

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

Interview with
Raymond Harbert

July 14, 2005
Las Vegas, Nevada

Interview Conducted By
Mary Palevsky

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[00:00:00] Begin Track 2, Disc 1.

Mary Palevsky: *Let's go ahead and pick up there. Would you like to start with talking about life at Mercury?*

Raymond Harbert: Yes. I was assigned there in September of 1956. Holmes and Narver had taken over the contract from Black and Veatch. I left my family behind and lived at Mercury for a period of a year during the [Operation] Plumbbob tests. The whole activity began with setting up an office there. Mercury was interesting because it was a self-sustained city. We had theaters, we had a small hospital, medical supplies, we had mechanical sheds there for automotive repair, almost everything you could think about. There were theaters, there was a steakhouse, there was a bar. And you didn't really have any wants. Most of the people, if they could, would take off and go down to Las Vegas on the weekends: get your paycheck and go down there. And some of them would go down there and blow the whole week's paycheck and they'd have to hitchhike back to Mercury. That was the way of life out there. We got, I believe it was, \$7.00 a day *per diem* for living out there, and as I told you, I'd left my family in Burbank, California.

What did your family consist of at that point? Your wife. You had children. How many children and how old were they?

At that time, they ranged in age from fourteen to a baby.

OK. How many?

I had a total of seven.

You had seven kids; I didn't realize that.

There's only five alive today. My daughter was murdered in San Diego and one of my sons, on the anniversary of her death, committed suicide.

You told me that last time, yes. I'm sorry.

I would try to get home about once a month for a weekend and that was about it. I made sure my paycheck went home so she could pay the mortgage and all of the things that went along with that.

But life at Mercury; we lived in a barracks. I had a room; there were two cots in it and I had it by myself until the test series started. Mercury was pretty much just construction people up until just prior to the series beginning, when the scientists and technicians came in on test support. While we were doing this, [Operation] Redwing was being conducted in the Pacific, so all the scientists were out there. But we were getting everything prepared for the next series. That was one of the reasons they brought Holmes and Narver in, so that the learning curve would be minimal between the Pacific and Nevada; that was the transition there. Holmes and Narver got the original contract at Enewetak and Bikini as a result of their postwar activity on Okinawa.

Really.

Yes. We had built bases there on Okinawa and we were considered probably at that time the biggest contractor in the Pacific, so AEC [Atomic Energy Commission] hired us on that premise. We also had an extensive background in the design and construction of towers and that's one of the engineering expertises we brought to Nevada Test Site [NTS].

My office was in a separate building. We had to staff it; we brought some experienced people from the Pacific as part of our tests. Our construction inspector had worked in the Pacific, [00:05:00] because we were responsible to supervise, as engineers, the construction on the test site and make sure it was done according to plans and specs; his name was Johnny Clark. We

had Accounting and their accountant came from the Pacific. We had Procurement people and they had government experience in procurement. Oh, and we also had Surveying; I had a chief surveyor and about four survey crews that were working there.

My office was a room probably about eight-by-eight [feet] with a steel desk and chair and one side chair and a telephone, and that was about it. We worked very closely with REECo [Reynolds Electrical and Engineering Company] on scheduling and all of this activity.

Let me ask you one question here. Did Holmes and Narver at this point have the contract for the Plumbbob series, or was it for a longer—?

It was for longer. The idea was that because the tests were occurring in the Pacific, the next year they were occurring in Nevada, then back to the Pacific, then back to Nevada, that we would provide the engineering continuity and the know-how based on our experience; our analysis of structural failures, the effects of wind blast, and all the other things, precursory waves, what happens to structures. So that engineering expertise was part of what the Atomic Energy Commission bought.

OK. Thank you.

In the Pacific, we did not only the engineering, but we did the construction; there were no subcontractors out there. We did the construction; we did the camp management, camp support. We had our own fleet out there of LCMs for transportation, both at Enewetak and Bikini. But here in Nevada, we were primarily engineering and construction managers where we subcontracted or supervised and inspected work done by REECo.

OK. Thank you.

OK. I hope that explains the relationship.

It does indeed..

One of the first things when I got there after the office, I was assigned a car and that car was a Buick, but it was a car that had gone through nuclear tests. It had been part of one of the early programs out there. The engine was still running and everything. It was out there to see how it withstood blasts and it was in good shape. Ultimately, we got a rental fleet and we used those, but I drove that for about two to three months before the cars came in.

Were you worried about contamination in that car?

No. One of the things that has always bothered me, in retrospect, is [that] radiation was played down. They knew radiation had effects; as an example, when I had to leave the Pacific, the limits were 3.9 Roentgens per thirteen-week period. Now it's down—I don't know the levels—much lower. The scientists were saying, well, because we're exposed to sun radiation all the time, atmospheric radiation, your system would naturally kick it off and there'd be no mutation. But there were some of us that were concerned about children at a later date and those sorts of things and probably with some just cause. But it was played down.

Secrecy was a major issue. We had to get what are called Q-clearances before we could work on any project. We were not allowed to discuss anything with our family other than where [00:10:00] we were and broad general terms of what we were doing.

It was a closed society. One thing that I think people have to look at is [that] those of us who participated early on in the test programs, both at Nevada and the Pacific, were veterans of World War II. We were extremely patriotic; we had come home, the Cold War was on, and we looked at ourselves as warriors of the Cold War and we were doing something *extremely* important to protect our country and working for the president. That was a big part of our motivation. And I'll always carry that feeling with me and did for the rest of my career. But I think it's something that was engendered in the sixteen million veterans that went out there.

