Nevada Test Site Oral History Project
University of Nevada, Las Vegas

Interview with Bruce Church

April 27, 2004
Las Vegas, Nevada

Interview Conducted By
Jeffrey Richardson

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Jeffrey Richardson*: Mr. Church, I would like to first thank you at the outset for taking the time to be interviewed today. Can we begin by you explaining your background? You could give your full name for the record, where and when you were born, what your educational training was, and how you came to be involved with the Nevada Test Site.*

Bruce Church: OK, my name is Bruce Walter Church. I was born June 9, 1941 in St. George, Utah. That was the regional hospital, even though we lived in La Verkin, Utah. And those first few years my folks moved around quite a bit—including a year in Henderson, Nevada—so actually the time from when I was one to two years old I actually lived in Henderson as an infant. *I'm sure Henderson was quite small at that time.*

Well, that was the beginning of World War II and the industrial complex at Henderson was growing significantly. And my dad was advised to go down there for employment and he went down there and worked as a chemical lab technician for about a year. And we'd have probably lived there forever in terms of growing up, but my grandfather had a heart attack about a year into that program and my dad was asked to come home and take over the farm while he recuped. So that brought me back to my roots in southern Utah.

So I was educated at Hurricane High School, attended elementary and Hurricane High School here in Hurricane, which meant that I rode a bus twice a day. And then I attended Dixie Junior College in St. George.

On the completion of that, my idea was to also become a chemist and I went to Las Vegas looking for summer employment between college as a chemical technician. And that search ended up at the United States Public Health Service laboratory in Las Vegas on Charleston. And I spent, oh, maybe a month-and-a-half there as a technician, mainly standing at the hoods doing wet digestion. So that means I had lots of involvement with a lot of chemistry and high concentration acids—not a pleasant work assignment. After six weeks or so of that I was ready to bag it. And just at that time, in fact it's a really interesting coincidence, I walked into the laboratory director's office one morning and I was going to say, `You're either going to have to pay me a whole lot more money or I'm leaving`. And I was not being paid much; I was a GS-1 [Government Service, grade 1]. And before I could get that out of my mouth he said, `How would you like to go to the test site?` I knew what that meant in the way of income because the guys that worked at the test site got *per diem* and we made about as much money from per diem as we did salary. At least a GS-1 did. So I jumped at the chance and changed my life forever in terms of a working career.

Going to the test site, they put me to work in a counting laboratory. And what that means is, is that my job as a technician was to put samples in a radiation detector and record the activity that was measured by these detectors. That's why they called it a counting laboratory, because you literally counted the pulses created in Geiger-Muller-type of detectors and gas proportional detectors, where the pulses are created by the ionization from radioactivity.

And what year was this?

This is 1961, the summer of 1961. And when I got to the test site in this early part of August it was desolate, desolate in terms of just very few people. There was no activity to speak of and **[00:05:00]** very few workers. And my job at that time was to go around to all of the old work

locations and change out air samples from the samplers that were scattered around the test site. We did that on a weekly basis, monitoring the equipment and collecting the samples. And then I would bring them back to the laboratory and measure the beta radiation and the alpha radiation, which was just background. It was very dull and very boring in terms of the radioactivity involved. From my standpoint, as I was learning about measuring radioactivity, it was very interesting.

And then on September the first of 1961 the Russians broke the moratorium that had been in effect since 1958, and overnight it seemed to me the test site changed. All of a sudden it was full of people. Commonly the few colleagues we had there at the Public Health Service, after work during the weeknights that we stayed out there, we would go to the recreation hall and have it to ourselves. We could shoot pool, play ping pong, and that's mostly what we did, we played ping pong, or table tennis. And we were basically the only ones there. And overnight the recreation hall just became so crowded, we couldn't even get in it. So our recreation after that became one of playing hearts down in our trailer complex, around Building 155. Building 155, I think, still exists.

But that was the focus point of the Public Health Service operations in those years. Their job, the Public Health Service job, and had been since 1954, was to monitor the off-site radioactive contamination situation, monitor the environment, collect samples out of the environment, and put out film badges during the test period. But during this period of moratorium, they had stopped doing most of that in the off-site. The Public Health Service had very few people actually. One of the things we did in the laboratory in Las Vegas is we still collected samples from cafeterias all around the country. And the cafeterias would send a daily diet. They would put a tray through the cafeteria line and put the same things on the students

were eating and that would go into ice cream cartons and be shipped to the Public Health Service laboratory. Once it arrived there, then it would become blended and then we would have to do this wet digestion that I mentioned, which meant that by using concentrated nitric and hydrochloric acids, that we would dissolve all of these food solids into a clear liquid and then dry it onto a planchette that would go into the counting room for measurement of the radioactivity in the food. And they did this ongoing during the moratorium to basically measure the change as the fallout from the atmospheric testing of the 1950s diminished, and that's what they saw. And that's what we saw in the air when I was measuring the air radioactivity when I went to the test site. Well, a few days—I can't remember exactly how many, it wasn't a lot—three or four days after the Russians tested in the atmosphere on September 1, I started to see an increase of background in these air samples that I collected around the test site. And each day they would steadily go up. And that started to become very interesting to me as a young man.

Lots of activity increased in the Public Health Service. New young engineers started to arrive on the staff and training classes began. And the United States embarked on a very aggressive—as it turned out for that year and the subsequent few years—underground test program. United States fired its first underground test on the fifteenth of September. And reflecting back it **[00:10:00]** seemed like the whole place was transformed almost overnight into a very, very busy place with a huge influx of people of all kinds: a lot of miners and drillers and support staff that Reynolds Electrical and Engineering Company hired, as well as the national laboratories, Los Alamos,, Sandia, Livermore, the Defense Nuclear Agency, probably DASA [Defense Atomic Support Agency] at the time. They all brought in a lot of people. The Public Health Service brought in a lot of people.

And because of my knowledge of the off-site area around southern Utah, they asked me to do some interesting things. One of the first things they asked me to help do was to reestablish the film badge program. And because I was a native of the St. George area, and I also was a football player and had a letterman's jacket, they asked me to go around the test site and wear my letterman's jacket so I would be readily accepted by the off-site public. And that did open a lot of doors.

And what were your duties with the film badge program?

It was to basically reestablish it. It had ceased, and so we went around to all of the people who had formerly worn film badges in stations where they put them. For example, I ended up going back to my old Dixie College president, Arthur Bruhn, and I had a meeting with him. And he wasn't too interested or concerned about wearing a film badge. He was more concerned that I was not back in college. And so our discussion actually was spent more on getting myself back into college and finishing my degree than it did almost anything else. But I visited the county sheriff and other prominent people as we reestablished that film badge network, and I did that all around Washington County of basically covering a loop up through Enterprise and over into Panaca and Pioche and Caliente, Alamo, Ely, as I came down the eastern side of Nevada.

I met a lot of interesting people. One of the incidents I remember, because it was a negative incident, was talking to a lady, it was probably around Caliente or Pioche or maybe even Ely. And she was still very upset because sometime in 1955 or 1957 people—no, it might have been earlier than that because I know they were not Public Health Service people. She claimed they were AEC [U.S. Atomic Energy Commission] people, which meant they were probably Los Alamos technicians because Los Alamos had the off-site assignment in 1951, 1952, and 1953. So it might have been as early as 1953. But she was upset still in 1961 that these

people who wanted her elderberry jam as samples to measure didn't ever come back and tell her about the results, or compensate her for the jam. So she was under the opinion that that was a pretence in order to confiscate her elderberry jam. But this was not feigned anger; she was visibly still upset. And I always remembered that years later as I became a DOE [Department of Energy] official, and an AEC official, and as I talked to our public affairs people. That was always a lesson to me on how we should conduct public affairs, in terms of always completing a promise or a commitment to people. If you say you're going to give them results back from something, you always wanted to make sure you did that.

Oh, because they had said that to her, that they would get results back to her.

Yes. Either they promised her or she believed from some reason that they owed her something back—and I think it's only normal to do that—that they owed results or compensation or at least **[00:15:00]** close the loop. And because they never did that she resented that for many years later. And I think that kind of—I'll use the word "arrogance"—I think that kind of arrogance in those early years on the part of people making contact on the off-site, and sometimes I think people used classified requirements—which probably were honest in those early years—gave them the appearance of being arrogant when they may not have been, when they just simply were following regulations and rules. But I know that a lot of that kind of interaction led to a lot of misunderstanding in the off-site as I dealt with it considerably later on.

Which probably got worse over the years?

Well, I think it got worse because of the telling and retelling of experiences and stories. I think the folklore actually did get worse, and it still exists today and it is compounded significantly as people springboard off of their beliefs of what occurred in those years and have never really bothered to find out the facts.

