DOE/EH-0456

# HUMAN RADIATION STUDIES: REMEMBERING THE EARLY YEARS

*Oral History of*
*Merril Eisenbud*

Conducted January 26, 1995

**United States Department of Energy**
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# FOREWORD

IN DECEMBER 1993, U.S. Secretary of Energy Hazel R. O'Leary announced her Openness Initiative. As part of this initiative, the Department of Energy undertook an effort to identify and catalog historical documents on radiation experiments that had used human subjects. The Office of Human Radiation Experiments coordinated the Department's search for records about these experiments. An enormous volume of historical records has been located. Many of these records were disorganized; often poorly cataloged, if at all; and scattered across the country in holding areas, archives, and records centers.

The Department has produced a roadmap to the large universe of pertinent information: *Human Radiation Experiments: The Department of Energy Roadmap to the Story and the Records* (DOE/EH-0445, February 1995). The collected documents are also accessible through the Internet World Wide Web under `http://www.ohre.doe.gov`. The passage of time, the state of existing records, and the fact that some decisionmaking processes were never documented in written form, caused the Department to consider other means to supplement the documentary record.

In September 1994, the Office of Human Radiation Experiments, in collaboration with Lawrence Berkeley Laboratory, began an oral history project to fulfill this goal. The project involved interviewing researchers and others with firsthand knowledge of either the human radiation experimentation that occurred during the Cold War or the institutional context in which such experimentation took place. The purpose of this project was to enrich the documentary record, provide missing information, and allow the researchers an opportunity to provide their perspective.

Thirty-two audiotaped interviews were conducted from September 1994 through January 1995. Interviewees were permitted to review the transcripts of their oral histories. Their comments were incorporated into the final version of the transcript if those comments supplemented, clarified, or corrected the contents of the interviews.

The Department of Energy is grateful to the scientists and researchers who agreed to participate in this project, many of whom were pioneers in the development of nuclear medicine. ❑

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# DISCLAIMER

The opinions expressed by the interviewee are his own and do not necessarily reflect those of the U.S. Department of Energy. The Department neither endorses nor disagrees with such views. Moreover, the Department of Energy makes no representations as to the accuracy or completeness of the information provided by the interviewee.

# ORAL HISTORY OF MR. MERRIL EISENBUD

***Conducted on January 26, 1995, in Chapel Hill, North Carolina, by Thomas J. Fisher, Jr. and David S. Harrell from the Office of Human Radiation Experiments (OHRE), U. S. Department of Energy (DOE).***

***Merril Eisenbud was selected for the oral history project because of his former positions as Director of the U. S. Atomic Energy Commission's (AEC's) Health & Safety Laboratory (HASL) and Manager of the New York Operations Office, and because of his research into the effects of environmental radioactivity. The oral history covers Mr. Eisenbud's long career, focusing on the years spent founding and managing the Health & Safety Laboratory, his research on radioactive fallout in the United States and abroad, and his experiences with early occupational exposure, especially in uranium processing.***

## Short Biography

**Mr. Eisenbud was [redacted] He received his BSEE (Electrical Engineering) from New York University (NYU) in 1936. Mr. Eisenbud is married and has three children. Mr. Eisenbud began his career as an Industrial Hygienist with the Liberty Mutual Insurance Co. (1936 to 1947). In 1945, he was appointed an Associate Professor of Environmental Medicine at NYU Medical Center.**

**In 1947, he was asked to serve as Director of the AEC's new Health & Safety Laboratory in New York, a position he held until 1957. During this time, HASL was instrumental in alerting people to start monitoring fallout and participated fully in Operation Sunshine. From 1954 to 1957, Mr. Eisenbud concurrently managed the New York Operations Office for the AEC, which was responsible for the procurement of all uranium for the entire Complex.**

**In 1959, he retired from the AEC to teach and perform research full-time at NYU, eventually serving as Director of the University's Laboratory for Environmental Studies. As New York City's first Environmental Protection Administrator, from 1968 to 1970 during the Lindsay Administration, Eisenbud was perhaps the first official in the United States to have that title.**

**Mr. Eisenbud has also served in the following positions:**

- **1956–1982, Member, Board on Radioactive Waste Management, National Academy of Science;**
- **1957–1985, Member, Expert Panel on Radiation, The World Health Organization;**
- **1964 to present, Member, National Council on Radiation Protection and Measurements;**
- **1969–1981, Member, New York State Health Advisory Council;**
- **Member, the National Advisory Council of the Electric Power Research Institute; and,**
- **1964–1966, President, Health Physics Society.**

**Today he is Professor Emeritus of Environmental Medicine at NYU's Institute of Environmental Medicine, Adjunct Professor of Environmental Science and Engineering at the University of North Carolina (UNC), and Scholar in Residence at Duke University.**

**Mr. Eisenbud has published many times on environmental radioactivity, urban pollution, environmental effects of power generation and human ecology.**

## Early Days as an Industrial Hygienist

**FISHER:** Good morning, Mr. Eisenbud. My name is Tom Fisher. I work with the Department of Energy's Office of Human Radiation Experiments [(OHRE)]. I'm here with my colleague, David Harrell.

Today is January 26, 1995. We're in Chapel Hill, North Carolina, visiting with Merril Eisenbud.

I should preface our interview by saying that a number of times during this interview we will refer to Mr. Eisenbud's autobiography, called *An Environmental Odyssey*. We will speak about a lot of the biographical, personal, and historical information and just refer to the book during the course of doing that.

We would like to begin this morning by inquiring about your early days as an industrial hygienist and how you took such a unique road into the Atomic Energy Commission—different from so many of your colleagues—the experiences that that provided you, and how it had such a profound effect on your hands-on work with the Atomic Energy Commission later on.

**EISENBUD:** Well, during the war years, I was a young industrial hygienist. I was 26 years old when the war started. I was with an insurance company at a time—the Liberty Mutual Insurance Company—at a time when they were really the only ones that were doing serious investigative work, for selfish reasons: If they could find out about occupational diseases, it would cut their loss ratios; but, at the same time, the worker would benefit and the policyholder would have less insurance costs. So everybody benefited.

That work was begun by Metropolitan Life back in the teens and was followed by other insurance companies, including the one that I worked for. So I had, by the end of World War II, about 12 years of intensive, very intensive, experience.

Not a lot of education. I had taken courses at Harvard, the University of Pennsylvania. Whenever I tried to get established as a graduate student, something would happen, and finally, the war came.

My degrees are a Bachelor's degree in Electrical Engineering and two honorary Doctor of Science degrees, one from Fairleigh Dickinson University and one from Catholic University in Rio de Janeiro[, Brazil].

But, on the other hand, I've got a curious history, because I'm a full Fellow of the New York Academy of Medicine, a member of the National Academy of Engineering, an honorary life member of the [National] Academy of Sciences, and a lot of other things like that, so that I've bracketed medicine, engineering, and science, and currently hold three academic positions.

I'm professor *emeritus* of Environmental Medicine at New York University Institute of Environmental Medicine. I'm adjunct professor of Environmental Science and Engineering here at UNC and scholar in residence at Duke [University (Chapel Hill, North Carolina)], where I spend most of my academic time these days.

## Hired as AEC's First Industrial Hygienist

**EISENBUD:** After the war, I was asked to—during the war, there were no industrial hygienists in the program. Probably a good thing; it's a long story as to why I feel that way. But there were no industrial hygienists.

Things worked out very well, because they had very good engineers at the major sites—Oak Ridge, Hanford, and Los Alamos, Argonne, or Chicago—but what was overlooked was the fact that there were literally dozens of small laboratories and factories that were not of the Oak Ridge type, where they had no supervision.

And so it was recommended by my former mentor at Harvard, Phillip Drinker, that the AEC hire an industrial hygienist and set up a laboratory to provide the service to these places that were too small to help themselves.

So, in 1947, when the AEC was formed, the New York Operations Office, which had responsibility for most of these little places around the country, set up a laboratory, which I very shortly became director of, which was basically a service laboratory.

We ran a film badge service. There were no commercial services in those days, so we ran it [ourselves]. We did urinalysis for various toxic substances.

We did some epidemiology, because beryllium was the most serious [source of] disease, the most serious problem we had, and we undertook to study the disease and actually set the standards that still exist 50 years later. They were tentative standards at the time.

Well, one thing led to another, and the laboratory eventually, by accident, became involved in [nuclear] fallout studies. I say "by accident" because for some reason, the AEC Division of Military Applications did not have the foresight to set up a monitoring program for fallout.

When fallout began to be reported after the first series of tests in Nevada, our laboratory was really the only group in the country that knew how to pack instruments into suitcases and go out to the field and work. So we were asked to set up a monitoring program, which we did.

**FISHER:** That sort of mobility and versatility is something that you learned early on, even during the war.

**EISENBUD:** During the war—

**FISHER:** —going to other industrial plants?

**EISENBUD:** That's right.

**FISHER:** That hands-on approach.

**EISENBUD:** Right, yes. I have a great respect for hands-on experience.

## Insuring Atomic Workers

**FISHER:** I have a question for you: Are you familiar with a guy named Charles Williams?

**EISENBUD:** Yes.

**FISHER:** —who worked with you at Liberty Mutual?

**EISENBUD:** Yes.

**FISHER:** Well, one of my particular concerns, or interests, within this research effort is information on the insurance branch, or on insurance issues. It's a question that the Advisory Committee [on Human Radiation Experiments] has had, and they've asked us a number of times about it.

I've had a very difficult time locating information about the importance or the nonimportance of the insurance function of the Atomic Energy Commission and, earlier than that, the Manhattan MED.[1]

Liberty Mutual was insuring atomic workers very early on, and [I] have read some references to Charles Williams and, maybe, some contract negotiations he had with the Atomic Energy Commission in order to provide life insurance and liability insurance on a personal level to atomic workers. I'm wondering if you know or you were involved in his work, or—

**EISENBUD:** —Well, I knew him very well. He has been dead for many years. He was a geologist—which shows the kinds of people that got into this field—who had developed techniques for looking at human lungs, and, by optical methods, he could tell what kind of dust was in the lung, and that's how he got in [to the insurance industry]. He became vice president of the company. He stayed on after I left. I left in '47, and he was there until he died.