We're getting fewer and far between nowadays, because we're getting like the whiskey ad, [in] old age we may mellow a little bit, but we also get a little more decrepit.

So you're saying that sense was engendered in that whole generation.

Yes, in that generation. We'd come out of the Depression where things were bad: parents couldn't even afford to resole the shoes on kids, you put cardboard in your shoes to keep from wearing your soles out. That was the nature of it. You ate everything on your plate. Everything that was cooked was made for minimum cost, maximum size, and might not have been the best nutritional meals, but it kept us going and kept us mentally alert.

But that was the environment. And as I told you earlier, I got out of high school, I went directly into the military in February of 1941, before World War II, because we knew the rising threat. But I also wanted to get my military service over; I volunteered for the draft, which was a one-year period at that time, hoping that I could get it over with and get on with my life. Four years, seven months, thirteen days, and seven hours later, I finally got out and then reassumed my career. So that was that sort of background; that was the mental attitude. We were warriors of the Cold War; it was just a continuation of where we left off. And it gave you a good feeling.

Well, one other little thing before you go on, which was—and thank you for that, because that helps—I'm very interested in that generation, in your generation, of coming through World War II into the Cold War. I think it's a very important part of the story.

Well the precursor to that was the Depression where everybody had to help everybody. My father was a veteran of World War I and he was involved in the American Legion and there were a lot of injured veterans at Sawtelle [Veterans Hospital, Los Angeles]. We used to, at Thanksgiving and Christmas, put together food packages for the families of those veterans that were in the hospital because they had no other source. There wasn't enough food to go around.

My dad's post sold fireworks [for] the fourth of July, sold Christmas trees at Christmas in order to earn money so that they could do this type of work in support of the veterans out of World War I. So that whole feeling was engendered in me, for one, but most of us.

In the whole generation.

Yes, it was generational. Tom Brokaw called us "the greatest generation." The situations made us the greatest generation. It wasn't that we had different genes than anyone else, it was the life story that made us what we were. There were those of us that came back that couldn't hack it.

[00:15:00] I know my best buddy in high school, we were at UCLA [University of California, Los Angeles] during a homecoming, and they'd built a bonfire there and they put some dynamite in the base of it to start it. When that dynamite went off, he went berserk because it brought back the memories. He was in an A-20 aircraft and they had been bombed several times by the Germans in North Africa, and he just couldn't hack it. But that was what each of us brought home, our memories of it. Background.

Yes, it's important background. The other thing that you had said when we started this question of the understanding of the era and the car, my question about the radiation, you made a remark about genetic concerns, concerns about children with genetic causes. Do you mind my asking, did you see any of that in your family, are you talking about?

No. No, I did not.

But colleagues you were concerned about?

Yes, some of the colleagues did. The early RADSAFE [Radiological Safety] out in the Pacific when I was there, and even at Nevada Test Site, was not that disciplined. We had film badges, but we went into areas that were heavily contaminated without good protective clothing, without respiratory masks. And of course it's not only just the gamma rays; it's the alpha rays. Alpha

contamination was heavy up at Nevada Test Site, that was always a concern. There was an area called 400 up there that was badly contaminated by alpha contamination.

Well, back to life at Mercury.

Yes. Let's go back.

OK. We had the Steakhouse and all the amenities anyone could ask for, and the price was right. And we just lived there. Early on, there were primarily construction people. A lot of the construction people drove out. Not many of them drove in from Nevada; not many of them from Las Vegas. Not many of them, really construction people, lived on the test site. It was primarily people that were supervising it and deeply involved in it. All of my surveyors lived in Henderson or Las Vegas and so they had to drive out every morning.

The early activities at the test site in 1956 was to make asbuilt drawings, so the engineers—and these were going into a structure that had undergone the previous tests—bringing their drawings up to date so that those structures could be modified for the next test series. And that we did. Those drawings were sent back to Los Angeles and they in turn used those in preparing new drawings for modifications or upgrading of facilities, plus all the new facilities.

For the Plumbbob series, there were towers, there were balloon locations. The balloons were tethered balloons moored about 1,500 feet above the ground surface from three different directions and a vertical cable. The winches were located at 120 degrees apart so we could position them in a precise location and keep them there. The cable that went up from ground zero was there to maintain the height.

The decision to use balloons, what was that about and what did you think of that?

When you have a shot, you have a heated column and that column becomes a draft and a vacuum and it sucks up all of the debris at the base of the tower. Now, they wanted to [00:20:00] achieve two things. The towers on this test series were 500 feet high and one at 700 feet. That would limit the amount of yield, so they were looking at upping the yield. In upping the yield they came up with the concept of balloon tethering where you had essentially no material directly below the device.

OK. So we had the balloons. We [also] had tunnels. Rainier Tunnel was the first one of that nature. We also had vertical drill holes. And I made a list here; there were a total of twenty-nine tests. There were thirteen balloon shots, nine towers, one rocket, two tunnels, and two safety shots which made up that grouping.

What's a safety shot?

They're one point. What they did is an atomic bomb at that time had a series of igniters around them, like spark plugs. They were referred to as "points." And part of the safety test was to ignite one of them and see whether that would trigger the chain reaction. Both [of these] safety tests did not. OK. So that was part of the safety.