So if something would have been done more on the government end with getting more information out or a better understanding of the information. I actually came across a 1955 AEC booklet—it was distributed near the test site—that said, `Your best action is not to worry about fallout`. *I mean there seemed to be,* `Just don't worry about it,` *was the attitude. You think if more information would've been given early on, things could've been different with the public in regards to safety issues?*

I absolutely believe that a more aggressive program to interact in the way of information—I'll call it handholding, showing interest other than—I've read those same bulletins, those same brochures, and they're correct. They're true. I hear today, and I read it in print almost every other week, as politicians tend to use this same platform today in 2004 as they did years and years ago, that this statement, `Well, the AEC lied to us, the government lied to us`. And they refer back to these same brochures as `the government having lied to us,` because the government said then, `There is really nothing to worry about`. And they think that they lied to them in those publications, when in fact they told them the truth then, that is the truth today. But because of the lack of education, certainly a much less aggressive program than what we've done later on, I think all of that—because the whole thing was new, it was mysterious. And even today public education is totally deficient on atomic physics, on radiological principles, on the basics of even understanding radioactivity in our environment. A lot of that is in the back of high school physics textbooks but they never seem to get there. And I've had the opportunity to talk to a lot of science teachers through a program that we've had over the years and ask them the question, `Why don't you teach that?` And the excuse they give me is because it is—several excuses. One is, `It is in the back of the book and we never get to it`. The other is `It's too controversial and so I` **[00:20:00]** `skip it.` So from an

education standpoint we were fed on this same void, this lack—and our whole country does not get exposed to some of these more what I call exciting scientific things because it takes a little bit of *work.*

Do you think the recent moratorium has added to that, the fact that we aren't testing anymore so the issue for some has kind of disappeared?

Well, in this area it doesn't seem to have disappeared. There's several things that keep it on the table. One is the issue of radioactive waste, both high-level and low-level. Because they're so close to Nevada, they are exposed to the issues of Yucca Mountain. They are exposed to the issues surrounding the disposal of low-level waste in Nevada. Plus in northern Utah there is a low-level waste disposal facility which disposes of waste slightly above background and that's about it. And that particular company has been trying to increase their ability to dispose of higher classes of waste, like class-B and class-C waste, and the Utah legislature continues to turn them down. And it's all over the paranoia and misunderstanding, in my opinion, of radioactivity and radiation effects and radiation biology. It is such an emotional, political problem in the state of Utah that you can't even hardly have an effective dialogue with anybody because it's overrun with emotion. Then the politicians have capitalized on that. Every time there's an election in this state, politicians try to capitalize on the fear of the people by stating that they are opposed to disposal of waste or they are opposed to testing. When the Congress reacted to the president's proposal here a few months ago of perhaps resuming limited testing at the test site—and I think the Senate passed a resolution basically supporting that—that examination of going to some limited testing to look at specific designed weapons that would be earth penetrators and destroy deep-based bunkers, when that was mentioned it caused quite a stir in this state. The Democratic representative from the state of Utah—they have I think four representatives now; one of them is

a Democrat—has actually introduced legislation worded to protect the Downwinders, if you will. It's an interesting piece of legislation. The people in the downwind area have not been comforted by the fact that the tests moved underground, which shows a real ignorance on their part because they have an absolute lack of knowledge of the amount of radioactivity released from atmospheric tests versus underground tests. They don't know that you can—just by having an open shaft, you don't even have to stem it—just by putting a nuclear device down an open shaft and detonate it below ground, still retains huge percentage of the radioactivity in that local area, as opposed if you were to fire it in the atmosphere.

And you would say they're not willing to learn about the issue.

Well, they haven't shown any overt knowledge in the discussions you hear either in public forums, from politicians, and DOE doesn't go out and educate. They have really hunkered down.

Should they?

[00:25:00] Oh, absolutely, in my opinion. Especially if they're going to renew a program, and maybe sometime they will.

But DOE has an off-site program that I was instrumental in starting in 1980. It's the Community Environmental Monitoring Program. It's operated for DOE by the Desert Research Institute. And they have stations in St. George, Cedar City. They ring the test site. Ely, Alamo, Tonopah, Goldfield, Indian Springs, Las Vegas, Overton. That program was set up in 1980 to do just some of the things we're talking about. It was to bring DOE's experience, the information concerning the underground test program, to the public. One of the first things we did in 1980 was to have a town hall meeting in every community around the test site and we held them in a number of communities that didn't have sampling stations or monitoring stations. And we brought the DOE manager, we brought various DOE assistant managers, other officials that

could answer questions—technical people, as well as the managers—to be in front of the community to answer their questions. And we did that for—I think I participated in something like sixty meetings, and we had just shy of a hundred. I didn't make it to all of them. At that time I was division director. I was director of the Health Physics division for DOE. And so I attended most of these. In fact my division basically managed that program and I was personally instrumental in getting it set up and convincing management we should do that. And we I think had quite a bit of success. It depends on how you measure success but we had communities that turned out well in terms of numbers of people and those communities basically were Cedar City and St. George, Alamo.

What did you do at these meetings? Explain what you were doing?

We had a presentation where we showed them what the off-site monitoring program and the on-site monitoring program was all about. We shared with them some data. We tried to help them understand what those numbers meant. And we told them basically what we could about what the program was all about. But specifically we took with us the EPA. The Public Health Service in 1970 transitioned into EPA. So the Las Vegas became an EPA laboratory, but it was basically the same people and the same mission. Just the name changed in 1970. And they still had the same mission, to do the off-site monitoring. And because they had been doing it so many years we felt that we needed to do something different. And even all those years we had sampling stations around the test site. They were just air monitoring stations that EPA operated—Public Health Service, then EPA. But we wanted to become more visible and we wanted to have something in front of the public that they could more easily understand.

Now this particular program, the idea was really born by observing what happened at Three Mile Island in 1979. A lot of the staff in Las Vegas went to Three Mile Island to support

the downrange monitoring around Three Mile Island. And one of the things they did around Three Mile Island to help the off-site public was they established gamma ray monitoring devices **[00:30:00]** out in the public that had a meter that they could actually see go up and down. Had a chart, in other words, and that soon transitioned into electronics to where you could see a digital meter that would change as it measured the ambient radiation, and we put a very sensitive detector in connection with this meter that they could see change.

Well, that enjoyed quite a bit of success and public acceptance at Three Mile Island—and I went to a seminar in Washington, D.C. where that was presented and came away from there with a very positive impression that it would serve us well around the Nevada Test Site. So I convinced my boss [Mahlon E. Gates], the manager, that it was something we ought to do. He agreed. That led to funding and then I got with the EPA folks and we set up a new, more aggressive program where DRI was involved as well as EPA. We thought it would be prudent to bring in a state organization that would be a little more independent, closer to the people of the state of Nevada. And so DRI was given the mission to go to the communities, meet with the community fathers—either a mayor or a town council or whatever was available in that particular community—and brief them on the kind of monitoring station that we wanted to put into the community. And we wanted a local person to operate it, to be trained so they could be very knowledgeable and be able to talk about the numbers and the data that were created from the measurements. We suggested to these people that they choose a high school science teacher. We felt that they'd be the best qualified to understand the program, to go through the training we had in mind. And so they set about doing that. They went to, oh I don't know, fifteen or twenty communities around the test site to establish those stations and set up a station manager. That

station manager actually became a part-time employee of DRI. And that situation exists today. These people still exist as part-time employees of DRI.

We moved four or five different kinds of sensors into these stations because we wanted to measure not only the ambient gamma radiation—which I just talked about, that they could see changing momentarily—but we also brought in several different kinds of air samplers so we could sample for not only particulate radiation—and that's where you actually have a vacuum cleaner that pulls air through a filter and the filter pulls out the particulate—but we wanted to sample the other gases that might occur, particularly if we really had a release from an underground test because an underground test, when a release is made, releases what we call radon and xenon, which are noble gases. In other words, they're very difficult to contain. So we put some noble gas samplers at these stations, and to do that you actually have to pump the air and compress it. So we actually had compressors that would compress the air and liquefy it and put it in a container, and then those containers were exchanged routinely. We also wanted to sample tritium. Tritium takes a special sampling device. We actually had to have small refrigerators that would pull the air into the refrigerator and actually collect that on special material inside the refrigerator that would have to be sampled. So we had these four different sensors, if you will. Three of them were passive collectors where you actually have to take the material back to the laboratory to do the analysis, and then we had a direct readout that was an active sensor where they could see what the gamma radioactivity was.

We took these station managers to the University of Utah and engaged a professor that **[00:35:00]** was again totally independent of the test site, and DRI hired him to run a two-week course to train these schoolteachers.

Do you remember his name?

Gary Sandquist. Dr. Gary Sandquist is the one that did the training for about the first twelve or fifteen years.

Did you guys ever notice anything out of the ordinary, anything extremely bad during any of these sensorings? No?

No, for two or three reasons, and we didn't think we would. We would've had to have a really bad accident, almost beyond the capability of what an accident would happen, to have a positive sample. There's a lot of things that come into play to make that statement. See, the last venting that occurred, oh when was that, in 1970, I think it was, Baneberry, December the eighteenth, 1970. That venting was really the last venting that occurred during my tenure there, in a sense, because there hasn't been any testing since 1982. Or was it 1992?

Nineteen ninety-two.

Nineteen ninety-two. I was going to say, we did a lot of testing in the 1980s, I thought. Since 1992. And even as bad as Baneberry was, it was difficult to measure radioactivity off-site. And the reason for that is, and one of the very important factors as we got ready to test, was the weather conditions. The wind conditions, especially wind speed, is very critical with respect to dose off-site and getting radioactivity off-site. We almost had dead calm, as calm as it ever is, on the day of Baneberry. And as a result of that, the cloud basically stayed right on the test site. We actually had more of a problem on the test site than we ever could've had off-site because of those conditions.

If it's difficult to measure off-site, why go through everything that you just talked about?