Somebody else asked me about the insurance branch; it may have been you. I think I—whoever it was, I told them that I had heard about it but never had any contact with it and didn't know what they did.

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[1] Manhattan Engineer District, the Federal Agency set up to develop the atomic bomb under the ultrasecret Manhattan Project

The standard—we had "hold harmless" clauses in the contracts we wrote, and the reason for that is obvious. Nobody really knew what the problems were that we were getting into, and in order to induce a company to undertake a contract working with radioactive materials whose properties we knew nothing about, we had to hold them harmless.

The same was true of the beryllium industry, where we had a contract. Again, beryllium was very toxic. There was no prior experience with it, so we had "hold harmless" clauses in it. That was a matter of AEC policy. I don't know what the insurance branch did. I know that we had one [(a "hold harmless" clause)]. I really don't know why it would be that Charles Williams, who was a scientist, would get involved in negotiating contracts.

Now, he did have a Q clearance,[2] even before I did, and, probably none of the other people in the company had it. So it may be that since he had the clearances, he got involved in the discussions with the policyholders.

The one in particular that I can think of is MIT.[3] It was doing a lot of Manhattan District work. It was right across the river from where he was, and I'm sure he discussed these things with them.

## Setting up the AEC's Health and Safety Laboratory

**FISHER:** When do you think the Atomic Energy Commission really got involved or interested in industrial hygiene, or did it happen at the MED? Do you think that they were really interested in compiling long-term health data with a mind's eye towards actuarial tables where they would be able to—

**EISENBUD:** —That was late in coming. I was the first industrial hygienist to be hired, and then, within a matter of a year, Los Alamos had one, Hanford had one, and there were others scattered around.

And, of course, the laboratory that I set up, the Health and Safety Laboratory, which was the original medical division, had [responsibility for] industrial hygiene and health. I think those of us that knew the history of industrial disease recognized the importance of epidemiology.

There are any number of examples of where we—when I say "we," people like myself—as we gave talks, would point out the need to accumulate information in a systematic way, so that it could eventually be used for epidemiological purposes.

I think the best example of that I could give you is when [the] Mallinkrodt [plant] closed in St. Louis. Hanson Blatz and myself took on the job of listing all of the employees that ever worked there and the doses that they received—the whole-body gamma dose, the dose to the lens of the eye, the radon dose—and that was all tabulated.

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[2] a high-level security clearance issued by AEC (and later DOE), comparable to a Top Secret clearance from the U.S. Department of Defense

[3] Massachusetts Institute of Technology (Cambridge, Massachusetts)

And, for lack of institutional memory, of which there's a great deal, when somebody from ORAU[4] called me and asked something about Mallenkrodt, and I asked them what they were doing, they said they were doing an epidemiological study of the delayed effects on the workers. I said, "Well, have you seen our report?" They had never heard of it.

**FISHER:** Reinventing the wheel.

**EISENBUD:** Well, we found it for them. We found it. I think I mentioned that in my book.

**FISHER:** Actually, in an interview with Newell Stannard that you gave, you said that Mallenkrodt and Harshaw were the worst.

**EISENBUD:** Yes. They were the worst.

**FISHER:** Now, what does that mean? The worst what?

**EISENBUD:** Well, they were—these were plants that were designed to operate for, perhaps, 60 days, just to make enough uranium for a couple of bombs. They went on for five years, six years, something like that, and the exposures were very high.

Against the standards of —I don't remember exactly, but I think the maximum amount of uranium in air was supposed to be 50 micrograms per cubic meter; we were measuring milligrams per cubic meter, and they were excreting as much as a milligram a day in their urine.

So I would say our group was, for that time, uniquely epidemiologically conscious. We even hired the first biostatistician that the AEC ever had, a fellow named Brandt. He worked for us at a time when even the national laboratories didn't know what a biostatistician was.

**HARRELL:** Did your work get those plants closed, or were they closed because they were no longer needed?

**EISENBUD:** It was obvious that they either had to be fixed up or closed, and, for the most part, they were closed, and Fernald [(an AEC uranium processing facility in Ohio)] was (*inaudible*).

## Worker's Compensation History

**FISHER:** It was an interesting time in the evolution of the insurance industry for workers at that time, because there was some conflict between workman's compensation[5] for accidents versus repeated exposure.

This was an issue that keeps coming up in insurance branch stuff, where, if any employee fell down on the plant floor and broke his leg, that would be covered, but repeated exposure to a substance during the course of work, like uranium in a mill, would not be covered by a

[4] Oak Ridge Associated Universities, the operating contractor for Oak Ridge Institute for Science and Education

[5] The legal name is worker's compensation; *workman's* compensation is retained wherever it was used because it is commonly substituted, especially in speech.

workman's compensation provision in the state that they worked. It's especially true in Tennessee and Washington.

**EISENBUD:** Well, it depended on the state. I discuss that in my book. This helps to put the whole subject into perspective, because it was not until after the war that all the states had workman's compensation coverage for the workers. Imagine that! The first one didn't have it until, I think it was 1922, which was long before you folks were born, but not so long ago in historic terms. Europe was 50 years, 75 years ahead of us.

The first state was Wisconsin. In 1922, I believe, they got a workman's compensation policy, but for occupational disease. And there were bona fide historical reasons why occupational disease wasn't included. People recognized that they were [creating] reservoirs of silicosis[6] cases, lead poisoning cases. Whose cases were they? If a man worked for 10 different companies and was exposed to silica and now has silicosis, who pays?

And they finally worked that out, but it wasn't until well after the war that the rest of the states had workman's occupational disease coverage. And then the question of statute of limitations came up, and it took time to resolve that.

The people that get into the field now, they think, "Oh, these are easy questions, and we should have thought about them." But no, it wasn't easy at all; it was tough. It was a tough fight.

**FISHER:** You point out in your book that when information on health was forthcoming from employers to employees and to industrial hygienists and such, it was always done on the employer's terms. They kept a lot of that health data rather close to the vest. Was that true with the AEC early on?

## Contamination and Industrial Worker Education

**EISENBUD:** No. And that's a misconception. Did I tell you about Brannigan?

**FISHER:** No.

**EISENBUD:** We, in New York, had an ex-fireman, a New York City fireman, who—do you recognize the name?

**HARRELL:** I remember from your book.

**EISENBUD:** Okay. He was an educator, and he was hired by us to go around to these plants and lecture the workers. When the DOE was preparing to defend a class-action suit by the workers at Fernald, one of the assumptions was that they weren't told they were working with uranium.

Well, that was a lot of hogwash. Brannigan even wrote [educational] comic books and distributed them around. He did a great job, and, finally, he was doing such a good job, he was hired by the Washington

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[6] a chiefly occupational disease of the lungs caused by inhaling particles containing silicon dioxide

office to do the same thing for the Headquarters that he had been doing for New York.

So yeah, there were some things that the workers didn't know, but the—you know, there was a period when polonium was—well, uranium was [known chiefly by trade names such as] Oralloy and thorium was Mirnalloy, and stuff like that. But they knew it was radioactive.

**FISHER:** When you say that workers were aware that they were working with uranium, for instance, that's fine, but did they know what uranium was? Did they really know the health effects? Did they know the possible dangers?

**EISENBUD:** The health effects were considered to be more serious than they turned out to be. There has not been— the uranium industry is a big industry, now, and except for the mines, which are a national disgrace, the industry itself has never had a case of uranium poisoning.

I take that back: They've had accidents. Arnold Kramish was burned down at the Philadelphia Navy Yard, got terrible exposure from uranium hexafluoride. And then there was that one that they had more recently at Kerr-McGee, which killed somebody, that sort of thing.

But among the uranium workers there is no evidence of an excess of either lung cancer or bone cancer or latent—delayed kidney disease, which is what you would expect. And at that time, we didn't know.

In fact, the first general review of the toxicology or industrial hygiene of uranium was given by me at the 1955 Geneva Conference held by the United Nations. It was on the same program with Harold Hodge of the University of Rochester, who described his animal work. Those two papers were published together, both in the proceedings of the conference and in the, I guess, the *Archives of Industrial Medicine*, or whatever they called it in those days.

In my paper, written with Joe Quigley, a physician, we concluded that, of all the heavy metals, uranium was the least toxic. This was based on [the state of knowledge in] '55, so we had about 13 years of experience.

But we saw no kidney disease, despite the heavy exposures, and we had enough autopsy material, workers that died for one reason or another, so that we found there was much less uranium in the body than would be predicted on the basis of the animal work.

Hodge, who had not seen our paper, because we all threw them together—you know how it is at a meeting like that—he said that, of all the heavy metals, uranium is the most toxic, and that was based on animal work.

**FISHER:** So there really wasn't any difference in standards between the Atomic Energy Commission's treatment of workers' safety and health and industry's?

**EISENBUD:** The AEC was way ahead.

**FISHER:** Was way *better*?

**EISENBUD:** Way better, yeah.

**FISHER:** And that was the case from the start?

**EISENBUD:** Yes. It had to be. They didn't know what they were getting into. The only radioactive material that we had experience with before World War II was, about 1,400 grams of radium, a little over a kilogram; [it] killed over 100 people. We don't know how many more, but at least 100. Well, I don't suppose you've seen my editorial on plutonium, which came out in the last month.

**FISHER:** No.

**EISENBUD:** I'll give it to you. Plutonium is not a problem, and it makes me angry that the DOE doesn't say so. In fact, I've clipped something out of the paper just this weekend which originated from the Secretary [of Energy]'s office on how bad plutonium is. Thousands of workers have been exposed to plutonium. We've had 50 years of experience. There's one case that may be—of bone cancer in a heavily exposed worker in Los Alamos. Do you know about that one?

**HARRELL:** Mm-hmm. I was just talking to Chet Richmond.[7]

**EISENBUD:** And I think you might as well give him the benefit of the doubt. After all, he has had a bone cancer, so I guess he's had his leg amputated or something like that. Maybe he's dead now; I don't know. But the point is that one case, in all those thousands of workers—that's a great record.

## Federal Versus State Responsibility for Materials Production Safety

**FISHER:** Well, you spoke earlier, though, about the national tragedy of the uranium miners. Do you think that Government inaction led to that disaster?

