for Excellence in production of a vital war material. The flag was flown over the campus for a year or more. Iowa State was the only educational institution to have received this prestigious award, which was usually reserved for industry.

For many who worked on the Ames Project, the personal satisfaction and knowledge of its importance were reward enough, and in many cases motivated them to stay on at Iowa State for many years to come. In fact, secret classified work on a variety of projects involving radioactive material and other rare earth elements continued at Ames for decades after the war. In the aftermath of World War II, as more details about the Ames contribution came to light, there were also reports of other secret

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The year is 1946 and World War II is finally over. Iowa State chemistry professsor Harley Wilhelm, who oversaw the Ames Project, poses with an ingot of uranium, like those made during the war. He is flanked by Joan Visser, an Iowa State senior in home management, and Dorothy Beckheit, a sophomore in home economics.

research taking place at Iowa State College, at the same time but independent of each other.

A Manhattan District History, published in December 1947 (each page stamped SECRET and declassified in 1976), contains a lengthy chapter on the Ames Project that documents in detail all of the activity that took place at Ames beginning in 1942. It notes significant research and production not just of uranium, for use in the Fermi chain reaction, but also of cerium, thorium, plutonium, beryllium, x-ray structure, rare earth elements, and more.

The report goes on to note many pioneering contributions, ranging from "basic information in the fields of chemistry and metallurgy, needed in the manufacture of atomic weapons; . . . a large number of chemical and metallurgical processes in order to produce the raw materials . . . [and] a considerable amount of consulting work with many branches of the Manhattan District."

After the war, Spedding pressed for a continuation of government support for ongoing research, and in particular proposed that part of the funding be used to build a research reactor. In 1947, the Ames Laboratory was officially established on the Iowa State campus as part of the Institute for Atomic Research, under the Atomic Energy Commission. Spedding stayed on as director. A synchrotron, used to produce high-energy radiation for research, and a research reactor were both built and used extensively. In 2012, the Ames Lab celebrated its 65th anniversary, and continues today as a U.S. Department of Energy research facility, operated under contract by Iowa State University. The lab is still producing cutting-edge research, some of it focused on solar and magnetic energy.

A boulder marks the site on campus where the humble building called Little Ankeny once stood. Taking its words from what had so quickly become only a footnote in postwar accounts, the bronze plaque reads: "A striking achievement among the many associated with the wartime atomic energy projects in the United States was the production of many tons of pure uranium by a group consisting of faculty and students working in a disused building on the campus of the Iowa State College at Ames."

Scientific curiosity, loyalty, and the desire to serve their country motivated the hundreds of individuals who were part of the Ames Project. Most of the interviewees highlighted here are no longer living, but there are still many who share vivid memories of their time at Ames. Their stories need to be restored as part of our national narrative of one of the most significant periods in modern history. The personal accounts here are a beginning. ❖

Susan Futrell is an Iowa City writer. She grew up seeing the Ames Lab reactor out her back window but didn't know the history behind it until she met Virginia Carlson while researching another story many years later. She is deeply grateful to all who told their stories of the Ames Project. She is currently working on a book about apples.

NOTE ON SOURCES

In 2007, with support from the State Historical Society of Iowa, the author interviewed 19 atomic research workers at Ames (1941–1978) and family members. The recordings are held and being transcribed at Iowa State University, Parks Library, Special Collections. This archive also holds material related to Frank Spedding and other Ames Project scientists. Ames Laboratory's library holds additional collections.

In-depth studies of the Ames Project include: Carolyn Stilts Payne, "The Ames Project: Administering classified research as a part of the Manhattan Project at Iowa State College, 1942–45," Ph.D. diss., Iowa State University, 1992; and Steven Ray Karsjen, "The Ames Project: History of the Ames Laboratory's Contributions to the Historic Manhattan Project, 1942–1946," thesis, Iowa State University, 2003. Also see work by Joanne Abel Goldman on the Ames Project, especially "National Science in the Nation's Heartland: The Ames Laboratory and Iowa State University, 1942–1965," *Technology and Culture* 41:3 (2000); and "Frank Spedding and the Ames Laboratory," *Annals of Iowa* 67:1 (2008).

See also Corbin Allardice and Edward R. Trapnell, *The First Pile* (Oak Ridge, TN: United States Atomic Energy Commission, Division of Technical Information, 1955; rev. 1961); *Manhattan District History Book I-General; Volume 4-Auxiliary Activities; Chapter 11–Ames Project*, microform (Ames: Iowa State College, 1947); Samuel Glasstone, *Sourcebook on Atomic Energy* (New York: D. Van Nostrand Co., 1950); Henry DeWolf Smyth, *Atomic Energy for Military Purposes: The Official Report on the Development of the Atomic Bomb under the Auspices of the United States Government, 1940–1945* (Princeton: Princeton University Press, 1945); and Laura Fermi, *Atoms in the Family: My Life with Enrico Fermi* (Chicago: University of Chicago Press, 1954).

An extensive health screening project, led by Dr. Laurence Fuortes of the University of Iowa College of Public Health, has helped identify work-related health problems suffered by former workers exposed to hazardous material at Ames and the Iowa Army Ammunition Plant in Middleton, Iowa. Many of these workers have become eligible for compensation through the Department of Energy and more recently the Department of Labor.