To convince people that there's nothing there. To let them see it, let them participate in it. Because they don't believe us. They didn't believe the government. And the idea was to build up credibility with the public by having a public person, a schoolteacher, operate the equipment,

observe the measurements, train them so they knew that the sampling devices were all about, how the samples were collected, how they were analyzed. They visited the laboratories. They understood the process of the analysis. And we taught them to understand the data. And the idea was to have them knowledgeable as a person in the community who could talk to people. That paid huge dividends. Some of the largest dividends took place with the station manager in St. George who had referred to him by the Chamber of Commerce and the city council, as well as other people became aware of him and they would contact him. When you drove through St. George today, you could see that it's a growing area. When I grew up in this county, Washington County, all during the 1950s and the 1960s, and the 1940s and the 1930s, the population of this county was static. When we did the off-site dose reconstruction program, it became important to know what the demographics were over a long period of time in this county. And that's why I happen to have this information in my head, because we went back and dug up the demographics for Washington County, as well as a number of other counties. And it wasn't till I did this that I realized that during the 1930s, forties, fifties, and sixties, the population of Washington County was static—right at ten thousand people—which basically says that the death rate and the move-out rate was equal to the birth rate and the move-in rate. And I was an **[00:40:00]** example because of the kind of subjects that I was interested in. I not only had to go away to become educated in those, but the employment in this county was out of the question. That's no longer the case. There are actually chemistry laboratories in this county. I have a cousin who actually manages a chem lab in St. George. So a big change, and that change started to occur in the 1970s slowly, and in the 1980s it's booming. There's now over a hundred thousand people in Washington County. Most of that has occurred in the last ten to fifteen years. So there was not a

lot of people in those years and as we've—remind me what we were talking about before I got off on that.

The difficulty in measuring off-site, so why go through the process? As you explained, it's for the PR.

Oh, oh, the reason I brought it up is that we set this program up. During the 1980s, there was a really high influx of people, a lot of people moving in, and a lot of them had concerns. They had heard about John Wayne in *The Conqueror*, for example, and they had concerns of not only raising their children here but a lot of them wanted to grow gardens, and they actually had fear and concerns about that. So Jack Heppler, the station manager, who was a schoolteacher—he taught at Dixie High and then later for Dixie Junior College, and in fact I still think he's employed at Dixie Junior College. He's no longer the station manager, but I think he's still employed there as an instructor. Jack had many opportunities to tell people what the real situation was: that there was next to no radioactivity in the soil, you can grow a garden without any fear. There's really no increased ambient radiation like everybody thought there was, and so the exposure here is really no different than anywhere else. And because of his status and stature as a schoolteacher—and now an informed, educated citizen—he had credibility with these people and he could talk to them and convince them that they could move here without fear. Plus there were commercial aspects of this. He was contacted twice in one year—this was maybe by the Chamber of Commerce who asked him to get in touch with movie production companies. Just like *The Conqueror* was filmed in a very scenic place northwest of St. George, there's a lot of scenic area around southern Utah. And in both cases the production company said, `We'd love to come to Washington County, St. George,` which is where they all stayed, `and make this movie and probably spend a million dollars in your community, but our production crew is afraid to come because of the fallout.` And in both cases Jack

was able to belay their fears. And they came and made their movies, spent their money, which made everybody happy, Chamber of Commerce and the businessmen are happy and I guess the movie production people were happy. So there was significant payoff even during the 1980s by having one man in that community educated and knowledgeable and able to talk to people on a first principles' basis and convince them that their fear and hysteria and concerns were unreal, which is what they were. Unreal.

I want to talk to you more about The Conqueror *but I first want to ask, obviously in this particular example in the St. George community the off-site monitoring testing that was done seemed to be very good. It got a lot out to the public. Would you say the overall program in other areas and overall was just as well disseminating information to the public?*

The communities that were really interested, like Cedar City, had the similar payoff. Alamo, which is a smaller community closer to the test site, many of the people in Alamo worked at the test site and had inherent information and knowledge. There was not near the concern in places that were that close to the test site, but there was people who had some concern. Our community meetings in Alamo were always very well attended, but it was more of a social event than almost anything else. Everybody in that small community knew everybody else. They knew **[00:45:00]** our station managers. Our station managers—I think the first two or three town meetings we had there—served cinnamon rolls for everybody. It was really a friendly atmosphere. Cedar City wasn't too bad but St. George was actually fairly antagonistic.

Overall though you would say that the project was a success?

Well, it must've been because they're still funding it. My feelings when I was directly managing it, it definitely was. Definitely was. It gave us an *entrée* into the community to get questions answered. When everybody would contact us—which they frequently did—we would generally

direct them to the station manager so they could go see the monitoring station, talk to the station manager, and become comfortable with the results of what that station was developing as a history.

Let's talk about The Conqueror *a minute. The issue around the filming of* The Conqueror*, a movie that came out in 1956, was that it was filmed in Snows Canyon, Utah which is about twelve or so miles outside of St. George. It was filmed in 1954.*

To the north and to the west.

—and the basic story goes that the film was shot in an area that was contaminated by nuclear radiation, resulting in a large number of the cast and crew contracting cancer. Of the 220 cast and crew members, ninety-one eventually contracted cancer and of that about half, or forty-five, ended up dying from cancer. Do you recall when you first heard about this particular controversy? I believe there was an article in People *weekly magazine which came out in November of 1980 which was also picked up by several local papers, including the* Las Vegas Sun*. Do you remember when you first heard about this particular controversy?*

Oh, I've had to deal with that controversy so many times, I can't even tell you the first time.

Before 1980 do you think that it came up?

I think that a lot of the controversy really was stimulated by Three Mile Island.

OK. So it makes sense, the following year the first article appears.

I'm just trying to reflect back through the 1970s. I need to go back and tell you a little bit about my personal history and how I got involved. So let's go back and recount that a little bit to get us up to 1980.

As I mentioned, I worked at the test site 1961 to June of 1962, and then I did go back to college at the University of Utah, where I found a job working on a fallout research program

[Radioactive Cesium in Milk]. And I was there for three-and-a-half years getting a degree in basically molecular biology, but really I was getting ready for a health physics degree because I took a lot of physics, mathematics and chemistry and radiation biology, radiation physics. I was probably, I consider, the most non-biologist biology major that there was.

But I worked with a professor by the name of Robert Pendleton during those three-and-a-half years, and he had a research project from the National Institutes of Health to measure fallout in the environment. So I spent that three-and-a-half years both in the field collecting samples all over the state of Utah, because that project established milk sampling stations throughout the state of Utah, back down in my home country of Washington County as well as all over the state of Utah. We not only sampled milk but we sampled other foodstuff connected with the dairy farms: **[00:50:00]** feed, for example, and other products that the farmer might grow. To try to correlate it, we sampled his soil.

We also did a lot of other things in the environment, mainly out of the interest of Dr. Pendleton. He loved to hunt and fish and so we used our program almost as an excuse to get out and do a lot of hunting and fishing. So thereby we collected a lot of game and fish samples throughout the state of Utah. He had a permission with the Utah Fish and Game to collect mule deer through herd units scattered all over the state—southern, central, northern—and so we got to hunt mule deer around the calendar—spring, summer, fall, winter—and collect samples from those mule deer—muscle as well as their thyroids, other tissues, their paunch contents—to basically see how radioactivity moved from the environment into this animal and then from the animal to man. He was very interested in what's called trophic levels. Trophic level is a relationship between one food level to the next food level. For example, we would collect fish and then we'd eat fish as foodstuff. We'd eat—you know, people drink milk. One of the

elements of that program was to measure people, and we'd bring in to the laboratory up at the University of Utah, up at the medical facility—that laboratory was operated by Charles Mays and Ray Lloyd—and I actually spent most of my time in that laboratory over those years, even though I was in the field a lot too. But because of my background at the test site, measuring radioactivity in samples, I was hired to do that work as a technician up at that laboratory. So I counted a lot of people in their whole body counter, and we brought in all these farmers and their families as well as a number of other people. We'd measure their thyroids as well as their whole body.

There was some incidents that happened at the test site in the summer of 1962 right after I left. I knew they were coming. Sedan was a Plowshare event that happened in July of 1962, and that was a big excavation experiment. You probably visited that when you visited the test site.

Yes, sir. It's hard to miss.

The dust from that traveled a long ways from the test site. I think that was either late June or early July, and then later on in July there was a very small test called Small Boy. That was like a one-kiloton test on a ten-foot tower down in Frenchman Flat. Both those tests had fallout that went over northern Utah. That provided Bob Pendleton with a lot of ammunition to go to work. In terms of providing radioactivity and samples, I mean we just sampled all over the place. And it was exciting for a kid, a twenty-one-year-old.

How'd you make your way back to the test site?

Well, we completed our bachelor's degree there in 1965 and on a Public Health Service fellowship went to Colorado State where I got a degree in radiological health in August of 1966. And because we wanted to get close to southern Utah we ended up back in Las Vegas and I went to work for Pan American World Airways running a laboratory at the Nuclear Rocket

Development Station. And the reason they hired me was because of my experience and background in whole body counting, and it was to develop a whole body counting capability for workers at the Nuclear Rocket Development Program. That program was exciting, but after **[00:55:00]** being there a year there was a new U.S. president, change of administrations, and they killed the program. And it lost funding and really kind of petered out.

I was there a total of three-and-a-half years and made the transition to the Atomic Energy Commission, went to work for them in the fall of 1969. And I went to work basically as a staff health physicist. In 1973, I was promoted to the chief of the radiological branch, and that was my first management job in the AEC. I was a supervisor and had my own contractor-operated laboratory. I had supervised a few technicians with Pan Am, but now I'm supervising a staff of health physicists and managing programs at the test site.