**EISENBUD:** That was simply bureaucracy in its worst form. That's all explained in the book. I sent a copy of that book to [former Secretary of Interior] Stuart Udall, who I've gotten to know quite well over the years. It's got the whole story of how that came about, and he ignored it in what he said in his new book, *Myths of August*.

**FISHER:** Mm-hmm.

**EISENBUD:** He just conveniently leaves things out when it doesn't suit his purpose.

Now, what happened was very simple, very simple. The 1946 Atomic Energy Act preempted responsibility for health and safety from the states, and gave it to the AEC. But only after the source material was removed from its place in nature—which means, after it was taken out of the ground.

Now, about the same time that we appreciated we had to do something about the mines, we were faced with a very serious problem in the beryl-

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[7] For the transcript of the interview with Richmond, see DOE/EH-0477, *Human Radiation Studies: Remembering the Early Years; Oral History of Chet Richmond* (scheduled to be published later in 1995).

lium industry. There was nothing in the law that said we had to protect the beryllium workers, but my chief, Bill Kelley—who was manager of operations, and whom I later succeeded—took the position that if we were the main customer, we were going to see that it's produced safely, and we would set standards, which we did, for beryllium.

That was done in 1948 or '49. [There was] nothing in the law that said we *had* to do it, but there was nothing in the law that said we *couldn't* do it. With uranium mining, the law was specific that we didn't have responsibility. On the other hand, there was nothing that said we couldn't take responsibility if we wanted to.

In the case of beryllium, as I recall, the way it was set up organizationally, beryllium procurement came under the Reactor Development Division, and the lawyer in that division saw no problem with what we were doing. In fact, they adopted our recommendations, and they were issued by the General Manager on behalf of the whole AEC, not just the New York Operations Office.

With respect to the uranium mining, it was a different lawyer who said we had no responsibility; that we should leave it up to the states. We explained to them that the states didn't have the kind of staff that it took to make the measurements; they didn't have the instrumentation. They were small mining states, where the health departments didn't have the independence that Illinois or New York or Massachusetts would have. They said, "No, leave it up to the states." And Kelley said that he would not sign contracts for uranium procurement unless he could put standards into the contracts.

And they did something that was unique, so far as I know, in AEC history. They picked up the whole Raw Materials Division in New York, moved it to Washington, and called it the Raw Materials Operations Office.

That happened about 1949, I would say, or '48. I would love to see the documentation on it. I know that there were staff papers going back and forth that ought to be looked up, but there was no malevolence on the part of anybody. It was just that some lawyer took the position that if we didn't have the responsibility for it, we should leave it to the states. He was simply a states' righter.[8]

**FISHER:** Did you feel slighted by that? Did you feel that this was some sort of scam that was being perpetrated to strip you of the authority for that procurement process?

**EISENBUD:** Well, at first, we didn't think it was so bad, because—I think I can produce evidence that showed that we attempted to get the—we, in New York, pointed out to the [U.S.] Public Health Service that something needed to be done. But they didn't get going for a few years. When they did get going, they did it with instruments that we provided from New

[8] one who holds the doctrine of *states rights*, a strict interpretation of the U.S. Constitution by which all rights not delegated to the Federal government belong to the states

York. So—we were busy people, and we knew there was a bad situation developing there.

I personally made the first radon measurements ever made on the Colorado plateau. The numbers I got were, basically, the same numbers that we were seeing from the European mines, where we knew they had trouble.

## Plant Safety and the Community

**FISHER:** When we talk about the workers, both in plants and in mines, do you think there's any credence to the ideas of Stewart and Kneale[9] when they talk about the "healthy worker effect"?

**EISENBUD:** Well, there is a "healthy worker effect". You see it everywhere where you do a study of workers. It should have been particularly strong in the AEC, because the workers—well, not in the mines, but in places like Mallenkrodt and elsewhere—were Q-cleared, which meant they had to be clean livers, for the time.

**FISHER:** But they were also being more heavily monitored, and the "healthy worker effect" is used to rebut the idea that there's no exposure coming from plants, because, look, the workers are fine. Whereas in populations—

**EISENBUD:** —The "healthy worker effect" simply recognizes that if a person isn't healthy, they're not likely to be a worker. So that's point number one.

Secondly, in modern plants— and certainly, AEC was as modern as any of them—you have medical supervision, so that if people develop disease, the medical staff tell them about it, and the workers go see their personal physicians; it gets taken care of.

So there are many reasons. And then, around AEC, drinking was frowned upon. You know, that has a major effect on the health of people. So there are many reasons, you see, why people who work are healthier than people who don't work. Does that answer your question?

**FISHER:** I think so. Just, it seems that if you're talking about plants, and you're talking about a facility, a mill like Fernald, or Rocky Flats, [Colorado,] for example, and if the plant would point to the "healthy worker" population as a reason for no offsite contamination or the safety of a process, it discounts the effects that might result in people living off the plant site who are not being monitored and screened to that close degree; who are not necessarily the cream of the crop, physiologically—

**EISENBUD:** Offsite?

**FISHER:** Offsite.

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[9] See generally the theories of Alice Stewart and George Kneale

**EISENBUD:** Well, but, the offsite problem is completely different. It's a political problem. It's involved with big money, and that's your basic problem in the Marshall Islands. Oh, I've got a great deal of sympathy for the Marshall natives. I think they were treated very badly. But enough is enough. I mean, they've been given a half a billion dollars, or something like that, and, you know, they were victims in the backwash of a war that killed 55 million people. Those were terrible times.

Now, that's one extreme. The other extreme is Fernald, where there was a great deal of public relations activity, a great deal of money spent on public relations, trying to get across the message of, everything as secret.

It was said that Fernald was called Feed Materials Plant, because we told them we were making farina for cows or something like that. I produced a—in fact, I didn't produce it, they found; one of the lawyers had sent it to me as a souvenir—a letter that I sent to the Ohio Health Department in—the AEC told the Health Department exactly what they were going to do. Their people would clear and go through the plant. Now, if they didn't go out and advertise it to the public, that's a problem of state politics. There probably was no reason to.

And there wasn't much interest. When John Harley and I published our first fallout paper in *Science*—it was early: 1951, was it, or '52?—we thought there was going to be tremendous press interest in it. Not at all. I don't recall that we got a single press inquiry.

The point I wanted to get back to about Fernald, was that when the offsite class-action suit went to trial, the judge said there was no basis for a trial. He threw it out—because there was good monitoring, and the doses were much lower than the actual radioactivity.

But there was pressure put on DOE, and [then-Secretary of Energy] Admiral Watkins gave the community $75 million because of the anxiety caused by the existence of the plant.

Where did the anxiety come from? A Cincinnati lawyer was hiring public relations people to drum up the concerns of the press. I've got a slide from *Newsweek*, "They lied to us." That meant me, because I was the one that had the responsibility to communicate with, not only the workers, but the public.

But I wasn't going to go out and communicate with the public; I wouldn't do it today. It would be my job to make sure that the state officials knew what was going on, and then let them decide what's appropriate.

**HARRELL:** You mentioned that there was good monitoring at Fernald. Was there ever a plan, or an idea, to monitor the communities around facilities such as Hanford and Fernald, to get a handle on it?

**EISENBUD:** No, there was no reason to: the doses were too small.

Now, Hanford is a special case, but the publicity on that has been bad. Let me say that the same lawyer is involved in the class-action suit there that was involved at Fernald.

When they talk about the dose at Richland [in Washington state] from the iodine that was released, what you've got to do is ask, "How many people lived in Ringold, and were there any two-year-old children?"

There were 100 people living there, and nobody knows whether there was a two-year-old child or not. And suppose there was one, or two, or three. This was wartime! These were—and even after the war, I mean, the Cold War was worse than the war, so far as the strain that we were under.

## Monitoring Radioactive Fallout

**FISHER:** You spoke earlier about some of the bureaucracy and the secrecy. I think that that's an important element of the work that you've done. I read in a newspaper article something to the effect that you said things were classified not because they needed to be, but mostly because nobody ever thought to declassify stuff.

Did classification have an effect on the work that you were doing, the compartmentalization of the Atomic Energy Commission?

**EISENBUD:** Well, I think, maybe [it had an effect], for selfish reasons in our lab. We wanted to get our stuff published. We were doing good work, and we didn't see any reason why we should keep security stamps on things when they didn't need to be.

So, when the time came to write about fallout from weapons testing, we just didn't say anything about the designs of the bombs and the types of materials and exactly what the yields were for each test. Those were the secrets. We left those out, but we could produce the fallout information.

The same way, in the uranium plants, the only thing that was classified— the process wasn't. What was classified was the production rate. So you just don't put that in [the published reports].

**FISHER:** But there would be instances where there would be a bomb test or a blast that you wouldn't know about, and then you would get a call from Rochester, saying that, "Our levels are going up," and you weren't able to prepare ahead of time.

**EISENBUD:** Oh, that was plain stupidity on the part of the AEC.

They were warned, because after the 1945 test in Alamogordo,[10] they had fallout. They had fallout on cows, and they had fallout 1,000 miles away in a cornfield, in contaminated cornstalks that were bought up by Eastman Kodak to be made into interleaving paper for x-ray film, and you can imagine what that x-ray film looked like.

So they should have known, but didn't. I don't know why they didn't. I was amazed, because I got the call from Rochester saying that they had had a fallout. And so, when I called around, I found out that nobody had

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[10] a city in New Mexico 50 miles southeast of the first atomic bomb explosion (July 16, 1945)

a monitoring program, which amazed me. So, you know, we got into it in that way.

**HARRELL:** Had there been any idea before that point that the fallout would go that far?

**EISENBUD:** I don't think anybody thought about it. If you go back into the Manhattan [Engineer] District literature, there are any number of memoranda analyses of what to expect from fallout.

There were a few people—I think Joe Hirshfelder was one of them; I don't know whether he's alive now or not—who were concerned about fallout during the war.

But the Hiroshima and Nagasaki bombs were intended to be exploded high off the ground, where the fireball wouldn't touch the surface of the earth, and so you wouldn't have much fallout. All you would have is a very fine fume, which is widely dispersed, which is what happened.

**FISHER:** And did they try to monitor the fallout from those tests—or, from those explosions?

**EISENBUD:** I don't know. I don't know.

**FISHER:** I guess nobody else would have been prepared to do that, no other countries.

**EISENBUD:** No other countries could have done it, and I don't think we began to do it until—we began to do it for intelligence reasons after the war, when AFOAT was set up.