They also had another safety test, which was not recorded here, which was a vertical drop of a nuclear device and seeing whether the impact would set off the device. And that did not happen.

OK. So you don't want either of those things to happen.

No.

You want it not to set off the chain reaction if just one point is ignited.

That's right.

And you want it not to set off the chain reaction if it drops.

Right. There was also one other experiment out there, and it was called Gravel Gertie; it was on the edge of Frenchman Flat, closer to Mercury. It was designed to see if they could house an explosion, without letting it basically leak, and the shock wave. What it was, was a concrete cylinder with cables strung across the top and a mesh put across that and then gravel put on top of that so that when the explosion occurred, the energy was absorbed by throwing off the crushed rock. And that was that type of experiment.

The rocket shot was from, I think it was a P-51, but I'm not sure. It flew out of Nellis [Air Force Base] and fired over the test site.

The towers, as I said, ranged in size from 500 to 700 feet.

One of the interesting things about the balloon shots, or about the construction—we're talking about the construction period—one of the things the government insisted on in the federal procurement regulations was that you take the low bidder. And of course today I would say I would hate to make a trip to the moon on a ship built by the low bidder. But the low bidder for the transformers was Central Transformer Company out of Little Rock, Arkansas, I believe. And so we had to buy them. We had asked for GE [General Electric] or Westinghouse, but at that time you couldn't specify a name, you had to specify design parameters. So we got this company and we got them in there and we set them up and started running tests. And as you know today it's, what, 120 [degrees] here maybe today or 115. Out there those transformers, [00:25:00] when turned on, could not stand the heat. They would vibrate because of the inadequate way they were made and they would blow up. So we had to ultimately go back and procure on a name basis GE transformers and replace every transformer in there. But it was again the low bidder. In the missile business, I saw the same thing. So it's one of the fallacies of our procurement system: you always don't get what you think you've asked for. All they had to do was give you a

certificate to say it's comparable, and you couldn't question it, you couldn't make them prove that it was; their certificate was OK.

So in fact the GE ones had no problem?

No, we had no problems with them because they were properly made, and we used them throughout. You can see the number of tests that we made. We were able to reuse those sites.

The drill holes were vertical holes, forty-two-inches in diameter, for LASL [Los Alamos Scientific, later National, Laboratory] and I believe it was in Area 4. What we did to get these vertical holes drilled, you drilled with a small diameter and then you reamed it and reamed it and reamed, then we put a casing down. Well, on the first hole [when] we put the casing down, it was sealed off at the bottom, and we tried to push it down through the drilling mud that was still contained in the hole and the bottom ruptured, broke through the steel casing. I offered to go down and take pictures of it. I said, Put me in a parachute harness with an aqua pack for oxygen and I'll go down and take some pictures so we can at least make some analysis. Well, they wouldn't buy that. They didn't want to risk this engineer's life, but at least I tried, I made the offer. And we finally got it fixed; it's a simple fix. What you do is fill the casing full of water so it equals the pressure on the outside, then once you get it in place and you begin to set, the mud begins to solidify, then you pump the water out and you can put your device down in there.

OK. So technically, let me understand this a little better. What happened at the bottom? What broke?

At the bottom, it's sealed off, and it was sealed off in like a cone or an orange peel, so that it came together on the bottom.

And it's sealed with what?

Welded. It was welded shut. But the pressure became so great that it ruptured those welds.

OK. I understand now. That's interesting.

And see, when I talked earlier about the learning curve, this is the sort of thing you learn. It's extremely important that not only it be passed on from generation to generation but test to test, so you're not repeating the same error. And that's when in the previous [interview] I told you I was disappointed in Holmes and Narver because they didn't get debriefings from the people in the Pacific to improve the operation. But that's my only complaint against Holmes and Narver.

We did a lot of surveying out there and we had a lot of landmarks, like Rainier Mesa. Rainier Mesa was named for the event that was going to occur in the Rainier Mesa which was a tunnel 1,700 feet long, shaped like a hook with a cab on the end of it. But out there, there were two hills in Area 12. And those two hills were rounded off; they looked like a woman's bosom and they picked up the name Dagmar. Television was in its infancy at that time and [00:30:00] Milton Berle had a big-breasted woman on there, no talent, whose name was Dagmar. So everybody started referring to that landmark as Dagmar. Just a bit of trivia. I assume that's what you want.

Yes. Details make a good story.

OK. I told you the total number of tests in Plumbbob.

We had some interesting construction problems as we went on. Holmes and Narver had built a lot of towers, so [they] were experienced. The tallest tower was the Smoky tower and that was out in Area 12, out near—I think it's Area 8, actually, is what it's referred to. It's at the north end of the test site and it was 700 feet high. The base legs were eight-inch-solid rounds and it built up from there and went into a block column as it got higher. It had guy wires attached to it.

I made a trip out there one day when they were capping off at the top, [at] the 700-foot level. What they had done there was take a beam and put it across the top. I think the dimensions of the tower were twenty feet by twenty feet; they were either twenty by twenty or twenty-five by twenty-five, but it was basically a square. And across the top of that, they put a steel I-beam. They hooked a shiv, which is a pulley, onto that and they took and ran a rope up through there and it went down to a cage at the base of the tower. The way you got up, because there's no elevators there, you could go up a ladder that was put on the side of it, but a 700-foot tower is a *long* way up. That's like crawling up a seventy-foot building.