The AEC and later on DOE's job was basically to manage contractors. Those government agencies—it's sort of like NASA and a few other government agencies—they're a mission-oriented agency and they accomplish their work through contracts and contract organizations. And so they're basically managers. And that was the mission of the Nevada Test Site office, was to manage the contractors affiliated with the Nevada Test Site and other test locations. During the early years, the 1950s, the Nevada Test Site office and people from that office managed activities in Hattiesburg, Mississippi. Later on in the seventies as we had the Plowshare program and went into gas stimulation, they had several sites in Colorado, sites in New Mexico, and then we did weapons testing in the seventies on Amchitka Island in Alaska, as well as the previous testing that was done in the Pacific on Bikini and Enewetak atolls.

One of the things I did during the 1970s was a lot of remedial actions on those sites. And 1971 was my first experience with remedial action when we cleaned up the Tatum Dome test site

near Hattiesburg, Mississippi. I went on from there to do remedial action at the sites near Grand Valley and Rifle, Colorado.

Which all involves cleanup, the remedial action?

Yes. Basically picking up the hardware and disposing of all of the hardware that was there, and some soil remedial action. There was a lot of soil remedial action at Hattiesburg at the Tatum Dome site. Very little soil at the two sites in Colorado and the other gas stimulation shot, Gasbuggy, which was just out of Farmington, New Mexico. There was a Plowshare project near Carlsbad, New Mexico [Gnome**]** that was a lot of soil remedial action with that because that was a reentry down into a cavity and you brought a lot of that dirt out, and that's what caused a lot of problems at the surface. There was some soil remedial action in those years at Amchitka but not much because there was not any significant reentry.

The remedial action programs done during those years and continuing to be done by DOE is a very long, tortuous story that I'll try to avoid much of during this discussion. Much of it, in my opinion, is unnecessary. I have published several papers in the last few years where I've done risk analysis showing that the risk to the worker in the remedial action is greater than the risk they're trying to save to the public. And simply said is that we are trading real death that we cause **[01:00:00]** workers through accidents of all kinds to mythical, calculated future cancer deaths that has a probability that is miniscule. And so it becomes, to me, very nonsensical from a risk standpoint, as well as being very expensive and totally unnecessary. And the remedial actions for the most part, not all with respect to DOE because there's some remedial actions that probably have been worthwhile and necessary. But much of what they do, especially when it comes to earth remedial action where you're doing a lot of earth movement, most of those are

just nonsense, and the risk in doing that earth movement is considerably riskier than just leaving it in place, from the radioactivity.

A huge project that I really analyzed and became a driving force for this premise was the UMTR [Uranium Mill Tailings Remedial Action Project] program, the uranium mill tailings cleanup. They spent almost $1.5 billion doing that, cleaning up all the uranium mill tailings piles, mostly in the states of Colorado, New Mexico, and Utah. And experienced a number of fatalities. We did a lot of earth moving when we did the Enewetak cleanup. That was a big earth moving project. We had six fatalities during that project, and that was to do with plutonium, not uranium or radon. And the risk analysis in both cases from the radioactivity was just miniscule, absolutely miniscule. And if you like, I'll give you a copy of those papers.

I would like that. Do the people involved with this cleanup, did they realize the risk, the government employees, of doing the cleanup?

Well, the employees are contractor employees and most of the employees at risk are really subcontractors. You'll take the major contractors—and the subcontractors are generally earth moving subcontractors—and those guys don't know *sickum* about what the risk is that they undergo generally from either sense. You're a truck driver, you're subject to a certain risk as an occupational hazard, but I would guarantee that you couldn't talk to a single one of them that really understood the risk. For example, you probably don't know your risk that you took to drive up here today. If you did, you'd really be abnormal. It's only weird guys like me who study risk, that know that your risk driving up here is like one in a hundred, which is a pretty good size number. If you could take those kind of odds to the casino, you could probably do pretty well. Most of the odds that you gamble on, especially roulette and outside of poker, which is your best odds, are much higher for the establishment. Very, very low odds for the participant. But you

driving up here today, your odds for being in an incident was like one in a hundred. Now that's not a fatality. A fatality starts to get up to like one in ten thousand, to actually be involved in a fatal accident, which starts to get a little more acceptable. But every time you get in the car, to be in an accident that's kind of a fender-bender-kind of accident, your odds are like one in a hundred, which are fairly high. And most of us, [by the] time you get to be my age, have been in one, or two, or three. Have you been in one?

Yes, I have, and you've scared me subsequently enough that I think I'm spending the night here, so I see the couch over there. [Laughter] I guess the reason I ask is I think some people would argue that—and not as you explained it with contractors and then subcontractors down—that the government should do some sort of action to clean it up, even if there is a risk to, if they were government employees, as opposed to there even being the miniscule risk to the public at large because of the fact that it is the government doing the work. But yet why should the public be in any harm, even if it is a much smaller risk, than those people working to clean it up?

[01:05:00] Well, I think that's a very good question and a very good statement. The fact is the public is the one that's demanding it. They're demanding the cleanup. They really don't care about the risk to the people who are doing it. They are so concerned about the miniscule radiological risk, and there is such a high level of emotion with respect and related to almost anxiety and fear that they insist on that remedial action being done. I've been in so many of those meetings where I've listened to these people, and you just walk out of there shaking your head, just absolutely shaking your head. Plus, even worse, is their concern to the environment. They would rather see us do significant harm and damage to the environment in the way of excavation and earth remediation than they would to risk miniscule harm from a radiological risk. And those are so far out of balance that it is just unbelievable.

What's the miniscule risk that you're talking about?

Oh, less than one in a million, and especially if you want to talk about risk to flora and fauna. It just gets exceedingly high. But the radiological risk to people—see, we're cleaning up the levels of a standard of like a few millirem per year or less. And the standard of a hundred millirem per year—which is you take our world bodies, such as the National Council on Radiological Protection or the International Commission on Radiological Protection or the Federal Radiation Council or any of these bodies both United States and international—have set a level of a hundred millirem per year to the general public and say that is absolutely safe. The risk to that hundred millirem is about one in a million. One to ten—one in ten million. Very, very, very low. But yet you go to the cleanup criteria that has been established at some of these sites and they're talking about one or two millirem per year. So they've gone beyond one in a million to like one in a billion in terms of risk to people. And yet we're going to put people in harm's way at—if you're a truck driver your risk is less than one in a hundred for an accident and it's less than one in ten thousand for a fatality. So do you see what I'm talking about, when you're trading what I call a fourth-order risk for a sixth-and-a-seventh-order risk. And plus you're spending hundreds of millions of dollars to do it. Somebody has lost their sanity.

Seems to go back again though to what we talked about earlier, just a lack of understanding between the government and the public about what is in the best interests. I mean if you even explained it to them, whether they would accept it or not—?

No.

Yes, so I mean—.

Well, who has that responsibility of educating the public?

I would have to say the government.

Who in the government?

I guess at that time, I mean, the AEC, the DOE.

I'm talking about today. Who has it today? These cleanups are going on today. These standards that I'm talking about are today. This is not yesteryear. This is today. This is the level of fear and paranoia that still permeates United States society, and the world.

Who's the head of these cleanups? Under what division? What agency?

Well, in DOE the funding organization is called Environmental Management, I think it is. They're the ones that basically provide the bucks to clean up most of these DOE legacy sites. But who's setting the standards? They're not setting the standards. The people who are setting the standards is the federal EPA and the state EPA. Most often it's the state and the community that **[01:10:00]** set these standards. So who is responsible for the education? [Pause] It's a rhetorical question.

Sure.

I would say it's the community that's responsible. It's the educational process that's responsible. You can't hold any government agency, I don't care who they are, [responsible] for the educational process that's required. They're incapable. They don't have the infrastructure. They don't have the budget. They don't even have anything close to the ability to educate the masses of this country. There's only one program, and that's called public education, that can. It's the only program that goes on at the grass roots, that goes on in every community, every schoolteacher, that's all local. You have the local school board, you have the county. Everything is generally done, at least in our states, the West here—the ones I'm familiar with are Nevada and Utah—is all done on a county basis. One of the largest school districts in the country is Clark County School District. And that huge educational program is really the one that's

responsible for educating the young people of this country. And then let's go to the next level: higher institutions. They have some responsibility, I think, but do they do it? Heavens, no. Is it required of you as a UNLV graduate student to have any physics?

At the Ph.D. level?

At any level.

As an undergrad, no, I think you can go in the liberal arts and sciences the entire time without doing physics.

That's exactly right. And I don't care what state you're in. UNLV is just a typical university when it comes to that.

The government has to have some responsibility, though. I mean they have to do something to help disseminate this information. We can't just say it has to all be done at the state or the local level. That's not getting—.

The government's actually doing a lot of stuff. They actually are. You can go on government web pages, National Institutes of Health, Nuclear Regulatory Commission, DOE, and there is tons of information. You can go to the societies. The Health Physics Society has tons of information. The Radiation Research Society. Just the various physics and engineering societies. There's tons of information out there.

Are they doing enough to disseminate it, though?