**FISHER:** What's that? AFOAT?

**EISENBUD:** A-F-O-A-T, Armed Forces Office of Atomic Energy, and that was an intelligence group. They were the ones that found the debris from the Soviet explosion.

**FISHER:** So, when this—when monitoring became policy, or when monitoring began, was it policy? Was it written into the express charter of the Health and Safety Lab, that you will monitor fallout, bomb blasts, or—

**EISENBUD:** —No; [we] never even got a budget for it, originally.

**FISHER:** Just something that you took the initiative to do yourself.

**EISENBUD:** Well, we did it because it was interesting. That first fallout occurred during a snowstorm, so it was the snow that brought it down. Since there was a cold snap on the return—the falling of the snowfall—we thought, "Well, let's collect snow and see how extensive this is."

We had contracts with companies and universities all over the Northeast, and we collected snow. The fallout was on a Friday, and by Tuesday, we had a map.

**FISHER:** Yeah, you described that process in your book.

**EISENBUD:** Yeah.

**FISHER:** And Shields Warren was able to use that in Congressional hearings.

**EISENBUD:** Yeah. Nobody knows where that map went. There was just one copy of it, and it's probably still in Washington somewhere.

Now then, what happened was that some point in the early '50s, Eastman Kodak put the Commission on notice that unless they could be given information on the characteristics of fallout, when to expect it, and how much, they were going to hold the Commission liable for damage to product.

And so the director of Military Applications asked if our group would take responsibility for dealing with the photographic industry. That was a nice contact. They had good scientists, and we worked together with them and learned a lot together.

**HARRELL:** Did Eastman Kodak have more pull because they had been a big contractor earlier?

**EISENBUD:** That may be, but I think probably—it's a pretty big company, and the industry was big. AEC had enough troubles; all [Kodak was] asking for was information about, you know, which way the clouds were going.

**FISHER:** And Eastman Kodak didn't have any concern at that time for the effects on people, just the effects on their film?

## Radiation and Cancer Rates

**EISENBUD:** Nobody had a concern about effects on people, except close in.

You've got to remember, until 1956 or '57, we believed that there was a threshold for cancer. That's something that's overlooked.

There were two authoritative reports in 1956, one from the Medical Research Council in the United Kingdom, and our own National Research Council, summarizing what was known about biological effects of radiation, and all they talked about was genetics. But genetic problems are not acute problems. You would have to expose generation after generation, contaminate the whole pool. That's not something you do: genetic effects are not seen in a few people, because they were irradiated.

**FISHER:** And those genetic effects theories would not be based on animal research, would they?

**EISENBUD:** They were based on animal research, on fruit flies and mice.

**HARRELL:** But those would be—those were short or acute genetic effects.

**EISENBUD:** Well, when you get involved in the algebra, what you do is irradiate one generation and study the number of mutations in that generation. And then you calculate the rate at which it will dilute the breeding population. How long will it take for the population to come to equilibrium. It turned out that the genetic effects were less than those predicted on the basis of the mouse.

That's why no effects have been seen in Hiroshima or Nagasaki; there have been no genetic effects identified. There may be some there, but they're so few that you can't measure them.

Cancer, on the other hand, has become a much more serious problem, beginning in the early 1960s when, really, two things happened.

First of all, we stopped relying on a threshold theory and went to no-threshold. We actually went to a linear hypothesis and then recognized that almost all of the cancers that are seen in humans will occur more frequently in an irradiated population. But that was a late development. I mean, that was not until about 1963.

**FISHER:** Was that part of the BEAR reports?

**EISENBUD:** No, it came out—it was—I don't remember the date of the first BEAR report. That was about 1970, wasn't it? It came out of the Hiroshima—

**HARRELL:** B-E-A-R reports, also, the B-E-I-R reports?

**EISENBUD:** Well, it's—let's see, the ones right now are B-E-I-R. The first one was B-E-A-R. I think that was about 1970, but there's always a lag. You know, the information came out of Japan. They suddenly began to see excess cancers in the irradiated population.

Now, from the time you see this until you get it in print and peer review it, it can be three, four years.

**HARRELL:** But were these cancers from fallout?

**EISENBUD:** No, radiation, directly.

**HARRELL:** Radiation. Had there ever been studies of the effects of long-term exposure to fallout on cancer in animals or people?

**EISENBUD:** Well, the effects would be the same. The only difference between direct radiation and fallout is that in the case of direct radiation, your whole body is irradiated externally.

In the case of fallout, you can have both. If the stuff is on the ground, you get external radiation, but if it gets into the food supply or water or air, it's internal radiation. So the dosimetry is more complicated.

But I don't think there was ever any question but if radioactive material got into the body, it would produce cancer. We knew that from radium; we also knew it from radon. But it's a matter of dose; a question of how much.

**FISHER:** And there was always thought to be a threshold until—

**EISENBUD:** —until—well, there's still a lot of people that will insist there's a threshold. In fact, in *Science* this week, there was an editorial by Koshland pointing out that there are new developments which indicate that the repair processes of DNA probably mean that the linear hypothesis is overconservative.

Now, you can go one step further. There are people that say that—you know what *hormesis*[11] is?

**FISHER:** No.

**EISENBUD:** Hormesis—there's some evidence—I don't subscribe to it, but there is some evidence that low doses of radiation are beneficial.

**HARRELL:** We've heard various things about that.

**EISENBUD:** Yeah. Now, the best example, which, apparently hasn't surfaced— it's in the literature, and people haven't picked it up—is the Chinese study in the high-background area there, where the high-background area is three times normal, and there are a lot of people exposed. I mean, it's a big population.

They've looked at cancer, and they've looked at genetics, longevity, and everything. The people in the high-background area are better off than the people in the low-background area.

**HARRELL:** Is that the only study of background areas throughout the world?

**EISENBUD:** That's the only one in which any meaningful data have come out. When I was at NYU, our group did a study down in Brazil, but the population was too small to produce meaningful data.

There is a population in India that's big enough, but the Indian government has just been dragging its feet for 30 years now, and hasn't wanted to do anything about it.

**HARRELL:** How does the idea of a threshold dose differ, or how is it the same, as your ideas of a de minimis[12] dose that you talk about in environmental radioactivity?

**EISENBUD:** Well, I think I'm a practical man. If an effect is so small you can't measure, I say, let's forget about it.

## Safety of the Nuclear Industry

**FISHER:** And that would be a de minimis dose? There would be some point—

**EISENBUD:** —Well, at some point, yeah. A de minimis dose of radiation in the nuclear industry, for example, might be the dose that would produce estimated effects that are so small that they wouldn't affect the mortality and morbidity statistics for the industry as a whole.

I mean, your atomic energy industry is a good example of that. You've probably had 500 deaths from injuries—you know, falls off ladders, automobile accidents—a lot of automobile accidents in the program—chemical explosions, and that sort of thing. There have been six radiation deaths, and the last one was over 30 years ago. I don't know why your organization doesn't brag about that.

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11 the stimulating effect of subinhibitory concentrations of any toxic substance on any organism

12 a level below which a dose is statistically insignificant

**FISHER:** It's a very sensitive issue, I suppose.

**EISENBUD:** Why?

**HARRELL:** Well, public opinion being what it is about radiation, to say that.

**EISENBUD:** But who creates the public opinion?

**FISHER:** It's just not something that we're going to go around saying.

**EISENBUD:** Well, you should. You should give medals to people like me. I want a medal for all the work I've done.

*(laughter)*

**FISHER:** Let me write that down.

**EISENBUD:** Well, I'm serious. You know, most of us—I was a Johnny-come-lately. The real work was done during the war. I didn't really get into it until *after* the war.

But I think people, Herb Parker and—those are the real heroes—they didn't get the Fermi award. None of those people have. Recently, Robley Evans did. That's because it was basic science, and not because of the fact that it had such a great impact on the safety record of the industry.

Not only is the radiation safety record good, but the general accident record is about one-third of what it is in the rest of the industry. The only industry that is safer, I think, is the financial industry, these people that sit at desks.

**FISHER:** Well, Waldo Cohn[13] wants a medal, too, so he's in good company, or vice versa: you're in good company with him.

**EISENBUD:** He wants a medal?

**FISHER:** Yes.

**EISENBUD:** What for?

**FISHER:** For his work. For the radioisotopes distribution policy; for being the architect of that policy.

**EISENBUD:** Well, look. This year, 8 million people will receive radioisotopes for medical purposes. I don't know how many lives that will save, but probably a lot. Who did the work? Paul Aebersold. Do you know his name?

**FISHER:** Sure. He wrote the paper with Waldo Cohn in 1946.

**EISENBUD:** With Waldo Cohn, yeah.

**FISHER:** Although Waldo Cohn says that he did all the work.

**EISENBUD:** Well, but—

**FISHER:** The administrative stuff was Aebersold, but the idea was Cohn's.

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13 For the transcript of the interview with Cohn, see DOE/EH-0464, *Human Radiation Studies: Remembering the Early Years; Oral History of Waldo Cohn* (scheduled to be published later in 1995).

**EISENBUD:** That may be. No, Aebersold was a missionary, if you knew him. He was a nut. He committed suicide, which is probably the extreme of his nuttiness. But he was very fanatic about the importance of radioisotopes and what it was going to do for you.

**FISHER:** Well, I'm wondering if the de minimis dose would be an acceptable factor in a human experiment.

**EISENBUD:** Well, you're asking the wrong question. I told this to the chap that was here a couple of weeks ago. I don't know whether—I haven't seen it in your charter; it should be. The basic question is, "Were the precautions taken in the administration of radioactive materials for experimental purposes any different, any less rigorous, than the precautions taken in pharmacological research or toxicology?" Isn't that the basic question?

**FISHER:** That's the fine line everywhere we go. You know, what was the AEC doing differently than what was being done in industry or academia?

## Use of Children in Research

**EISENBUD:** Yeah, right. Yeah. You go into *Industrial Hygiene* and look up the toxicology of lead, fluorides, zinc fume fever—I could probably mention some others. People [(researchers)] used to experiment on themselves, on their children, on whoever they could get hold of. And I don't know of anybody that was ever hurt, because this work was done by people that were prudent.