You had to get up to the top, so what they did, and you talk about innovation, this rope came from the top of this cage. It was a wooden cage, probably about three feet by six feet, and it had a brace on each end of it and a single hook over the top of it. The rope went from that hook up over through the shiv and out to the back of a truck. The truck was on the hill out about 1,000 feet or so, maybe 2,000 feet, I don't know how far. So there was a man at the base of the tower, you would get into the cab and the man at the base of the tower would wave his hands and the truck would start up the hill, and as the truck started up, you would go up the side of this tower. But as you went up, you had to kick off the side because there were no guide rails and this thing would swing, sway in the wind and everything. So you're going up [and] when you got to the top, the step across was about eighteen inches. And believe me, that was the *longest* step I ever took in my life. It was a *huge* step because that's a long ways down. But it was interesting. A beautiful view from up there; [you could] see all of the test site.

Let me ask you a question: I've been curious about, not just with yours, you refer to the "cab" which contains the device?

Usually, yes. Can you shut it off for a minute?

Sure, and it's a good time to shut it off anyway. OK. Great.

[00:34:12] End Track 2, Disc 1.

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

What I wanted to understand was the derivation of the word "cab," why it's called "cab."

I can't answer why it was called a cab. I can tell you the connotation that it was used [in]. The cab is where the nuclear device is housed, and whether it's on the bottom of a balloon or it's on the end of the island, it was where—maybe "ab" came from "atomic bomb."

It could be.

I don't know. But we referred to them continuously as a "cab," whether it's on top of a tower, under a balloon, or whatever.

Great. That helps.

Or mounted on the ground.

Great. OK.

OK. I thought one of the things that you ought to record is, what is it like in preparation for a shot? What occurs at Nevada Test Site? I'll take you through it step by step and I'll discuss at least one pertivation to it, or two pertivations to it.

We start in the afternoon at four o'clock. It was fixed. The key people involved in the test would assemble in a meeting room at Mercury. The meeting was chaired by the AEC representative. It was either Jim Reeves or Max Smith or one of the others. It was co-chaired by the test conductor. Gerry Johnson was the one that did it the most. Chuck [Charles] Violet was there one time, or maybe more than one time, but he was there for Rainier.

We would meet there and a series of briefings would begin. The first briefing would be by people concerning weather, and these were experts from Washington. We got reports from

weather stations all over California, Nevada, Arizona, and Utah, and from that they tried to predict what the weather would be like at zero time when the device went off.

The next discussion would be on micro-barograph. And what this was, [was] one of the things they were concerned about was shock waves bouncing off the atmosphere and doing damage either in Las Vegas or Pahrump or even as far away as Los Angeles, where windows had got shattered. In preparation for that, they had stations around which measured pressure waves and they would shoot off some high explosives prior to the meeting and get their readings and information.

The third was a presentation by device people on what they considered the amount of radioactivity that would be released [would be].

There was a fourth briefing which then coalesced all of that data and they came up with a prediction of the fallout pattern based on the winds, wind direction, the amount of material that would be caught in the cloud and released by the cloud and the time it would stay in the cloud.

Once that was over, if it appeared that we were not going to hurt the people in St. George or Salt Lake City [Utah] or Pahrump [Nevada] or Las Vegas, the AEC manager would then say, Let's proceed to the next step. And we would break up and reassemble at eleven o'clock.

At eleven o'clock we reassembled at the command post. The command post sits between Yucca Flats and Frenchman Flat, on a ridge there. We would meet there in their conference room and get updated information. Assuming everything looked favorable, they would then [00:05:00] say, Let's go ahead and proceed. At that point, it would kick a task off for me, what's called a "T-party." We called them "T-parties" because it referred to the towers. We'd send

crews in and remove all salvageable equipment non-essential to the test so that they could be used at a later date.

At three o'clock there'd be a final briefing, and they would get a go-ahead to start the automatic sequence timer. From that point, it could go on. There was one point in the automatic sequence where you could abort it in case of emergency or anything.

One thing that had been going on earlier, to back up a little bit, is Security had been sweeping the test site to make sure [it was clear] because there were protesters and sometimes the protesters would try to wander onto the test site to interfere with the test.

All shots were scheduled to go off pre-dawn. And the reason for that was so that you could get the best photo information possible. The heat and everything else would not distort the images.

That's the way the program went.

There was one interesting sequence like this that occurred. We began at the four o'clock meeting and they could not predict the wind. With all the information we had, they weren't sure what was happening in the winds. So the AEC manager said, *Let's go to eleven o'clock. We'll adjust at eleven o'clock.* At eleven o'clock, we met again and they still did not have the answer. And this was a tower shot, so everybody convinced him to go until you had to start the automatic sequence timer.

So at three o'clock we had another meeting and the fallout prediction couldn't be made because of lack of sound weather information. So he gave the go-ahead to start the automatic sequence timer with the understanding that if they didn't have an answer by the time "abort" came up, that they would abort.

About ten minutes before the abort came up, they got a call. Everybody ran back and we got back there. What they found out is that there was a series of hyperbolic winds around the test site. They were coming from all directions. A hyperbolic wind, because of several different lows in the area, were causing that. And as a result, we went ahead with the shot and it was one of the best shots we ever had because everything dropped on the test site. So it was unique.