They don't have the charter to disseminate, other than what they've done. One thing they're doing is making it available in today's media, you know, web sites. Oh, you could spend a day just finding the web sites that are available. And DOE has funded a lot of really great web sites. There's a really great web site that managed by a good friend of mine for DOE just on the effects of low-level radiation, and that's the name of the web site: Low-Level Radiation.

Interesting. I want to get back to The Conqueror.

OK, well, I'm getting you there.

I want to switch tapes real quick.

[01:13:11] End Track 2, Disk 1.

[00:00:00] Begin Track 2, Disk 2.

OK, go ahead.

Let me trip you through the 1970s now a little faster. The seventies, a lot of this remedial action was going on, and they were going on because there was an evolution of education and experience that was happening in the United States, and public concern, as well as concern with respect to the agencies. Then you had Three Mile Island happen, then you had Chernobyl happen, which elevated people's concerns. You had a lot of activity in the state of Nevada happen, and there was issues that began happening in 1976 with Beatty, where the governor, O'Callaghan and later on [Robert] List tried to close that site down over a period of years, even though they ended up accepting waste clear up to 1993. But that gave birth to the Low-Level Waste Policy Act in 1980, and then later on the High-Level [Nuclear] Waste Policy Act of 1982. This actually is going to be the subject of a book I'm going to write, and I have been gathering lots of information on that to do that. I've had interviews with Governor List that I've taped, because he single-handedly was able to engineer a boycott where the states of Nevada, South Carolina, and Washington threatened to stop the influx of low-level waste in their states because there was no policy with respect to the overall United States in what they were going to do.

So this was going on. This elevated the whole business of public concern about what to do with radioactive material. With the two incidents of reactors, with Chernobyl and Three Mile Island, the whole business of waste and waste disposal and nuclear power came to a head. Major

policy shifts in our government took place. All of this aroused the interest in the public with respect to what went on.

What's happening to me during this time period, I'm now a branch chief at DOE in Nevada, and soon become basically the lead health physicist for DOE. In 1980 I was promoted to the health physics division director. In that position I get exposed to more policy, both in Washington as well as elsewhere. As we move into these years, now hearings are starting to occur. In the late seventies there's hearings in Washington trying to connect cause and effect to the military folks involved with the tests early on at the Nevada Test Site. There's hearings connected with workers in uranium mines. There's hearings involving the Downwinders. And this starts right through the 1980,'81,'82,'83 time frame. And as I move up into more responsible positions, all of these things start to take place. And so now I find myself involved in not only preparing my Washington bosses for hearings connected to the early fallout and the participation of soldiers at the test site, but support them at their elbow as also a participant in these hearings.

It was this whole elevation of public awareness. It just happened all over. It happened in Congress. It happened in the public sector. In the late 1970s people started filing lawsuits against I think it wasn't DOE. We were AEC until 1974. Nineteen seventy-four through nineteen seventy-eight was ERDA [Energy Research and Development Agency], just a short period of time, and then it's been DOE since. I remember **[00:05:00]** being asked to come to Washington in about 1980-81 time frame by the DOE chief counsel's office where we went over like 300, 350 claims and lawsuits. It's actually a claim first. According to tort law, if you're going to sue the government you have to file a claim. The government has a choice to either pay the claim or let it ripen, and if they let it ripen then over a period of time it actually ripens into a lawsuit. Or they can deny the claim and so forth.

This was a significant—the first it ever happened within DOE. They didn't really know what to do. And in those years there was claims being generated all over the complex. Significant numbers of people were getting involved in claims against Livermore, against Los Alamos, against Sandia, against our contractors. And decisions were made—they almost had no other choice—and that was to litigate, let them ripen into actual lawsuits. We could really get into a lot of detail here. But I think the thing that's important to note at this stage is that we went through a training period of time where we were training attorneys, to teach them health physics, to teach them about radioactivity. We brought in lots of experts to help train these attorneys so they could go back and responsibly litigate. Having this on the horizon caused me to go to my boss, Mahlon Gates, and tell him, We cannot go to court with the data that's in the archives. It's too old, we're too unfamiliar with it, we don't know its strengths, we don't know its weaknesses, and it would be foolish, in my opinion. We need to do a modern dose reassessment. He agreed—this is late 1979—and he accompanied me to Washington on three different occasions where we lobbied our headquarters for funding to start what became known as the Off-Site Radiation Exposure Review Project. We were able to obtain that funding and we got that project underway in 1980. Portions of it were started in 1979, and that was the genesis of the CIC [Coordination and Information Center] and the library, and I think you've met Martha DeMarre.

Well, that all began in 1979 when we made commitments in front of these hearings. One of the big criticisms the agency got in front of Congress is that they were sitting on and hiding behind classified documents, which was only partly true. What we did in those hearings, and I was present, I was sitting up at the bench with the headquarters representatives when we collectively—and of course the chief spokesman made the commitment; he was assistant

secretary level—made a commitment to the Congress to make the records publicly available. And then it became my job as to how to do that.

So it's in this atmosphere during the early 1980s, late 1970s, when we really see the shift in policy, the controversies and everything start to show up, which leads us to The Conqueror.

Right. Right. Yes, you have to set the stage and you have to see where I got placed in this thing through my career path development, and it was like a collision course. Now, during those years I appeared on many radio talk shows, I appeared in radio interviews, I appeared in television talk **[00:10:00]** shows, television interviews. I had some bad setups. I went to a television talk show in San Francisco where I really got set up.

Addressing just the larger issues or—?

It was this fallout issue. In those same years we appeared in hearings in front of a number of committees. During the Reagan years when only part of Reagan's tenure the Republicans had control of the Senate, and when the Republicans controlled the Senate, Senator [Orrin] Hatch from Utah had the chairmanship of the—it's to do with the law and when the Democrats, Ted Kennedy, had the chairman of that—?

Ways and Means?

No, no, it wasn't—that's money. Anyway, whatever that committee is, and as chairman then he tried to get a bill passed that would compensate the Downwinders. Took ten years for that to happen, from 1982 to 1992. And at first he tried to work with compensation on the basis of risk or dose, dose as related to risk. I frequently used to try to get people to understand, dose is like any drug or chemical. The poison is in the size of the dose. For example, you can take an aspirin a day or an aspirin three times a day and you have no chemical poisoning effects, but if you take a bottle of aspirin you can overdose and die, and that's true with almost all of our medications.

You can overdose and die. Well, everything in our environment basically works the same way. You can overdose on water and drown. You can overdose with radioactivity and it can kill you. But small doses you can stand. And that is why people need to understand the whole concept of dose, because we're exposed to radioactivity every second from our conception on, from the solar system and from the earth, in the way of cosmic rays, in the way of natural radioactivity in the earth, comes to us from the earth via the route called food, as well as direct radioactivity that exists. Some of the highest gamma rays that we measure come out of the soil in the way of potassium-40, which is a very small percentage of all the natural potassium on earth. It's made through cosmic interaction. It's a natural radionuclide. We have high energy cosmic rays that impinge on us. We can measure that. That's what we measure at these community monitoring stations. We measure it at the rate of about what we call twenty-five micro-r [roentgen] per hour, and depending on the elevation or the kind of rock or earth that you're in, that can vary anywhere from about ten to thirty or forty because of the difference in elevation—more cosmic rays—or the difference in having more uranium or radon in the rock. And so you see, depending on the station you can see quite a difference in the ambient background. We're exposed to that every second of our life. It's like interest; it never sleeps.

Have people been exposed to dangerous levels of radiation from nuclear testing off-site?

No. Now let me put that in the proper frame of reference. The levels that people have been exposed to fallout from weapons testing in the past, specifically the 1950s and specifically 1953—

With Harry.

With Harry, and I need to tell you a little bit about Harry because Harry personifies everything that was true about keeping things safe off-site. Because that was when the meteorological guys

didn't get the wind speed at high elevations **[00:15:00]** forecast correctly. And when the mushroom cloud from shot Harry penetrated up to about ten thousand feet, it hit a level of wind that was very fast and it transported the fallout from the test site down across the rim of the Grand Canyon and it actually went over Riverside, Nevada towards the Grand Canyon. And it got there in three-and-a-half hours. Wind speed was generally very carefully monitored for every test right from the first test forward because it's that speed that gets the radioactivity off-site. It's very critical because most of your radioactivity when you have a nuclear explosion is in the very short half-life material that occurs at the instant that the explosion occurs and all of the fissioning takes place. Most of the radioactivity has short half-lives—are you familiar with the term "half-life"?

Sure.

Of milliseconds and then seconds. And see, if you've got a very slow wind speed—like Baneberry where it took like twelve, fifteen hours to even drift off the edge of the test site--most of the decay has already taken place.

What about in three-and-a-half hours?

In three-and-a-half hours you've got a lot of radioactivity that's moved off-site. And another thing that they didn't know and really have no way of knowing, that there was another meteorological phenomenon over the Grand Canyon called a shear, and that turned the fallout 90 degrees. Instead of heading over northern Arizona where the track was headed, it took a right-angle turn over Washington County. And then so in about four-and-a-half hours you had fallout occurring over Washington County, and this community you're sitting in right here, Hurricane, even got more than St. George.

Dangerous levels of fallout in four-and-a-half hours?

No. Now let me explain “dangerous.” “Dangerous” implies that you’re going to have a health effect, that the risk is significant enough that you could expect to have a health effect.

Among a significant portion of the population, or among one individual?

Among enough of the population that you can observe it.

OK. So even everything that St. George experienced, that Hurricane experienced, was radiation but not to any level to where there should’ve been any alarm.