Now, the problem with radioactivity is that you don't have a threshold. I was just working on that basis. But the doses we're talking about are very small. I don't know what the doses were in the plutonium cases. I never took the trouble to look them up. But the kind of thing that they did up at—what's that?

**FISHER:** Rochester?

**EISENBUD:** Well, I was thinking of the children's home.

**FISHER:** Fernald School [in Ohio].

**EISENBUD:** Yeah, right. That was very, very important work they were doing up there.

I can remember many discussions of, "How can we get information about this or that and the other thing?' and always it would boil down—because we were interested in children, children being more sensitive to many things.

Where do you get hold of children where you can monitor their diet for a period of months? They have to be institutionalized. Well, you want them to be institutionalized and you want them to be healthy—healthy, metabolically.

Well, that pretty much limits you, and that's, I suppose, how Fernald was selected, although I wasn't involved in that at all. Never really even heard about it. So I don't know where you draw the line on risk.

The only time I ran up against this problem myself was when we developed a method of measuring the amount of radioiodine in a child's thyroid by simply sitting them in a chair in a shielded room and holding a sodium iodide crystal up to their neck, and, in about 15 to 20 minutes, we would be able to tell them how much thyroid they have. We developed a lot of information and published a lot of useful data.

Where did we get our kids? Well, I only had three of them, so—I mean, among us we've probably got a dozen or so.

**FISHER:** So they were all the children of scientists involved?

**EISENBUD:** No, no. We went to the outpatient clinic of the Pediatrics Department, and if we—

**FISHER:** In the city? Because you were up in Tuxedo [Park, New York]?

**EISENBUD:** No, no, this is when we—we were then in the city.

**FISHER:** Still?

**EISENBUD:** Still in the city. And we would talk to the nurses and explain that we would like to know about some children that had normal calcium metabolism and normal iodine metabolism, and so on.

And they would say, "Well, there's 12 of them over there," so we would go over and talk to their mothers, sometimes through an interpreter.

The kids would walk across the street, sit in the chair in this iron room, watch TV for 20 minutes or a half-hour, the mother standing right with them. We would give them a lollipop, and the mother's thrilled that she has participated in science. The child has got a lollipop and has watched TV.

Then, one day, I was asked whether we had informed consent. It never occurred to me that I would need it.

**HARRELL:** That's a similar controversy to what has evolved around the Hanford monitoring program, or dietary study, they did on the normal population.

**EISENBUD:** Yeah.

**HARRELL:** There are people who are hysterical about that.

**EISENBUD:** I don't know. It would never have occurred to me that I would need informed consent for that.

Well, fortunately, we already had all the data we needed, so, rather than try to translate all of this into Spanish, which was the kind of people we were dealing with in those days at Bellevue Hospital, we just quit.

## Developing Thyroid Radiation Counters

**HARRELL:** Were you measuring thyroid in normal people or thyroid in people who had injections of isotopes for diagnostic purposes?

**EISENBUD:** We did that, too. That's another one, a different story. No, these were just normal kids that, you know, we would ask the mother how much milk the child drank, and the mother generally would know very accurately how much milk they would drink, within 20 percent, 25 percent, which is good enough for our purposes.

Among those children that came over to our lab, there were a pair of twins. One of them had what we would have expected as a thyroid burden, and the other had none, no iodine in the thyroid.

So we talked to the mother and the nurse that was familiar with the case. They found that the child was asthmatic and was getting Lugol's solution, which has stable[14] iodine in it, and that tipped us off to the fact very small amounts of stable iodine could block the thyroid.

Now, the clinicians knew that large amounts of iodine would do that, but Lugol's solution has very small traces of stable iodine. So a thyroidologist named Blum *(phonetic)* and myself began an experiment, which we published, on how small the dose could be and what the effect would be on thyroid blocking.

That was done—I've forgotten what the sequence was. It was done as part of a clinical procedure in which the radioiodine needed to be used, anyway.

Oh, no, the thyroid had to be blocked. That's what it was.

**HARRELL:** Did you discover that effect?

**EISENBUD:** Yes. No. It was known before we came on it that large amounts of iodine would block the thyroid. What we found was that small amounts would do it, so that the dose could be as low as 50 milligrams.

**HARRELL:** And about what year was this thyroid work going on?

**EISENBUD:** '62, '63.

**FISHER:** Did you develop the counters yourselves, or—

**EISENBUD:** —The thyroid counters? Yes. Nothing very complicated about it.

**FISHER:** Right; right. Did you base that development on other counters that had been developed at Oak Ridge or Los Alamos?

**EISENBUD:** Well, I think our lab—our whole-body counting, it was probably ahead of the National Labs. We had very good equipment, and the in vivo[15] plutonium monitor was developed in our lab, which was a major development.

**HARRELL:** Because it seems like the Labs are very proud of their equipment that they've developed.

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14 as opposed to radioactive

15 within a living organism; usually, in the womb

**EISENBUD:** Well, I can give you—first of all, there's a great deal of N.I.H.—you know what N-I-H is? "Not invented here"?

*(laughter)*

**EISENBUD:** —throughout the National Labs. All the universities complain about it. And if a university publishes a paper on something, then the Labs will redo it, reinvent it, and publicize it, and from that point on, they forget where the idea came from.

**HARRELL:** So there's a bit of that, and the fact that reports don't get transferred around and people end up duplicating work.

**EISENBUD:** Well, our work was published in two papers that I worked with—his name was Blum; he was a thyroidologist. One was published in *JAMA* [(the *Journal of the American Medical Association)*] and the other one in—it was the first IRPA meeting, the International Radiation Protection Association.

**FISHER:** Who funded those sodium iodide studies? Because you were at NYU at this point; right?

**EISENBUD:** I think I describe that in my book. I describe the way another chap and myself were in the lab one evening. He was a heavy milk drinker, and I wasn't, and so we stuck our necks on our big 8-inch crystals to see whether we could see [evidence of] the iodine [in our thyroids)].

The Russians had just begun testing again, and we knew it [(radioiodine)] was in the air, but we didn't know it was in milk yet; we hadn't gone that far. He had a nice iodine peak [in his thyroid count], and I didn't.

So, while we were working with 8-inch crystals at that time, and what we needed was something much smaller.

That very night, I called Jim Terrell of the Public Health Service at his home and told him what we had and what I thought we ought to do with it, and would they do it, and we could do it for a couple of thousand dollars. We had staff; we just needed [funding]. So he says, "Go ahead and buy it, and charge it to your training program."

**HARRELL:** Did you ever have any idea of the monitoring programs, say, Russia or other countries had to detect our tests and their own fallout levels?

**EISENBUD:** Well, that was all very classified. And there was a lot of duplication. A lot of the things that we were doing, trying to monitor fallout around the world, was being done by this AFOAT organization. I think in my book I describe the way I ran into one of their people—

**FISHER:** Yeah, on the island.

**EISENBUD:** On an island, yeah. But we didn't want to get into intelligence. It required much more sophisticated knowledge of bond radiochemistry than we had.

**FISHER:** We were talking about foreign monitoring and how it was all classified.

**EISENBUD:** Yeah, but we didn't get into intelligence. It's a much more sophisticated field than what we were doing.

## Secrecy, Louis Strauss, and the Bravo Test

**FISHER:** The secrecy issues still interest me, and I was wondering if you could talk about a couple of them. For example, you talk about how conservative, politically, you thought Louis Strauss was[—that he was] a real Republican fat cat in those days and had some very definite views.

Do you think the conservative views of Strauss and others at the time contributed to all the clichés, "veil of secrecy," and all of that stuff, that hung over the AEC during the Cold War and maybe even contributed to some of the human experiments that occurred, that we know occurred?

**EISENBUD:** There were a lot of things about Louis Strauss that I did not understand, still don't understand, and some of those are discussed in my book. This whole story of Bravo was something that he was mixed up with.

**HARRELL:** I hope we can talk about that in more detail later.

**EISENBUD:** Yeah. I don't understand why our country could not have been more forthright after Bravo. And, as I said—did you read my testimony to the Congressional committee?

**FISHER:** Mm-hmm.

**EISENBUD:** I mean, my basic point was, there was no investigation. And one of the Congressmen said, "By golly," he says, "if you run a tugboat to the ground in the Navy, you have to have a court of inquiry." And here they had a major disaster, and no inquiry.

So that whole situation was strange during that period. I can't explain it. The only way would be to hold an inquiry, but most of the people that you would want are no longer here.

**HARRELL:** It's true. So the disaster with Bravo was just much larger than they thought.

**EISENBUD:** I'm not sure of that, either.

**FISHER:** Well, the 30-hour delay, though, would certainly be important.

**EISENBUD:** My recollection is that the Bravo shot, the March 1st [1954] shot, was forecast to be about what it turned out to be. And I have given to the Congress the date of a memorandum which I received which listed the expected yields of each of the shots. Nobody seems to have found that memorandum.

**FISHER:** Has your thinking about Bravo evolved during 41 years, or have you just— you knew that there were problems then and you—

**EISENBUD:** I never thought about it in 41 years. I mean, as I said at the hearing, this was the first time in 40 years that anybody has ever officially asked me what I knew about it.

I had notes that I had taken, which I used in my book, and what I said about Bravo in the book is pretty well documented. There are press releases that were made, which were lies; all those were documented.

And, of course, I had a special problem that I had the good fortune to be sent to Japan to try to quiet everybody down over the *Lucky Dragon*[16] incident.

**FISHER:** And there was more of the same. Put you in a tough spot there, didn't it?

**EISENBUD:** Yeah. It pulled the rug out from under me.

**FISHER:** And this was your friend, Strauss?

**EISENBUD:** I don't know who it was. Oh, well, it was, yes, because—yes, you're right. But all through the period that I was there, there was a silence on the part of the AEC. The Japanese had reconstructed what had happened and were publishing it in the newspapers. The AEC would not admit that there was a fallout. And when they finally did come out with a statement, they made it seem very trivial.