Interesting. Do you remember which shot that was?

No, I don't.

But it was during Plumbbob?

It was during Plumbbob but that's all I remember about it.

One thing I had left out in the discussion is we had observers for all of the shots, whether they were at Frenchman Flat or whether Yucca Flats. And at three o'clock when the decision was a "go" decision, they would get these visitors up, whether they're VIPs or the news media or whatever, and put them in a bus and take them out to an area adjacent to the command post. There are some benches built on the side of the hill, which is called Newsman's Nob [News Nob], and they would sit there and they would observe the shot. They would go through and there were loudspeakers there which would tell them when to put their glasses on, when they could take them off, and so forth.

[00:10:00] The effects to watch a nuclear detonation: I previously described what it was like in the Pacific. In the Pacific, you could see the shadow coming across the water from the pressure wave. In the desert here, what you saw was dust being kicked up as it came towards you and that was the pressure wave causing that. And so when that pressure wave got to you or you heard the bang, that was the first *sound* that you heard. Over the loudspeaker, they would tell you to put

your glasses on and you'd put your glasses on and wait for it to go off. You'd see this huge flash even through the dark glasses. Then you'd be allowed to take them off and you could watch.

A lot of things happened after that. In several cases, I went onto ground zero right after that, and I'll describe that later. But that was what a twenty-four-hour period basically looked like in a test.

There was one other test that occurred which is of note. In that case, I was in Las Vegas and I wanted to watch the shot; I was at the Riviera Hotel and I was up on a high floor with a window towards the test site. I knew the time; I'd called a couple times to make sure everything was go. And I'm standing there and I'm looking at my watch and waiting for it go to off, and it didn't go off. So I got on the phone to find out what happened and they said they went through the countdown and it didn't go. I immediately hopped in the car and went back to Mercury and we started scanning the drawings of the site. What had apparently happened is in the wiring in the cab, they had connected the device to the wrong power source so that when the T-party occurred and we took the transformer away at the base of the tower, we disconnected the power that allowed the device to be fired. And so they had to take the device down and re-whatever they did to it before it could be used again. That tower, I believe, was in Area 2.

In Area 7, where they had the balloon shots, the first balloon shot I saw—well, let me digress for a minute. The Navy wanted to see as part of its effects tests—in Yucca Lake bed, there were a lot of remnants of planes. They'd had them out there to see what would happen to those planes if they were subject to a nuclear bomb. So the Navy decided they would like to see what would happen if they brought a blimp in. They started a blimp coming in from Lakehurst, New Jersey. When it got to Guadalupe Peak in Texas, near Guadalupe Peak, which is north and east of El Paso, it got caught in a gust of wind there and hit the peaks and tore the blimp up.

So they sent another one. They anchored it initially at Desert Rock, which is the military camp. Then they moved it to Yucca Flat. Actually, we had an anchor set up there, a mooring anchor, and they moored the second blimp there. One night, I was at the movies where there was an announcement over the loudspeaker system – the movie was interrupted – calling the Navy crews back because the blimp had broken loose from its mooring and it was tossed into a hill over there, and *it* tore up.

They brought in a third one, and again it was moored at the same location but they [00:15:00] improved the mooring for it. And it was there when a shot was fired, I believe in Area 7. It was an LRL [Lawrence Radiation Laboratory, later Lawrence Livermore National Laboratory] shot. When the shock wave hit it, even though you had helium in it, it burned, and probably the heat on the surface of the material rather than the gas inside of it caused it, and it crashed to the ground.

So that was the story of the Navy's blimps that were out there.

But on that same shot, I guess it was a tower shot, I'm [not] sure whether it was a tower or a balloon, but there was enough heat generated from the device that the sagebrush on the side of a nearby hill caught on fire. We had to get people out there to put out the fire.

Now, this was from the blimp burning or was this from the device?

No, from the device itself. It was in that same area. Once you get away from the flats, you get these rises on every side.

So that's pretty much that part of the story. On the underground tests, they're a lot different. They're put underground to contain the radiation and we were pretty successful in that. There was only one exception to that where there was a fissure and it leaked. There's a picture of it down in the [Atomic Testing] museum.

Are you talking about the Baneberry one where there was—?

Baneberry, yes, that's Baneberry.

Were you there for that?

No, I was not.

Before you get to underground, let me ask you a question about atmospheric, because you talked about what it was like to see the above ground testing. I've never seen them, just in films, obviously. Do you get used to seeing that? Does it become routine in a way, or does it always remain—?

They're all similar and yet they're different. One of the things that happened is that just before the shot, they send rockets up on each side of them so they can watch the pattern. And if you look at some of the shots – these are in Nevada – you can see those vertical lines, and that's from rockets going up.

The first experience that you have is heat, a prickly heat. It's almost instantaneous. It travels at the speed of light. And you feel that. The light is intense, highly intense. That's why you have to wear the glasses, and you don't dare take off the glasses.

Now, speaking of that, Nevada used the tests as a magnet to draw people to the casinos. They published the dates. People came from Los Angeles, all over, to be in one of the hotels downtown or on top of them and look at them. Between the road to Mount Charleston and Lee Canyon, there is a road that ties them together across the ridge. There is a place up there called Lookout Point. People would go up to Lookout Point, which is probably about I'd say forty miles from the lake, but you can look down and actually see the test site from that point. They would go up there and, in spite of the warning and everything else to wear dark glasses, some of them

wouldn't and they got their eyes burned. But the Nevada Test Site was marketed [00:20:00] as an asset to the casinos. That is not what it is today. It's amazing, the complete turnaround.