Certainly not to the point that you see even today, where people are convinced every cancer is caused by that fallout. The truth is, is that the formal and very carefully documented epidemiology studies have failed to establish a link. There are some fine points to that. For example, in the big study that was done by the University of Utah when they lump every thyroid effect together—whether it was thyroiditis or an enlargement—when they lump it all together they can actually see some kind of relationship with dose. But when it comes down just to cancer, they cannot see a relationship with dose. And that’s what they published, but nobody knows it.

So obviously then if there wasn’t a “dangerous,” to use that term as you explained it, amount of radiation from the fallout in May of 1953 and even into June of 1953 when that Upshot-Knothole series subsequently ended, so that you would say by the time the filming of The Conqueror *came around in early 1954, there certainly wouldn’t have been any radiation in the area more so than normal.*

Right. For the best and most fundamental reason of all, is that the fallout is now a year old, so you’ve had continued decay plus weathering into the soil. And to conceive that anybody tromping around on that soil a year later after Harry is just ludicrous.

I’ve read something about pockets of radiation? No?

No. That's more mythology that we have put to bed. We were very concerned about that question. When we started the Off-Site Radiation [Exposure] Review Project, one of the things **[00:20:00]** we had to do and we spent due diligence in trying to reconstruct all of the old fallout patterns and reconstruct and resurrect all of the old measurements that were made during the 1950s, and the guys did a pretty good job of collecting that data. And what we observed when we looked at the old plots is we found these so-called "hot spots." And when we went back and looked at the data, and then we went out on the ground and did ground truth—because we could now use very sensitive detecting equipment and map it and we could sample it, bring the samples back to the laboratory, because we had the luxury now of time to be able to examine these—and what we found is that most of these items they were calling "hot spots" in the early 1950s when they were collecting data were actually incontinuities with respect to the pattern. Now there's no question that when you have a pattern—and most of them are kind of cigar-shaped or balloon-shaped patterns, or fan-shaped, as they go from the point of origin out they scatter somewhat—and that's depending on the meteorology. As the wind speed got higher and if you had what we called "line up" with the wind with elevation, you would have narrow plumes. But if you had shears, where you'd go from five thousand feet, like this example I showed you out across the Grand Canyon, if you go from five thousand to ten thousand and you got the wind blowing [in the] opposite direction, it just spreads things out. Now from a dilution standpoint that's good because you start diluting the fallout. But in terms of putting a pattern on the ground, it just spreads it all over as opposed to making it more narrow. So meteorology dictates everything about fallout: how far it goes, how it's dispersed, how it's diluted, what the fallout pattern on the ground looks like, how far it's going to go in terms and how fast it's going to get there with respect to places like Rochester, New York, when one of the early tests that Kodak found some

exposure on their film. And then there was a rainout in Poughkeepsie, New York, I think it was, some strange name like that, where they actually measured quite a bit of radioactivity. But with no knowledge, and you have enough radioactivity that you can measure very easy, they think that is horribly high and very dangerous. And it isn't. It just isn't. I could take you in natural environments, in places around the mountains especially, where you get up into higher mountains where the snow is deep, the rainfall or precipitation is large, and you can find, just from natural scavenging in the atmosphere, even before testing, these little "hot spots" that occurred from this accumulation. So even though it makes it very easy to measure, it doesn't necessarily make it dangerous.

Other scientists, I mean even going back as far as 1963, have said things contrary to that, even before the congressional Joint Committee—

Oh, a bunch of them.

—on Atomic Energy in 1963. Dr. Robert Pendleton, who you spoke of earlier that you worked under—

Good friend of mine.

—in regards to The Conqueror *he said that in a group of that size of 220 people, you would expect about thirty people to contract cancer, as opposed to the ninety that we saw there. Dr. Ronald Oseas of the Harbor UCLA Medical Center said the group is probably affected by the additive effect. Response to these comments, and how is it that of the 220 people, ninety—I mean is this coincidence that we're looking at?*

Did they make the same statement with respect to the percent that smoked?

No. I mean all of the comment was of the group at large, of the 220. But Dr. Oseas talked about that, of the smoking, that it was an additive effect, that the smoking caused with some sort of

combination with being affected by radiation could add to the problems if you were a smoker. First of all, is that true?

I know of no evidence that has ever shown that. I'd like to see his references because I don't know of any.

OK. So this term "the additive effect" is something—?

[00:25:00] Well, as time as gone on, and I refer you to this web page that I mentioned earlier about low-level radiation, as time as gone on there has been people publish about what's called the "hormetic effect." And hormesis is actually an effect observed in nature where plants, animals, human beings, are exposed to certain small quantities of materials that are necessary for their natural growth because it provides some stimulus. Now for example in our health we know that we need certain quantities of zinc, but you can overdose on zinc really easy. And there's another really bad one--cyanide. Cyanide is very deadly but yet in very small quantities it seems to trigger healthy growth. We have demonstrated it with plants just very easily. The Russians especially have shown where they've exposed crops to low doses of radiation and you see higher, healthier crops and healthier wheat as opposed to the unradiated. And that's what's called the hormetic effect. We know it goes on in nature, both from chemicals and minerals as well as other kind of stimulants, and what we're finding out is that people who may be denied exposure to low-level radiation may be less healthy than those who are. So people who make those kind of statements, they make it with a paucity of data. They make it because there's really very little that we know about it, and what we're finding out as we gain more and more information, that it's probably more of a beneficial effect than it is a detrimental effect, which is basically true with most of the stuff that we consume. And like I told you a minute ago, poison is in the size of the dose and we're learning more and more about that all the time, is that we can take small

doses of medications and it has very beneficial effect, but yet we get that dose up, it'll kill us. Well, we know that radiation works exactly the same way. People don't want to accept the hormesis theory because it is so against the dogma of the day to accept that about radioactivity, because it has been so contrary and it is so embedded in all of national and international philosophy. If you go back and look at the way they set all of our protection standards, it's all on the basis of the linear no-threshold philosophy, which basically says you have an effect all the way to zero. Well, if you think about it logically, that's insane. That means you got to throw out everything you know with respect to everything we know about all other exposures of minerals and these things I've been talking about in terms of chemicals and minerals and food supplements and additives and medicines. It's just illogical with respect to all of the mountains of experience that we have, that you're going to have an effect all the way to zero. It just doesn't happen. You can't measure it. That's one of the reasons why they can get away with it, because you can't measure it. And so they can illicit that dogma and so they use that and that's what they use to set all of these cleanup standards. That's what they use for the standards of the day, and that's why you find people like me and my various colleagues in the risk business that will attack the linear no-threshold theory as being more harmful than you can imagine because it drives us to do these other things like move ten billion tons of earth that you don't need to move and you're going to kill six or eight guys in the process. Now those are real. Those people die. You got names on tombstones. But when you do a calculation on the linear non-threshold theory all the way down to a few millirem per year, that's all theoretical, allows it to [pause] oh, what did I say it was? A probability of less than one in a million. You can't measure that. You can't measure it in a million years. It's all theoretical. We can calculate it and so therefore it exists. But you can't measure it.

[00:30:00] *Isn't it true that you also cannot measure whether a particular cancer—now there's obviously certain cancers that can be caused by exposure to radiation, but is there any way to positively prove that someone's exposure to radiation caused their cancer, even if it was one of the cancers that can be?*

There is no way. Radiation doesn't leave a label anymore than a lot of other chemicals leave a label. One of the best labels that we know of is lung cancer. If you're a smoker, you leave a label because you open that lung up and you see all that tar and crappy-looking stuff inside your lung, you've left the label. Radiation doesn't leave a label, and so we can never say for sure that it was the causation of a particular cancer. We can say, probability-wise, if you get exposures of these magnitudes your probability increases to the point it more likely than not was caused by it, which is the same kind of calculation we have to do with many other carcinogens. If I'm in a laboratory and I want to cause cancer in an animal, what do you think is my first choice that I would use to cause cancer, and what do you think would be my last choice?

I would say your last choice would be radiation.

Why?

Because you couldn't prove that that's what gave it to him?

No. It's because it is a poor carcinogen. You have to really give extremely large doses, and you start doing a lot of other damage to tissue to very effectively cause cancer in test animals. If I want to cause cancer in test animals, there are many drugs and chemicals that are very certain to cause cancer, and so if I'm in the cancer study business that's what I'm going to use. I'm going to use a carcinogen that's going to produce a high rate of cancer if I'm going to study it and I'm going to study mechanisms. The people who've had to use radiation, and we've had a lot of those studies in the past, they get so bogged down in the number of test animals and the statistics,

it becomes really difficult to do. And this is one of the things that we know about from probability and statistics. In order for us to produce dependable cancers in people, the number of subjects has to be huge in order for us to see a subject with a radiation-produced cancer, with a statistic behind it that says that it's at least more probable than not that it was caused by the radiation. You have to have such high numbers of subjects as well as fairly high doses to do that. Those experiments become extremely expensive and they're hard to operate on because you have to have such high numbers of subjects. We refer to the mega-mouse experiment because we know if we're going to study even ten times, even a hundred times what the standard is—I told you the standard was a hundred millirems per year? If we want to study a thousand, which is ten times, or even a hundred times, which is ten thousand, which is ten rem, that's ten million microrem. See, we're down here measuring background in the micro, and that's mostly what we see is in the micro, and most of the exposures we're concerned about is in the milli, from the fallout. We very seldom ever got any readings in the what we call the roentgen range, or the R-range. It was always generally in the milli, or the thousandth of an r-range. In order to conduct a mouse experiment at that ten and a hundred times level, you have to have a million. That's why we refer to it as the "mega-mouse." So whenever we've done cancer studies on populations in the past, it's always been hundreds and thousands of rads delivered slowly. And one of the concepts I haven't even talked to you about is rate of exposure, because when you deliver radioactivity in an instant you do more damage than if it's over a long period of time because of **[00:35:00]** biological repair, and that's been well-documented. Fallout occurs over time. It's not an instant sort of thing like you do when you stand in front of an X-ray machine or something else that can deliver or some other source or you stand in front of a reactor, an open port, or something like that, or I take you in for, like my dad did last summer, for radiation therapy where

he was getting exposures in the *gray* range. One gray is a hundred rad. A rad and a rem and a roentgen, they're all about the same. It takes a thousand millirem to make a rad, and so if I'm measuring fallout in terms of ten or fifteen or thirty millirem, or fifty or even a hundred millirem, or two hundred millirem, I'm so far from what we do with therapy. My dad was getting like 150—no, 1200 rem, because it was like a gray, a *day*.