**FISHER:** In fact, Strauss thought that the *Lucky Dragon* was a spy ship.

**EISENBUD:** That's what he said on March 30th [1954]. Now, that would have been a month afterwards. That was when he said that he was informed, and the implication was that I—John Morton and I—were the ones that told him that the burns on the skin of the fishermen were due to the action of lye, caused by the calcine coral. Yeah, that was—

**HARRELL:** —Was it for Bravo that you sent the balloon up?

**EISENBUD:** That was before Bravo.

**FISHER:** Before Bravo? In preparation for Castle, I think.

**EISENBUD:** Yeah, well, we couldn't find any fallout from the Mike shot.

**HARRELL:** Right.

**EISENBUD:** And there were people—I won't mention their names—who were saying that it was all blown into outer space; it was never going to come back. Of course, we know now that it probably just fell into the ocean because the islands are very few.

So the question was, well, maybe it's still up in the stratosphere, and that's why we sent the balloons up.

**FISHER:** And you found small amounts, didn't you?

**EISENBUD:** Small amounts. The measurements weren't very good, either, but they were the best you could do in those days. We got up to 100,000 feet.

**HARRELL:** Did you get to an altitude where you found no more, so you assumed that it had gone no higher?

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16 The *Lucky Dragon* was the Japanese fishing vessel whose crew was contaminated by the March 1954 Bravo test.

**EISENBUD:** No, we didn't have enough measurements. Those were the old Sky Hook balloons that were very expensive and hard to man: you had to chase them across the country.

**FISHER:** You mentioned that in preparation for these tests for Bravo, you did monitoring of wine and cheeses and water and soil and all sorts of things. Did you ever do any preemptive monitoring of the Marshallese themselves to get baseline values?

**EISENBUD:** Well, you addressed that question to me. I wasn't involved until after Bravo. I wasn't involved in the Marshalls. Well, I was; yeah. Now, wait a while. I take that back. Because we were out there for Ivy, which was two years before. You're asking me, did we get any baseline data? The answer is, no. It would have been an interesting thing to do.

**FISHER:** Why do you think that tests were done in the Marshalls? You've previously said that they were a pretty lousy choice of place. The tests were hard to observe and the terrain was nonrepresentative of where we thought we would be using these bombs. Was it just a "location, location, location" question?

**EISENBUD:** Where else could you do it? There was an article in the New York *Times* that said Cape Hatteras, here [off the coast of North Carolina], was considered a possible site for the tests, which was new to me. It wouldn't be very practical.

Nevada would be ideal, except that, when you got up above 50 kilotons or so, you made so much bang that you would begin to break windows, crack plaster. Couldn't go much higher than that, and here they wanted to go up to multimegatons.

So they had to go out somewhere, and the Marshalls seemed like a reasonable place for them.

## Nuclear Test Fallout Studies

**HARRELL:** Do you know what kind of monitoring was done for the tests up in Alaska?

**EISENBUD:** No.

**HARRELL:** You were out of the monitoring business then?

**EISENBUD:** I was out of it by then.

**FISHER:** When did interest in all of this—well, in fallout really, begin? We know about Project Gabriel, and that was in '49. That really got us started, and that, of course, led to [Project] Sunshine.

But was Gabriel really the beginning? We wanted to know how many bombs we could explode before—and the Russians, too—before what? Before the world's populations got cancer?

**EISENBUD:** Well, before you overexposed the world's population, yeah. I think, at that time, they probably were concerned more about genetic effects than cancer.

**FISHER:** And that was the genesis of this concern—Gabriel in 1949?

**EISENBUD:** Yeah, that was—yeah. A fellow named [Arnold] Kramish—do you know that name?

**FISHER:** What is it?

**EISENBUD:** Kramish. He was in charge of that.

**FISHER:** Yeah. You mentioned that he had been exposed at the Navy Yard [in Philadelphia].

**EISENBUD:** Oh, he was—that's right. He sent me a copy of a nasty letter that he wrote to [Energy Secretary] O'Leary just recently. A lot of these people don't like some of the people in the DOE now.

**FISHER:** Why is that?

**EISENBUD:** Well, I think that it goes back to what I said before. I think some of us are very proud of the fact that we had a difficult and dangerous job to do. We think we did it well. I mean, the last fatality from a radiation accident was what? [The] SL-1 [reactor criticality accident at Idaho]. 1961, 30 years ago.[17]

Yeah, they're going to find there was a big release up in Hanford. And, theoretically, if there was somebody drinking goat's milk on a certain farm that had had a dose of a few hundred rem, the probability that person will develop thyroid cancer may be 1 percent, which is higher than I would like to see for my children.

But suppose it happens. Suppose we get one or two cases. Those were days—and that Hanford release occurred after the war.

**FISHER:** The Green Run, right.

**EISENBUD:** Yeah, you people—well, you're probably too young, but my kids, who are now in their 50s, early 50s, were diving under desks at school, being taught what to do in case, when the whistle goes. That's what kind of world we lived in.

**HARRELL:** Do you think the question of fallout is still relevant, since there's less of a chance, now, of these weapons being used?

**EISENBUD:** I think there's a much greater chance of the weapons being used. I think the chance of having an all-out nuclear war is probably pretty close to zero. I think the chances in the next decade or two of somebody sneaking a bomb into New York Harbor or someplace else and exploding it is pretty close to one,[18] unfortunately.

**FISHER:** When we talk about all these fallout studies and the work that you did, what role did contractors play? Any? Did they have any role? Was there

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17 For an extended discussion of that accident, see "Fatal Worker Accident at Idaho's SL-1 Reactor (1961)" in DOE/EH-0454, *Remembering the Early Years: Interview With Dr. George Voelz, M.D.* (May 1995).

18 "unity," or 100 percent

cooperation between Government and non-Government researchers for these fallout studies?

**EISENBUD:** A lot of the analytical work was done under contract. At first, HASL [(AEC's Health and Safety Laboratory)] was doing most of it ourselves.

Then, when Bill Libby came into the picture, and he wanted to have strontium-90 in bones, and there were a lot of bone samples around the country—about 1,000, I guess—New York, my office, signed a contract with Columbia [University, New York] to get bone samples from the hospitals and analyze them.

We had contracts—I don't know whether contracts, or a memorandum of understanding—with the Department of Agriculture, the Weather Bureau.

Now, the radiobiology was done—a lot of that was done under contract, the work that Herta Spencer did at the VA [(Veterans Administration)] Hospital in Chicago on metabolism. She was interested in the metabolism of calcium, which brought her into the metabolism of strontium. That was a contract, probably, with my office, although I can't say for sure.

And then, I suppose there were other contracts. I can't think of any at the moment.

**FISHER:** You mentioned the VA Hospital. I meant to ask if any vets were monitored that were observing the blasts during Bravo or were just participating as seamen on the ship, the *Estes*, the ship that you were on.

**EISENBUD:** Yeah, they were all monitored.

**FISHER:** They were wearing badges?

**EISENBUD:** Well, not everybody, because if you're on a ship, and everybody's going to get roughly the same exposure—

**FISHER:** —Good point.

**EISENBUD:** You just—you may not even put them on people. You could the put badges around the various parts of the ship. But some of those doses were high. We knew that.

**FISHER:** Do you know where that dose information has gone? Because vets have an extraordinarily tough time.

**EISENBUD:** Who's having a tough time?

**FISHER:** Veterans are having a very tough time. Even veterans that participated in Bravo, for example, are having a very tough time, now, working with the VA to try and locate those doses and locate that dose information.

**EISENBUD:** That should not be so, because the Congress ordered the military to come up with a dose estimate for every person who was involved in the test, both civilian and military. That was assigned to the DNA, the Defense Nuclear Agency.

I happened to chair the committee for the National Academy of Sciences that looked at the procedures they used. We thought they were very conscientious, overly so. They spent a lot of money, well over $100 million, to get that data.

And I think there's a phone number where you can call and get it. I remember trying it out for myself, and I was able to get it for myself.

But there is the question of de minimis again. Most of the veterans received very small doses. By small, I mean well below one rem. Most of the money that went into the program was spent on dose estimates in that domain, less than one rem.

My own view was that there should be a cutoff at a dose of 5 rem. If all workers are allowed 5 rem a year, if a veteran just has one exposure of 5 rem, and isn't likely to work in the nuclear industry again, let's find out who had more than 5 rem, which could have been done for a lot less than $100 million. Maybe it could have been done for $10 million or $5 million. But no, they wanted it for everybody, and that was a tremendous undertaking. You know there are reports on that, don't you? That was all unclassified.

Now, I run into veterans—you know, they're pretty well represented at meetings—and they give me all these stories about what they went through with these various tests, and I listen. They believe it.

**FISHER:** Have you ever spoken to veterans' groups about your view of the levels that they were exposed to?

**EISENBUD:** No. No. I've never been asked to.

**FISHER:** Have you ever testified in a case, a court case of exposure?

**EISENBUD:** No. No. I have been very successful in staying out of court. Anybody wants to come to me, I'll give them advice. But usually, the people on one side find that I'm too much in favor of the other side, and the other side thinks I'm too much—so I'm being neutral; I don't get into court very often. I think, three times in the 50-some-odd years that I've been in this field.

**FISHER:** Good for you.

## Rocky Flats Exposure Data

**EISENBUD:** One of them was as a pro bono[19] witness for the Navajo miners. If I'm asked to, I'll have to say that, on the basis of what I know, and I think I've seen all the data, there's no problem around Rocky Flats.

**FISHER:** Despite the work of guys like [Gregg] Wilkinson and [Ed] Martell and those folks?

**EISENBUD:** Well, Martell was the first to measure the uranium from the plant.

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[19] done or donated without charge

**FISHER:** Plutonium.

**EISENBUD:** Plutonium, rather. No question about that. The question is how much.

**FISHER:** Well, especially after the fires. I guess you had left HASL when they had that big fire in '69.

**EISENBUD:** Yeah, but HASL went out, did studies and—well, what it adds up to is that Cobb, at the University [of Colorado] there, and the Colorado Health Department, have analyzed something like 700 specimens of human tissue—I don't know where they got so many—and found no plutonium in any of them.

**FISHER:** But there are questions about where they got the bodies. They were—as I understand it, they were prohibited from getting cadavers from within a 12-mile radius, from hospitals within a 12-mile radius of the plant, so they were forced to get cadavers from further away.

**EISENBUD:** I had not heard that. I had not heard that. I think if that were so, I would know about it, because I'm doing the fourth edition of *Environmental Radioactivity* now, and I'm looking very carefully at all the reports that are coming out of Rocky Flats.