You know there's low-level nuclear waste storage out there right now, and low-level nuclear waste moves through Las Vegas, moves through our highways. But they're moved through in containers that have been thoroughly tested. We're talking about Yucca Mountain now; I was on the OCRWM program with the Office of Civilian Radioactive Waste Management. I was an executive sponsor for that program.

Say the name again.

We called it OCRWM. Office of Civilian Radioactive Waste Management. It was handled out of [the] AEC in Washington. I was an executive sponsor and on the executive committee for that during early site selection for high-level nuclear waste storage.

So this is still the AEC days, then.

Well, no, this is the end of my career.

At the end of your career. OK.

But as part of that, we went through this whole scenario on nuclear waste and storage, and particularly the casks that we're talking about; they have dropped these high-level nuclear waste storage casks from airplanes, they've run into them with freight trains, and they can't destroy them. So the fear of nuclear—in spite of Oscar Goodman or our governor or any of the other politicians, and this is pushed by the casino owners. It ain't going to happen. I was on the CAB, Civilian Advisory Board to the low-level nuclear testing at the Nevada Test Site. The only incident we had was at Kingman [Arizona] where some fluid leaked out of a low-level container. As a result of that, at my initiative, they made a new study of those containers. The containers

were redesigned and they're completely safe and low-level nuclear waste continues to move through here.

In Kingman, Arizona?

In Kingman, Arizona, yes. It's on the highway. The guy parked his truck and all of a sudden he saw fluid dropping out of it. And that is caused because as you drive, the vibration of it shakes materials loose, and the fluids, and they go to the bottom. There was a stress point, and that stress point yielded a crack, and the crack allowed the fluid to come out. But it's safe up there.

But Las Vegas became an attraction for people, and they came from all over to watch it. And we obviously cautioned them, what we said, and all that other stuff.

Another device that went off was fired from an aircraft. There was only one fired from an aircraft while I was there, and it was fired off a missile. It was a warhead in a missile. It was called John, J-O-H-N. I went out to watch it go. It was fired somewhere over Yucca, the northern part of Yucca Flats. And where you have classically seen the mushroom cloud and the column of dirt and debris going up through it, what happened here, it was like someone had blown a cigarette ring or a cigar ring. It was a round circle, because there was no heat column to draw the material through there.

The underground tests, because they were contained, all you really felt was the earth tremor, the seismic effect. Now, at Rainier which was underground, the overburden, I believe, was about 700 feet above the top of the mesa. It was about 700 feet above the cavern. When it [00:25:00] went, what happened, it was in volcanic tuff, and volcanic tuff is a silicon material. I guess Chuck Violet told you this, but it's a silicon material. So when it went off, the heat caused that silica material to become glass and it formed a huge glass bubble. The support for that glass bubble was the pressure within this hollow ball of glass. But as it cooled, the pressure reduced to

the point that the pressure could no longer support the overburden. When that happened, it collapsed and formed a chimney effect. Now, we ultimately drilled into it and mined into it. But that phenomenology that occurred with the chimney and that was used in some of the concepts for the Plowshare program.

Interesting. OK. And you're saying "chimney"? "Chimlee"?

They called it a chimney.

Chimney.

Chimney. It's shaped not quite conical. It's shaped like that until it's strong enough to support itself. It didn't go all the way to the surface.

So it goes in with—

It started with the width of the glass cylinder—

And reduces.

And diminished and all of that material dropped to the bottom. It probably had a hemisphere left, and it dropped into that hemisphere.

Ah, OK. OK. Interesting.

But that phenomenology associated with that was used on Plowshare, a couple of projects.

Let me just ask a question here because before we went chronologically to Rainier, you were telling me a little bit about going into ground zero soon after an atmospheric test. Can you pick that up?

OK, I went into ground zero on more than one occasion, but two specific occasions I'll relate to you. One was in Area 7, and that was a balloon shot, so I have to go back when I was talking about it. That was a balloon shot in Area 7, and it was a Livermore shot. One of the things they were concerned about was when a bomb goes off it emits a lot of neutrons, and they were

looking for a methodology that would help absorb neutrons. They asked us to build an asphalt pad directly below ground zero which contained a borated compound, because they felt boron would absorb the neutrons. So after that shot went, part of my job as an engineer was to go in and find out if that happened. I took a couple surveyors with me and we went in and took Geiger counters. We started outside the asphalt pad. I believe the dimensions were about 400 by 400 square feet. We put up a grid and we walked in and took measurements every ten feet. What we found as we got closer to the pad [was] that the radiation increased. As soon as we got onto the pad, the radiation began to decline. That was because the absorption occurred. So when you looked at what we plotted, it looks like the Golden Gate Bridge. It builds up to the first tower, then it diminishes down, then it builds up as you went through the other side and out. So we did that in both directions. And as a result of that, I absorbed some radiation. That was that project, but we had to do it right away so we could find out the information.