Despite all this though the government has still to this day paid out $330 million in compensation to—?

Has nothing to do with fact.

More PR?

Back to Hatch. I was involved in this. We brought the best experts we had in the United States that could talk to Hatch and his committee with respect to risk and radiation dose. We even went through a very elaborate model, developed a model that we could show him that computed the percent of risk depending on the person's specific kind of exposure. And see, as we're doing this we have this data that's coming out of the [Off-Site] Radiation Exposure Review Project as well as all the old measurements, and we showed him, `Here's the data, here is the dose that the people got. We can even double it, and here's the dose that people got. Here is the risk.` And the fact is the risk only gets high enough that your payoff is just like that many people. It's just a handful, such a handful. That was not enough people. Politically that did not count for zip. When he passed the Radiation [Exposure] Compensation Act they developed a formula where risk and dose got tossed out [of] the picture, and it was based on presence. If you lived in eastern Clark County, all of Lincoln County, Washington County, Iron County, Beaver County, and Kane County, and if you lived there from 1951 to 1958, and you lived there from 1961 to 1962, and you could prove it, you got compensated. Oh, one other thing: you had to have one of fifteen or sixteen or seventeen cancers. So you had to have one of

the cancers on the list that's known to be radiogenic, plus having lived there in those years, and that's all it took for you to get a check for $50,000. That's why they have paid out $320 million. The folks who did uranium mining and people like me who worked at the Nevada Test Site had even fewer requirements. All we had to do was [have] worked. Then if we got one of those cancers on the list, then we got compensation. In the case you were a worker at the test site, it's $75,000. In the case of the uranium worker, $100,000. There has been two attempts recently. I attended a meeting in St. George that Senator Hatch was to, January, just recently, where he's attempting to expand both the region as well as the number of cancers. And I listened to people from Las Vegas who got basically zero dose from the test site, for lots of good reasons, come **[00:40:00]** there, old people, people much older than I am. The reason why I know—this one guy worked on a project at the NTS during the 1970s. He was an old guy then. So him and his wife have got to be in their eighties now and his wife's got breast cancer. They lived in Las Vegas their whole life, at least the majority of it, and they were asking Senator Hatch now to make all of Clark County compensatible so that his wife could get compensated for breast cancer because she lived in Las Vegas during the 1950s. That's the kind of people that you had testifying in front of this panel from the National Academy of Sciences. I think it was seven or eight of them, the National Academy of Sciences, there is a panel to make a recommendation to Hatch as to whether he should expand the number of cancers as well as the geographical area. People along the other side of the Grand Canyon were there like from Kingman en masse, all wearing shirts and things that you slip over your shirt, advertising, they were Downwinders and they had never been compensated. Well, Kingman I don't think ever got anything. Northern Mojave County, which is the huge county that embraces both sides of the Grand Canyon, the northern side of that, which is not a lot of people—you've got some out near Kanab, Fredonia,

and then you've got some down here just on the side of Mesquite that's in Mohave County and not a lot of people—but they were eligible in that first set of legislation. Beaver Dam and what's the name of that other little town, I can't remember it, it's been there forever, but all of eastern Clark County, like Overton, Mesquite, Riverside, Alamo, then all of Lincoln County, which Alamo is in Lincoln County, were all part of that geographical area. But there's people from counties in Utah, counties in Nevada, counties in Arizona that now want to see this geographical area expanded now. So if Hatch is able to get through an expansion in Radiation [Exposure] Compensation Act to expand that geographical area, as well as add more cancers, you can add a billion to 320 million. It'll go up in zeros.

Which is all good PR.

For a senator who's trying to get elected.

Certainly. With all of this, I go back to the beginning of everything that we talked about, with projects like the Off-Site Radiation Exposure Review Project and other attempts, setting up monitors, bringing local people involved, it seems like the NTS [Nevada Test Site], the AEC, the DOE, whoever, all did try to do a lot to get the public involved, to get the right information out there, but yet all of these controversies, all of these problems, are still here. Is there anything else that the government, whoever, AEC, DOE, could have done, do you think, that would've changed this? We talked about early on their, I think the term you used was "arrogance" early on in the testing, or would these controversies be here no matter what?

Well, let me define "arrogance" a little bit. I think their attitude, for whatever reason, was construed to be arrogance, probably more so than perhaps they were arrogant themselves, even though I think there probably was some of that. But I think the whole nuclear age unfortunately was born under secrecy and classification, for a good reason. Even to the extent that we tried, we

could not keep our secrets away from our enemies. And there's well-known stories of spies that delivered those secrets, and they're fascinating reading. That's one of the things that makes me just really smile when people comment about the government hiding aliens. When the government failed at trying to keep the most important secret we had in our whole existence, and we failed at doing that, I can't imagine that we could be successful in hiding the advent of aliens **[00:45:00]** or anything even close to it [laughter]. You can't even run an administration anymore. You have so many insiders that go out and write books and give interviews and spill their guts to the press that, you know, the person who believes today that the government can hide things from the public that are really important like these big things that I'm talking about has just got to be so naïve that it's just helpless. Just helpless.

Anyway, it was born under secrecy and classification, and during those years you've got to remember the Cold War is going on full tilt. And so as a worker you could really be–what's the right word for, you know—criminalized, to breathe anything classified. You are immediately a criminal with severe penalties. And so it was a scary thing for people in terms of protecting classified information because of the penalties involved. So living here and growing up and being back in this environment, I can understand, I think probably better than most, how people think and believe here. But I've also been a worker. I've also had that classified information and still have a lot in my head. And I have to be careful because I don't want to expose our country and our government through the dissemination of classified information, and yet I want to be as open with the people as I can be. And sometimes that's difficult, and that difficulty I think has been probably the culprit more than almost any other thing in terms of establishing an information bridge. I have had significant fights, internal fights, with people—colleagues in our management group—over me wanting to be more public and them wanting to be less public,

because they had responsibility for classification and secrecy and I had responsibility for public protection and openness. And that's a difficult line to walk. The last three years I was assistant manager, I actually had security under me, and that really became a dichotomy for me, to understand all the things we did to protect nuclear weapons. Plus I had to pass on the design and the tests as we prepared to test the weapons, and then over here had the responsibility to go out and run a community monitoring program and try to get people to understand basic principles. It was easy for me to see the dichotomy that people had then and now with respect to what can you tell? And if I've got to lay a root cause at the foot of anything or anybody, that's where I would lay it. It stops you from the openness that would've been really good to have had from the beginning. And that's why the government published the kind of booklets that they did. It became a situation where, `Well, you've got to trust me because I can't tell you any more. I'd love to but I can't.`

Besides it was so flipping technically complex. Without a degree in physics or advanced biology, it's really difficult to carry on a really good technical discussion with people. That's why we had to educate these science teachers. That's why we not only took them to a two-week, eight-hours-a-day intensified course, but for the first five or six years we took them to two weeks of review in between. After that initial two-weeks' course we brought them to a week's review every summer and then we did a two-or-three-day review mid-winter, generally during their **[00:50:00]** Christmas break. And I tell you, I saw change in people who came into that, particularly this one station manager out at California. We had a station in California on the southern edge of the test site. We had some people out of Ely and a few other places that were just rabid antis, what I call antinuclear. I saw those people do a 180-degree change just because of education, where they could come to understand what it was all about. And to see that change was absolutely amazing. It was the same thing that Jack Heppler saw when he could talk to

people on an individual basis and assure them, It's OK to grow a garden in St. George. I've been here for all of my life. I grow a garden every year and I don't have a problem. My kids are all healthy, I'm healthy, and I don't worry about it. Well, when he could say that to those people, then they could dispel their concerns and their fears.

Sure. The key is education, and that's what we talked about earlier. It just isn't feasible to give everyone that type of education.

I want to move on to one last thing that I want to ask you about that I find very fascinating. Obviously you're very passionate about what you've done and you're—

Is it that obvious?

[Laughter] Yes, it is that obvious. You're one of the founding fathers, if I'm not mistaken, of the Nevada Test Site Historical Foundation and you are one of the co-creators of the original idea for the Atomic Testing Museum. What led you to become such a proponent of wanting to preserve the history of the NTS? Obviously again we can see your passion, you can hear your passion for anyone that's listening, but why the historical aspect of it? Why do the historical society? Why do the testing museum?