**FISHER:** I might be incorrect about the 12-mile figure, but they were complaining about what they weren't able to get—and it was politics. The hospitals weren't willing to provide cadavers that were closer to the plant, and all of their cadavers came from further away from the plant.

**EISENBUD:** Well, there isn't much within 12 kilometers [(7.4 miles)] of the plant. I don't know where there is even a hospital.

**FISHER:** Well, I mean, downtown Denver is only 16 miles northwest from the center of Denver.

**EISENBUD:** Oh, yeah. You said kilometers, then.

**FISHER:** No, it's 16 miles from downtown Denver. It's very, very close to metropolitan Denver, which is the problem. Well, we can talk about this afterwards. I don't want to take up all the time.

**EISENBUD:** Well, okay. Well, I think—I don't know where you're getting your information, but you ought to talk to Ward Wicker *(phonetic)* at Colorado State. He's pulling all that together.

## Fallout Studies Leading Up to the 1963 Testing Moratorium

**FISHER:** I guess we could get back to Sunshine. One of the questions about Sunshine is why you didn't try and spend more time predicting what the effects of future testing would be, rather than just the effect of tests that had occurred thus far. Was there any thought to that?

**EISENBUD:** Who are you talking about? Me?

**FISHER:** The people that were involved in Project Sunshine.

**EISENBUD:** The whole objective of Gabriel and, then, Sunshine was—one of the objectives—was to calculate how many bombs would have to be ex-

ploded before you could get up to the strontium-90 burdens that were considered a threshold at that time.

It was still the same figure they have now. I think a tenth of a microcurie —oh, one microcurie on the body. And that little report that I just located again this morning has that information in it.

In my own case, I gave a talk down at the Philosophical Society in Washington, in which I thought that what has been exploded and what was up in the air and had yet to come down, was going to give people up to as much as 25 percent of the permissible dose.

**FISHER:** And that was in what year?

**EISENBUD:** About '56.

**FISHER:** There was a guy named Herb Glass, I think, that, after the Sunshine report came out, said that if the figures were right, but if we continued at our current rate of testing, that in 28 years, we would have achieved what Gabriel feared.

**EISENBUD:** Well, let me remind you what the [posttest atmospheric/stratospheric strontium levels vs. time] curve looked like. (*hands Fisher a book opened to a chart*) This is the thing that scared me, and a lot of other people, too.

**FISHER:** (*studying the chart's curve*) It was going straight up at the end, in 1960.

**EISENBUD:** Yeah. And the [U.S.-Soviet above-ground nuclear testing ] moratorium was '63. You can bet your boots that when [Soviet Premier Nikita] Khrushchev and [U.S. chemist Glenn] Seaborg saw that, it helped them come to an agreement.

**FISHER:** (*refers to the chart)* This is the chart, on page 273 of *Environmental Radioactivity*. I guess we're just finishing up some miscellaneous questions on fallout and stuff. I'm wondering if we have learned that much more about the processes and the scientific procedures for estimating or analyzing stratospheric inventory from when you were doing your work.

**EISENBUD:** I doubt that we have, because there hasn't been any open-air testing since 1963. I'm sure that the intelligence techniques have become more sophisticated, so that if a bomb goes off somewhere, there's probably a higher probability that they would detect it.

## Decaying Radioactivity in the Atmosphere

**HARRELL:** You showed us that curve of strontium levels going straight up at some point. Was that curve ever carried out over the next few years, and you can show it going rapidly down, as well?

**EISENBUD:** Oh, yeah. Yeah. Where's the book? *(turns to a page in his book and hands the book to Harrell)* Yeah, here are the data, the stratospheric inventory to '82.

**HARRELL:** Page 319. So that implies that the strontium remains in the stratosphere for up to 20 years or more?

**EISENBUD:** Well, it has a half-life of somewhere between 10 months and a couple of years, depending on where it was exploded and how high up it was exploded.

**HARRELL:** Really? So these amounts that are in the 1980s, are you assuming that they didn't come from bomb blasts?

**EISENBUD:** Oh, yeah. Yeah. 1980s—you know, if you take a half-life of two years, would be a—well, of course, there were bomb blasts. I think the bomb blasts are shown over here somewhere. There they are. There are tests in here.

**FISHER:** Oh, foreign tests. The French were doing tests, weren't they?

**EISENBUD:** French, Chinese, Indians.

**FISHER:** Does the EML[20] still do whole-diet monitoring and milk monitoring for strontium even now?

**EISENBUD:** I don't know. I don't know.

**FISHER:** Based on these extrapolations, do you think we've learned more about what conditions would prevail during the time of a nuclear war?

**EISENBUD:** No.

**FISHER:** We don't know any more than we did 30 years ago?

**EISENBUD:** The problems wouldn't be radiological.

**FISHER:** They would be societal and organizational and—

**EISENBUD:** Infrastructure.

**HARRELL:** What do you think of the nuclear winter[21] hypothesis?

**EISENBUD:** I don't know. I think the very fact that it's a possibility is significant. I don't know.

**FISHER:** You say in *Environmental Odyssey* that when you knew you were going to get involved in some of the bomb blasts, that megatonnage got up there, and the blasts were sending material into the stratosphere, that you began to read up on volcanoes and the interesting effect on the environment the dust had from volcanoes.

**EISENBUD:** Yeah.

**FISHER:** Is there a connection between that and the nuclear winter?

**EISENBUD:** Oh, yes. I think some of the calculations that were done by the nuclear winter people were based on information from volcanoes, because it is know that after major volcanoes, there's a perturbation of climate and a decrease in solar radiation.

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20 Environmental Measurements Laboratory, HASL's current name

21 the worldwide devastation, darkness, and cold that some believe would follow a nuclear war because solar energy would be blocked

**HARRELL:** What do you think of the AEC's biomedical program of animal experiments with beagles and strontium and inhalation of nuclides? Do you think that work was a good indicator of fallout effects?

**EISENBUD:** Well, it's a good indicator of the biological effects of the materials that they were investigating.

**HARRELL:** Well, what applicability did that have to the real-world conditions?

**EISENBUD:** I think those tests were set up in the '50s. At that time, we anticipated that—we didn't realize how good the industrial hygiene was going to be.

You're talking about Rocky Flats. I don't know whether they've got anybody at Rocky Flats who is carrying more than a permissible body burden of plutonium. I mean, they may have 1 or 2 or 3 or 10, out of 5,000. It just hasn't—the internal emitters have not turned out to be that much of a problem.

## Public Health Service Joins in Collecting Radiation Data

**FISHER:** Do you think the program was done in balance—you know, monitoring versus biological studies, biomedical studies?

**EISENBUD:** The biomedical studies started first, and that was because the people running the program were biologists.

The industrial hygienists came in, and they brought in meteorologists and geologists and geochemists and so on, and the whole question of environmental transport[22] began to be studied.

About all that did was open up more—raise more questions and more answers, which is why we don't have a site for a waste disposal facility at the present time.

**FISHER:** You were an early proponent of having the Public Health Service do some effluent monitoring and biomedical sampling and things like that, removing that function from the AEC.

**EISENBUD:** Yeah. But I gave a talk on that, I think in Minnesota, at a time when it was right at its peak, and I said, "I think that the AEC is doing—"—this was after I left the AEC.

**FISHER:** Right.

**EISENBUD:** I said, "I think the AEC is doing a great job. If nobody agrees with me, let the Public Health Service do it."

**FISHER:** And they didn't take you up on it.

**EISENBUD:** Oh, they did, to a large extent. Yeah, they began to publish—they took over the milk monitoring program and expanded that, and they published a monthly booklet. It was called *Radiological Data*, which sum-

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22 the movement of substances, such as radionuclides, through the environment through various mechanisms and agencies, including water, air, and direct contact

marized all the data they were collecting around the country [for studies] (in progress).

## Human Use Procedures and Committees

**EISENBUD:** At least there were human use procedures that had to be followed, but I don't remember when that was.

**HARRELL:** Are you thinking of the '70s, when they adopted the NIH [(National Institutes of Health)] guidelines?

**EISENBUD:** No, I think, before that. I think when they began to use isotopes for human work.

**HARRELL:** Right. There was an advisory committee on isotopes for human use.

**EISENBUD:** Yeah.

**HARRELL:** During the early AEC days. And then, when it [(responsibility for prudent dosage in human radiation research and therapy)] changed over to the [AEC's] Division of Biology and Medicine, eventually there became human use committees at various contractors and universities on sort of a varying basis.

**EISENBUD:** Yeah.

**HARRELL:** Was there ever a committee that started up at the New York Operations Office?

**EISENBUD:** I don't think so. We undoubtedly had somebody there whose responsibility it was to see that the requirements of the AEC manual were being followed. Most of that would apply to the various isotopes and the use by hundreds of organizations already. It caught on very quickly. There had to be some control over it. But I don't remember what the procedures were now. So far as the laboratory is concerned, I don't remember what we did. I would think that if we wanted to do that inhalation experiment, and we were working, let's say, with a concentration of radon that was roughly what you breathe, anyway.

**HARRELL:** You wouldn't have looked at it as significant enough to be—

**EISENBUD:** We wouldn't have; exactly.

**HARRELL:** —written down as a special case.

**EISENBUD:** Yeah.

**HARRELL:** Dr. Totter[23] spoke of the AEC being concerned that—or telling the Labs to comply with their own state laws. Were you aware of New York State regulations involving this?

**EISENBUD:** No. Of course, Totter was not involved when I was there, but long after I left.

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23 For the transcript of the interview with Totter, see DOE/EH-0481, *Human Radiation Studies: Remembering the Early Years; Oral History of Dr. John R. Totter* (scheduled to be published later in 1995).

**HARRELL:** Right.

**EISENBUD:** That was probably the '70s. No, it would never have occurred to me that I needed to have a human use application, if all I was doing was breathing normal room air. Now, I did say we had a generator in the room. I don't recall whether we did or not, because we could have done it all with room air, the normal radon in the air.

**FISHER:** Did that same type of work continue much later in New York? Do you know if they later adopted or had a committee, say, in the '70s or '80s?