The other one was at Frenchman's Flat. The Civil Effects Test Group had several [00:30:00] experiments there. There was a vault designed by a major vault company. There was an underground garage with a sliding concrete door to it, sealable door. There were three domes, two aluminum domes and one concrete dome. And I went in with a couple surveyors and we took pictures of what had happened. We were particularly concerned about the underground garage because that had been forecast as a civilian shelter and the government might have supported building more of those around as fallout shelters.

Those were my primary experiences going into ground zero, although I went into several of them.

I don't know whether I told you in the other session, but one of the interesting—did I tell you about my boss being color-blind?

You know, I don't remember, so tell me again.

OK. Sam Howell was my boss out of Los Angeles, and he would come up periodically to view what was going on, and this was during the early construction phase. And I took him out there in early spring, a drive through Yucca Flats. And I tried to impress him with how the desert was coming back to life. It's gone through its dormant stage and now it's coming back to life. And one of the unique features out there was underneath the shot towers, there was green grass. It was in a circle. The irradiation had actually aided the growth of a lot of things that you didn't even know were there. And so as we drove along I said, Sam, look at that. Look how green everything is. I said, Look under the tower. And he would say, Oh, yeah, interesting. Oh, yeah. And as we went around the site I continued to describe the colors to him. Got back to Mercury, and I didn't understand his more or less indifference to what I was saying. After he left and I told someone about it they said, Didn't you know that Sam is color-blind? So here I was describing something he couldn't see.

Yeah. Yeah. You didn't tell me that story, so thank you for telling me that.

OK. That was just one of those asides.

Yep. Asides are good.

Let's see, where else? I think that's pretty much a description of what happened during Plumbbob. I was there through all of them. When Plumbbob was over, they asked me to come back to Los Angeles and take over as chief project engineer. And if you can shut it down, I need another [break].

Sure.

[Recording is paused and then restarted.]

Yeah, OK, let's do that. So we're going to go—you're back in Los Angeles, I think.

Yes, my assignment in Los Angeles was as chief project engineer for coordination of engineering requirements with Lawrence Radiation Lab. I worked directly with Cliff Bacigalupi and Bob Petrie [sp], Chuck Violet, and the people involved in the upcoming tests for [Operation] Hardtack [I], which was to occur in the Pacific. In Los Angeles, actually my job caused me to spend at least one day a week in Livermore dealing with the people up there, and the other four days were overviewing the drawings that were coming out, making sure. And there were three of us chief project engineers. One was responsible for Los Alamos, [00:35:00] that was John Pollett who you may have met, I don't know, you may not have. John Pollett, and the other was Hal Perla, he was responsible for the military aspects of it. So each of us handled—and as a result of that, we were sort of rivals because we were pushing to get *our* work done by the design staff there, and who could be the most obnoxious to get *his* work done on schedule? And I tried on that. I was reasonably successful.

Oh, good. Where are Holmes and Narver's offices?

Originally they were on Figueroa. And they moved the AEC part of them down to the old Broadway Building on Broadway. We had a couple floors upstairs.

So they separated out the AEC portion.

They separated it. And originally in the Figueroa office, it was the second floor, and that whole building was dedicated. It was a Holmes and Narver building. And so all the classified work went on upstairs, and the unclassified work went on downstairs. So when I first came to the company, I worked downstairs until I got my Q-clearance, then I went upstairs, and that's when I began work on the design for the [Operation] Castle project. And so it made it easier where you didn't have the interface.

We went through that design. I went out about three times to the Pacific during this period. The first time I went out, I went out with Bob Petrie and Cliff Baciqalupi and we flew into Honolulu [Hawaii] and stayed at the Edgewater Hotel there. And I started getting a sore throat. And this was the time the big Asian flu came in. I wasn't feeling well, so I went up to my room, which looked down on the entrance to the hotel. And my phone rang. And I picked it up and I couldn't talk. I couldn't get a sound out. So I went over to the window and I saw the guys that had called me to come down to have dinner, and I couldn't even talk to them. They just finally went on, got in their car and went away. But when I got out to Enewetak, they put me in the infirmary out there and treated me for a couple days and then I went about my normal engineering business.

But as I told you in the previous [interview], they had that caste system out there, and on Enewetak—Parry Island was the island we stayed on, Parry Island—we had a metal building which was designed specifically for the Pacific. And half of the building was [divided] into individual rooms, and the other half or other third was a rec hall-type with a bar and all that. And again, that separation with the caste system, which I've never liked but enjoyed the benefits of it. And we stayed there.

We viewed a *lot* of the activities there. While I was there, they had gone back into Rongelap to see what had happened on the island, and they took some pictures of Rongelap. I have five of those pictures. Three of them I donated to the museum. And they're of the king's house and a couple other houses in the village, and a picture at Majuro of an outrigger, and I still [00:40:00] have two in my house here which I plan to give to them when I leave here one way or the other.

But one of the interesting things that happened on that trip, I was not there, but they found some animals still alive. The Rongelapese had been removed as a result of the Bravo shot. They received heavy fallout and they were removed to another island. Many of them subsequently developed thyroid cancer, and they were sent to Walter Reed [Army Medical Center] in Washington [D.C.] and treated there. And so it was interesting, from an experimental point of view, when they went back they found a pig and a dog and some chickens still alive there. They were able to capture the pig, and the pig was sent to Walter Reed and they made analysis of the pig. One of the things about the pig was that their skin is very similar to human skin, so they could get good radiological burn information off of it.