It's all embedded in everything you've heard me talking about. As we have the opportunity to convey information and educate people, it was embodied in all of the struggles to go out and get a lot of the documents and bring them to the CIC. That was a monumental struggle and it was very expensive. We had a $1 million-a-year budget. We spent a lot of money getting those documents, and it took quite an effort, and it took a lot of high horsepower. We actually had secretarial signatures, letters that went to the laboratories and contractors that had all this historical information in the beginning that said, You have got to let these people come and copy your documents. They have a mission to do this. And we formed a number

of teams to go out and find these documents. We hired professional historians, professional researchers that did this sort of thing and they helped guide us. They went out and did work in the community at all of these contractor locations. For example, we spent weeks and months at Los Alamos and Livermore, as well as other contract sites, and government agencies such as DASA and our own headquarters, copying all the documents. All the documents we brought back to the CIC were all copies. We didn't bring any original documents with us, but we brought them back, organized them, and put them in a way they were retrievable. And the idea is to make that very rich collection available to the public. It became a tremendous resource as we went into litigation for DOE's own attorneys, as well as the opposition attorneys. We've had a steady course of people coming to the CIC trying to establish their linkage because most of these people are interested in cause and effect, either for themselves or for loved ones who have had cancer and died. They're trying to establish the fact that they worked there, what were their exposures? And it's become a very rich collection for people to use. There's nothing like it in the world. And it was all threatened. I had retired. The mission of DOE was changing. Testing had ceased. Budgets were going down. And my successor let it be known that she was thinking of doing away with the CIC. That was the genesis of the foundation and genesis of the museum.

The manager at that time happened to be a good friend of mine, and it just happened to **[00:55:00]** be a window of opportunity. He was actually the deputy and became the acting manager, and so it was very easy for me to get entrée to him because he was a fellow that I had known for a long time. We worked at different offices. He worked in the San Francisco Operations Office and I worked in the Nevada Operations Office when we first become acquainted. And so I went to Terry Vaeth and I said, `Look, this is such an important collection. We cannot let it be destroyed.` It would've been easy for DOE, and they

could still do this, to satisfy the requirements that they have with the National Archives. And this collection has become so valuable that it's now become mentioned as a collection in the National Archives and it has some protection, regulations, and rules behind it. But DOE can satisfy that by just turning over to them a copy of the microfilm. It's all been microfilmed, so they could just send them a copy of the microfilm and haul all the original hard copy documents out to the burn pit, and they would be off the hook for four or five hundred thousand dollars a year in budget. So because things are going down, that was certainly being talked about by the other assistant manager. And I said, This is too valuable. And I said, It's not going to do the region of this country one iota of good to have these microfilms lodged in the Library of Congress in Washington. It needs to be here. It needs to be here for people in Nevada and Utah and Arizona and California to have easy access to it, for people who live in this region, who live around the test site, needs to be *here*. He agreed. One of the first things he did was take the responsibility for managing the CIC away from that assistant manager and gave it to the public affairs office who really appreciated what that mission was all about.

That was the first thing he did—very important managerial move. The second thing we did was to start exploring ways to create an institution that could preserve it. My object was then and would still be to now—I still serve on the board of trustees—is to get DOE totally out of the business. I would like to see that collection become the property of a private entity, a private entity that can exist forever, that's how a foundation can exist. And hopefully in revenue generated by the museum that will allow all that to happen. Because government is always subject to cutbacks and is always subject to making decisions not necessarily in the best interest of the public. I saw that happen in spades right out of graduate school with the Nuclear Rocket Development Program. What a waste, I thought. But government was being cut. We see that happen all the time. We see decisions made to cut out programs, to cut out technical things. We

see the pressure on NASA all the time. We would've had a space station *years* ago, right after we sent the first one up, if it hadn't been for budget cuts. So budget drives things and has to drive things. That's just the way things are. Our priorities change, we have wars, we have pressures that come and go, and budgets have to change, and that's one of the reasons why I'd like to see this valuable resource called the CIC collection taken completely away from DOE at some point in time. Right now it can't happen because the resources aren't there to deal with it, but I'd love to see it institutionalized—either within the university or a foundation or something where it would have a home forever—because it's going to take a lot more than the next generation to pass away before this controversy goes away.

I kept thinking with time that the controversy would die down but it don't, and for a lot of reasons. A lot of it's just political. The politicians use it. People with various agendas use it. **[01:00:00]** They use that public paranoia. And this book I want to write about the genesis of the Low-Level Waste Policy Act has a title: *The Politics of Fear*. The subtitle is *The Genesis of the Low-Level Waste Policy Act* but the title is *The Politics of Fear*. I had a ringside seat as I watched a governor of the state of Nevada use fear to jam through legislation, causing the president of the United States to have legislation passed and signed that has been absolutely worthless to us as a public. That legislation in a nutshell set up compacts in the United States of various states that would create within their own compact—and I think it was like eight compacts—where they would within their compact have to set up their own disposal site. Then they would all service that disposal site. So it'd become regionalized. You wouldn't ship this waste all across the United States. That's what the Low-Level Waste Policy Act created, in a nutshell. This is 1981 or 1982 it was passed, in the early 1980s. This is 2004. There is yet to be one of those sites opened. Hasn't been for the want of trying. There has been tons of money

spent in various states. Texas has now gone off on their own; California's gone off on their own. California can't even open a site in their state. There are only two operating low-level waste sites today, since Beatty closed in 1993, and those are the same two that existed before: one in the state of Washington on the Hanford reservation and one in South Carolina at the Barnwell site. About ten years ago, an Iranian was able to open up this little site up in northern Utah around Tooele and has become a multimillionaire because he was able to capitalize on the fear and paranoia of the people, and he opened up this little site for them to bring slightly tainted soil and stuff that's very, very, very low-level there and dispose of it. Class-A waste. Class-A waste ought to be going in the sanitary landfill. Shouldn't be shipped anywhere.

You can't blame him.

Oh, he's a brilliant opportunist.

Sure. Yes. Definitely.

That's just an example of the state this country is in. You can't even open a low-level waste radioactive disposal site today, in 2004. You couldn't in 2000. You couldn't in 1995. They spent hundreds of millions of dollars trying to open a site in southern California out in the boonies.

[01:03:21] Ahhh, NECo [Nuclear Engineering Company]—U.S. Ecology—NECo's the old name when they operated the Beatty site. They changed their name after that to U.S. Ecology to become more politically friendly with the environment. They've been in the low-level waste business since the early 1960s when the Atomic Energy Commission decided that it was going to be run by the public sector. They spent $350 million trying to get a site approved in southern California and finally gave up. California ships their waste to Hanford. One of these days California is going to choke. One of these days the whole country's going to choke.

The irony of all this is we all pay dearly for this. The fact that we have to ship all of our hospital waste, our industrial waste, and our university waste to facilities clear across the country makes it very expensive. And not only that, we've ratcheted up the whole cost of waste disposal in terms of the way we package it, the way we ship it, the way we containerize it, and the disposal fee on the other end, because the state agencies oversee these sites in those states have such horrendous requirements in the way of monitoring and packaging and environmental impact that they have to have all these surcharges. So we now all pay dearly for what List initiated in **[01:05:00]**1980 or 1981 with the Low-Level Waste Policy Act. And our subsequent fear and paranoia that the whole country has makes this cost enormous. It's silly. How many reactors have we started since 1979? None! How many are on order? None! Do we have an energy problem in this country? Yes! What's the price of gas? Two dollars plus [per gallon]. Why? Because we've got an energy crisis. Why have we got an energy crisis? Because we have a nuclear problem. Because we have an oil drilling problem. It's all related to environmentalism.

It's a lot to think about.

Well, the whole kernel of all that is, is fear based on no information. How do we solve that? It was the question you asked some time ago. Public education. It's the only way you can. Until the public decides, until our educators decide, that we're going to educate the public about things radiological and things nuclear, I don't see it changing.

Do you ever see that happening though?

Not in my lifetime. Alls I've done is seen it get worse in my lifetime.

Unfortunately that may be the way it continues to go.

Do you have anything else you would like to add?

Oh, I think we've—.

We've covered a lot.

I don't know how, what's the word that makes it all make sense?

I think there's all different people that can be benefited by several different areas here.

Well, I'd like to thank you again for taking the time. Like I said earlier, your passion for the subject is quite obvious and it's definitely interesting because I am one of these uneducated masses, despite the fact that I spend all my days in a classroom. Like you said, issues such as this are not things that people talk about, especially in areas, what, sixty, seventy miles from—

But you read about it in the paper.

Sure. Yes. You read about one perspective and [it] involves Yucca Mountain and everything along those lines.

Yes. It's been amazing to me. Since I moved back to Utah, I just take the local paper. [It] just covers Iron and Washington County, but I don't think there's a week goes by that there's not an article in that paper about these subjects, about the shipment of low-level waste or high-level waste or fallout or compensation or cancer. And it's just amazing to me the platforms that the politicians take and use these issues to get public notoriety: `I will protect you. I will protect you from testing. I'm going to introduce a bill. I'm going to give you more compensation.` Damned liars. [Laughter]

Well, thank you again for your time, for your information, for your expertise, and this has been very beneficial for myself and I'm sure for others. Thank you again, sir.

You're welcome.

[01:08:16] End Track 3, Disk 2.

[End of interview]