**EISENBUD:** I have no idea. We did at the University. And as I said earlier, it was sort of a nuisance to me, when all I wanted to do was measure what's coming out of a child's thyroid because there was iodine present in the milk. And I needed to go through not only the human use committee, which I did—and, of course, they just wrote it right off [(approved the experiment immediately)]—but they later decided I needed to have informed consent.

**FISHER:** It was easier to stop the study at that point.

**EISENBUD:** It was easy. Oh, we had all the data we needed. I have had experience in recent years—by recent, 15 years ago, I would say—where, if I wanted to have part of a urine sample that's being collected for another purpose in the hospital, and I want to just see how much benzopyrene is present in urine these days, so I want a sample of urine from various people, I would send a student over and he would come back with a whole box of urine samples.

And then, I suddenly found I couldn't do that any more, that the urine sample—if the urine was going to be used for a purpose for which the patient didn't give consent, then you would have to have a new consent form filled out.

And since I didn't need to have the name of the patient, and all this was going to be handled statistically, I didn't really see why I needed to go through another informed-consent procedure.

**HARRELL:** And you also didn't know when you were going to go to the hospital and get this all prepared? You just decided on an *ad hoc* basis to go over there?

**EISENBUD:** No, it wasn't—no, it wouldn't be *ad hoc*, but we might—let's say—let's take lead, lead urine—that's a popular subject—or lead blood. And maybe we did some studies 10 years before, and we want to know what has happened in the last decade.

So I want 200 blood samples. Give them a protocol. We want 10 infants, 10 children between 2 and 6, and from 6 to 10, and so on. And in a big hospital, that could be obtained very quickly.

The other thing, what we used to do, which I supposed involves human use, is get autopsy specimens.

**FISHER:** From Bellevue, you were doing that in a few studies.

**EISENBUD:** Not Bellevue, it's the Bellevue morgue, which is run by the City of New York.

In fact, they have a slogan on their new building. I've forgotten the words; it was in Latin. And in the translation underneath, something to the effect that, "In this house"—it's a quotation from classical Latin—"In this house, we, the dead, live for the living"—something like that, meaning that there were lessons to be learned.

The chief pathologist was a scientist who was trying to eke out as much information for the benefit of public health as he could. So if we needed thyroids or lungs, we could just tell him, and he would see that you got it.

**HARRELL:** So public health studies, in general, became more difficult over time.

**EISENBUD:** Yeah. In fact, a lot of the studies can't be done anymore. So public health—the public loses out.

I'm involved now, in an advisory capacity, indirectly involving the DOE as well, in a study in Italy of the prevalence of a genetic marker in people with beryllium disease. It's an important piece of work that needs to be done so that we can understand and prevent beryllium disease. And the informed-consent procedures, the blood samples are being collected in the plants, anyway. Why would it hurt if one quart of blood was going to be sent to Italy with no name, just a number, to help the study along?

**HARRELL:** So it's difficult to get a general consent to allow one's blood sample to be used for other studies that don't involve the person's name?

**EISENBUD:** Yeah. Sometimes it's hard to explain to the public. It's different when you have a doctor, a personal physician, and he can, you know, use general language. But there's a recent article [that says] it's a problem with organs, organ availability. It's pretty hard for a physician, at a moment of—within a few minutes after a patient dies, to talk to the family about taking a kidney out, knowing that a kidney can be put into a 15-year-old child 100 miles away.

**FISHER:** So all that work of the Trans-Uranium Registry wouldn't mean very much these days?

**EISENBUD:** I think it would be. Yeah, we did uranium analyses of human tissue, and all we did was pass the word among the physicians in the hospitals, if they run across any surgical cases or postmortem uranium workers, that we would like to have kidney, lung, bone. And they sent it to us. Did they get permission? I don't know.

**FISHER:** It's interesting how times have changed, not just how standards have changed.

**EISENBUD:** Well, Barbara Tuchman—do you know her?

**FISHER:** Sure, historian.

**EISENBUD:** Do you know her book, *The Paths of Folly*, I think it is?

**FISHER:** *The March of Folly*.

**EISENBUD:** *The March of Folly*? I think on the first or second page, she's talking about folly, and she talks about how wrong it is to judge folly contemporarily when we're talking about mores that existed 1,000 years ago.

**FISHER:** Even 50 years ago.

**EISENBUD:** Or 50 years ago. Yeah.

(*laughter*)

## Service to New York City

**FISHER:** Well, I'm not sure I have any more questions, per se. We've left out huge parts of your career, your work for [New York City Mayor John] Lindsay, and other things we haven't really touched upon.

**EISENBUD:** That didn't have anything to do with human use.

**FISHER:** I do have one question for you. I grew up in New York, myself, and we always heard rumors that there were potential incidents or actual incidents of sabotage to the water supply with radionuclides. I'm just wondering if that ever happened.

**EISENBUD:** There was one anonymous letter that went into Mayor Koch about—well, it must have been 10 years ago—saying that the reservoirs had been loaded with plutonium.

**FISHER:** Did that really happen?

**EISENBUD:** No.

**FISHER:** I mean, the letter actually was sent?

**EISENBUD:** Yes. The press was briefed and was very understanding, because we were going to take a few days to find out. And plutonium is not toxic. It's not soluble. Put it in the reservoir—

**FISHER:** It's not a good way to sabotage the water.

**EISENBUD:** That's right, yeah. And so it took a few days, and I think Brookhaven was given the job of doing the analysis. They couldn't find anything. That was the only [incident] I know of.

**FISHER:** Interesting. And did you have any role, any advisory role? I mean, you were long-gone, but were you called in to talk to him?

**EISENBUD:** I was talking with the Health Commissioner over the phone about it, but other than that, I didn't do anything. I really don't know how they handled the press, but apparently, the press was asked to cooperate for a few days.

**FISHER:** They must have handled the press well.

**EISENBUD:** And, at the end of that time—well, this was a big problem. I can't think of any way in which you could sabotage these reservoirs with plutonium. There are other things you could do.

## Industrial Safety

**EISENBUD:** There's a certificate I got for driving through approval for that third tunnel, which they're still building. It has killed 26 people [from construction-related accidents]. I read that the other day, and it just made me sick. 26 men killed so far in there.

**FISHER:** And you mentioned there were 33 fatalities in the nuclear industry.

**EISENBUD:** 33?

**FISHER:** Didn't you mention 33?

**EISENBUD:** No, only 6.

**FISHER:** Oh, only 6? I guess it was 33 years ago, the last one.

**EISENBUD:** 33 years ago.

**FISHER:** But there were a lot of automobile accidents and falling off ladders and all that stuff.

**EISENBUD:** Yeah. Well, there was a fellow down here at UNC (University of North Carolina)] that just completed a study of the effects of electromagnetic radiation on utility workers. And there was a slight suspicion that there might be an increase of brain cancer. Very slight, not a significant difference.

Anyway, his conclusion was: It isn't worth worrying about. You've studied hundreds of thousands of workers, and they're dying, they're getting electrocuted, they're getting burned up by steam lines that break, and getting involved in all kinds of accidents. That's what they should be concerned about, not the effects of electromagnetic radiation.

**FISHER:** Or people that live under high-tension wires.

**EISENBUD:** Well, that's another political thing. Yeah.

**FISHER:** That's exactly it, politics.

**EISENBUD:** *Power Over People*; I think there's a book on it. Well, I can't think of anything else that—

## Department of Energy Oral History

**FISHER:** Are there any questions that we should have asked and didn't?

**EISENBUD:** Yeah, you could ask me, "What's this all about?" I don't know why the subject ever came up. I was amazed at the amount of organization that has gone into turning out the report.[24]

I think these oral histories are fine; it should have been done a long time ago. But I can only assume—and this can go into the record—I can only

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24 DOE/EH-0445, *Human Radiation Experiments: The Department of Energy Roadmap to the Story and the Records* (310+ pages), February 1995. Included in the Roadmap are some 58 historical photos and summaries of more than 150 experiments from the '40s, '50s, and '60s.

assume that the additional press announcements that started all this came about because of ignorance on the part of the Government officials that had the information.

**FISHER:** Well, the Department of Energy is finding out a lot about its own history, even through this whole process, as well.

**EISENBUD:** Well, I hope you give us some medals.

(*laughter*)

**FISHER:** You and Waldo Cohn.

**EISENBUD:** Yeah, Waldo. The trouble is, there aren't enough of us left. You've got to hurry up. How many are left who can talk about the war years? There's [Newell] Stannard. He wasn't there during the war. He was like me, he was working on something else.

**FISHER:** [Carl] Gamertsfelder.[25]

**EISENBUD:** Gamertsfelder, yes.

**FISHER:** Friedell,[26] we talked to —

**EISENBUD:** Who?

**HARRELL:** Hymer Friedell.

**EISENBUD:** Ah, great guy. Did he give you a coherent—

**HARRELL** I think so, yes.

**EISENBUD:** Yeah. Of course, when he was young, he was a wanderer. He's marvelous, you know, Friedell.

**HARRELL:** And Clarence Lushbaugh.[27]

**EISENBUD:** Okay. Well, he's relatively—no, I guess—yeah, he was there.

**FISHER:** Talking to a guy like Gamertsfelder was great, because he would just be sort of —he was willing to talk about anything, and he was there for so much stuff. He was there on December 2nd.

**EISENBUD:** He was a key man.

**FISHER:** And he just has very interesting insights. He said that he knew, when they were standing around in the squash court in 1942, that something momentous had occurred. It didn't occur to him years later.

He said they all knew, and I found that fascinating. You don't read about that. It just was a very hushed tone, and they weren't sure what it was,

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25 For the transcript of the interview with Gamertsfelder, see DOE/EH-0467, *Human Radiation Studies: Remembering the Early Years; Oral History of Carl C. Gamertsfelder* (scheduled to be published later in 1995).

26 For the transcript of the interview with Friedell, see DOE/EH-0466, *Human Radiation Studies: Remembering the Early Years; Oral History of Hymer Friedell* (scheduled to be published later in 1995).

27 For the transcript of the interview with Lushbaugh, see DOE/EH-0453, *Human Radiation Studies: Remembering the Early Years; Oral History of Pathologist Clarence Lushbaugh, M.D.* (April 1995).

exactly, but it was something momentous that would change history. And it did. Very interesting to talk to these gentlemen, yourself included. Thank you for your time.

**EISENBUD:** If you think of anything else, give me a call. ❑