And speaking of pigs, I've got to go back and relate one more story about the test site. In Frenchman's Flat, they had the Civilian Effects Test Group, but the military also set up a farm there. One of the studies they were interested in is, how protective is the military uniform in case of a blast? So they had some uniform[s] out of normal khaki material made to suit pigs. And they put these uniforms on the pigs and put them in wooden stalls which held them in a fixed position in relationship to where Priscilla, which was the shot in Frenchman's Flat, went off, which was a balloon shot. When it went off, what happened, among other things, is that these wooden structures that the pigs were in hemmed in where they couldn't move broke. So the pigs were running loose. So the military troops were down there running around, chasing uniformed pigs. You know, you could make a comic strip out of that. Some of them were caught easy; some of them didn't want to get caught at all.

Did you see this?

I saw it, yes. I saw it, yes. We had other animals there.

I have a question that I don't know if you know the answer to, but we've had other pieces of stories about the pig uniforms. Someone said to me the other day, did they actually remake those uniforms so that they fit on the pigs?

Yes, they did.

With pants and tops, or were they just little jackets?

No, they were completely clothed in them.

They were.

Yes. They made them so they fit the pig.

Amazing. OK. Because someone, in amazement, when you look back on it, as you said, it's unbelievable, was curious whether it was just cut down—

No. No. No.

They were actually—

As I recall it. I doubt if I'm wrong but as I recall it that's—

No, I don't think you're wrong, because someone else had told me that—a military guy had told me that yeah, the quartermaster was told to make pig uniforms.

Yeah. Yeah. And they went to a tailor outfit and had them made. It would not make any sense if it didn't fit them like it would fit a person.

Correct. Correct.

I don't think the Army is that dumb.

OK. All right. Yeah, that's a good point. That's right. It would have to be covering the skin surface because that—

Sure. And you'd need the overlap, too. Because you may get different burns because of different thickness.

Right.

I don't recall whether they put chevrons on them or anything else. I wouldn't be surprised, [00:45:00] though. But there were donkeys there and there was a regular farm with cows in them and everything else. In fact, one of the scientists from Lawrence Radiation Lab, I forget his name, adopted one of the mules and actually shipped it up to Livermore and he had like a farm there and kept it.

Interesting. Very interesting.

But getting back to Hardtack, I was not there for the Hardtack shots. I came back. And when I came back, I was called into Chuck [Charles Wesley Jr.] Kelly's office. And Chuck said, Ray, we've got a new assignment for you. There's a program called Plowshare. There's an initial project we think is going to be in Alaska. Put on your new uniform and head for Livermore. And so at that point, I became chief project engineer and program manager for Plowshare. I had project managers working for me who managed the details of the individual ones on site, where I did all the coordination and planning for it, was responsible for it, and dealt with Livermore, and when we go into that next session, I can tell you about the Blue Sky conferences and what occurred there and what my role was and some of the interesting events that occurred.

Right. One question about this. Did you literally have to move to Livermore at that point, or are you still commuting?

No, no, no, I lived in Palos Verdes at that time.

OK. OK. This has been great, and just about a good time, a little less than two hours. I had one question. Yes, two questions in my notes. When you say "T-party," are you saying "T" with a "T"?

We just referred to as a "T"—

A “T” party.

And that is because it was removing equipment from the towers.

Right. And you said the word “micro-barograph”?

Yeah.

That’s the correct word. I want to be sure.

I think that’s the word they used.

We can look it up.

I was not a specialist on it. But what they did is they shot off these HE—measured the pressure waves at different locations off the test site, and they were concerned about the pressure wave bouncing off the atmosphere. So it depended on what was happening in the atmosphere, and you got a bouncing effect. They broke windows in Los Angeles, and it broke windows in Las Vegas, but at times when they broke windows in Los Angeles, they didn’t break them in Las Vegas because the wave skipped.

Interesting. Interesting. And speaking of waves, really early on you used the phrase, and this was when you were still in the Pacific, “precursory waves”?

OK, when a shock wave comes across the structure, it’s a pressure wave. The opposite site is called a precursor. And it’s a vacuum.

OK. So I think we’ll insert that right where you used that word and then we’ll have the definition.

And then the last question is really a content question which is, you referred to the security sweep out at the test site before the test, and the protesters. So what is your awareness of protesters during the fifties? Because we know a lot about the protesters later.

Well, they started at the same time. They were at the gates. When you go up there, you go up Highway 95 and then you turn off. On the left-hand side is Desert Rock. Then you go up to the

gate. They would line up out there and heckle the men coming in from Las Vegas to go to work, the REECo people, the subcontractor people, my own people, some of my people that I told you lived in Henderson. They would try to sometimes block it and sometimes just heckle, wave their signs.

[00:50:00] One area I did not mention which occurred at the end of my tenure up there was they had opened up Jackass Flats. Now, I know it as Jackass Flats. It's currently referred to as Area 25. So connotations change over time, but my reference is Jackass Flats. And one of my responsibilities was to survey the roads into there and lay out the roads and new construction for the roads in there, and set up the preliminary test site. And that was going on as I left Nevada.

OK. Right. OK. I think this is a good stopping point.

Does all of that stuff make sense to you?

It makes a lot of sense, and it's very helpful, so thank you.

I hope I add enough color to it to make it interesting.

It's great.

[00:50:57] End Track 2, Disc 2.

[End of interview]