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K-25 Oral History Interview

Date: 4/15/05

Interviewee: Richard Macklin

Interviewer: Bart Callan

DOES NOT CONTAIN
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Name/Org: Richard Macklin ETTP Date: 4/15/05
CISCO

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Exemption number and category: #2 Circumvention of a Statute
Department of Energy Review required before public release.
Name/Org: Gary W. Snyder 721567 Date: July 14, 2005
Guidance (if applicable): CG-SS-4, September, 2000

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[1:00:07]

Callan, B.: Go ahead and state your name and spell your name out for us as you'd like to have it preserved on tape.

Macklin, R.: R-I-C-H-A-R-D M-A-C-K-L-I-N

Callan, B.: How old are you?

Macklin, R.: 84.

Callan, B.: Why don't you give me some background about yourself and tell me where you were born, and you can expand on your childhood or growing up if you want to.

Macklin, R.: I was born in New York City actually, Long Island section of the city called Queens, went to Jamaica High School, got a scholarship to go to Yale University. Managed to get through there and finished up and got my Ph.D. and applied for a job in New York in the middle of World War II. Got a job with Union Carbide Company that started me off at Columbia University, where I was preparing to work down here in Oak Ridge. Laid out the physics lab in the back of K-1004A, the back end, the library was in the front end of "A", and there was also a "B" lab, which mostly did alpha counting and a "C" lab that did spectrometry.

Callan, B.: How old were you when you graduated, before you came to Oak Ridge?

[1:02:36]

Macklin, R.: I was born in 1920, so I guess when I actually came to Oak Ridge, I was still 23.

Callan, B.: And you said you lived in New York entirely before you came down here?

Macklin, R.: Except for New Haven, Connecticut, where I went to school.

Callan, B.: Why did you come to work at K-25? What was it that attracted you to come? How did you hear about it?

Macklin, R.: Well, I was just looking for a job. I'd interviewed with Bell Labs and a couple of other companies I think. These people thought

well, you know, you got an uncertain draft status, and we want you.

Callan, B.: So what company was it that you were interviewing with that you got out to K-25?

Macklin, R.: Union Carbide.

Callan, B.: When you came out here in 1944, what were your first recollections, first thoughts, when you arrived out here and saw K-25?

Macklin, R.: Well, it was still a place in construction.

[1:03:47]

Callan, B.: What was that like? What did it look like?

Macklin, R.: Oh, mud on the roads; buses to go back and forth from the dormitory with one little room.

Callan, B.: Was it something different than you'd ever seen before?

Macklin, R.: Well, it was an industrial place. I wasn't familiar with such a place, of course. Nobody was. [laughs] There were a lot of interesting people.

Callan, B.: What years did you work out at the K-25 site?

Macklin, R.: '44 to '52.

Callan, B.: After '52, did you stay out here and transfer to a different site?

Macklin, R.: Yes.

Callan, B.: Can you give me your background at K-25, including the years, and what you did after that?

Macklin, R.: Over at X-10, I guess you would call it, I worked in a physics division over there for a long time. They changed names to neutron physics and so forth -- retired finally in 1990.

[1:04:59]

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Callan, B.: How did you commute to and from work? What were the living conditions?

Macklin, R.: I mentioned busses already. I have a recollection of one, which going down the hill to K-25 did a bump, bump, bump, broke off a front wheel. So it went rolling down the hill, crossed over the lanes. Cars were dodging it on the way up. They telephoned and called up another wooden bus, picked up everybody and moved us on; got us going.

Callan, B.: Is that how everybody got to work, was by bus?

Macklin, R.: At that time.

Callan, B.: Where did you live? What were the living conditions like?

Macklin, R.: Oh, it was called Salina Hall and it had dormitory rooms, one room per person and a bathroom where you can wash the mud off your shoes as soon as you got home. You went out to eat in a cafeteria.

Callan, B.: If I had absolutely no background, what was the work that was done at K-25? How would you describe it?

[1:06:24]

Macklin, R.: Well they were getting a factory running basically. My own job was in the, as I said, in the laboratory division. Things were, you know, very friendly. One of our jobs was to run around all over the plant, collect little samples, and bring it back to the lab and see if they had any activity on them and things like that.

Callan, B.: Tell me about some of your most vivid memories about the time that you spent at K-25.

Macklin, R.: Here we go! Vivid memory of a fairly short fellow named Herman Rappaport. He wasn't directly involved in the lab. I think he might even have been running around taking messages to people and things. He liked to be the first one to know everything. So, when he heard people saying, "Here comes Herman," he thought it referred to him and when they were shutting up about Herman, it turned out this was a code name for some equipment that was coming down to lab "B", and it's going to be a special room back there, that was barred off and a lot of work going on to make to extra special, concrete walls, locked doors. It had a hole

in the floor to pull some radium up out of. Turned out that the Herman that was being talked about was a thing on four pipe legs, a big fat sort of thing about as tall as you are; a project my colleague, Harold Beyer, who worked up at Columbia and had a Ph.D. in physics. It was supposed to be shipped down form Columbia any time. So they were talking about its arrival and when it was due and when it was postponed to, and so forth.

[1:08:34]

But Herman got very upset about this, that people were talking about him behind his back and they wouldn't say anything. So the people over in the mass spectrometer lab, as I remember, are the ones that came up with the idea that well we'll modify this and call it Big Herman and boy, that got to him! [laughs]

Callan, B.: Was he a big guy?

Macklin, R.: He was a little, short fellow, proud as a peacock. [laughs]

Callan, B.: Oh what a story!

Macklin, R.: You get the joke, right? [laughs]

Callan, B.: (indiscernible)

Macklin, R.: That's the sort of thing that went on, good camaraderie.

[1:09:22]

Callan, B.: Any other interesting stories or any other vivid recollections that you have?

Macklin, R.: About that story?

Callan, B.: Any stories about K-25.

Macklin, R.: Oh yes. I had a whole bunch of them lined up.

Callan, B.: This is the stuff I'm looking for, so please just keep going.

Macklin, R.: One of our jobs was taking around a little needle of platinum coated around the outside with a tenth of a gram or so of radium to carry around in a lead container and put into a lead block that would slip into a -- we had a long pair of tongs, pick it up and put

it in carefully. That was a small amount of activity, but it was more than anything else around.

And we switched this over to other employees. There were many Army people with us. In fact, we wound up with a group of about 22; I think, I counted at one time before they split off into second activities. And this was to look at the intensity of radium, gamma rays that would get through the number of tanks that were at the top of the plant, sort of scrubbers for the off gas, leaked out of everything.

[1:10:49]

And they would gradually fill up with -- picked up some uranium, and the uranium would be less responsive to the gamma rays going through and so forth. So we would carefully map these every week or month or anything there was a special reason to.

And one day, of course, one of the people that were measuring managed to let his tweezers slip. He didn't notice it at the time, but later when they got back to the little office where they plot up their results and see whether they needed to change out this trap or not, they sort of set that alarm going. We've lost our radium. And radium was very valuable in those days. We didn't want any of that setting around or somebody could break it or eat it or anything happen. So we got dispatched over the lab quick to check up on these guys, find out where they'd been, what they'd been doing, take along some primitive portable Geiger counters that you listen with the earphones on your ears and it goes click, click, click all the time from normal cosmic rays and all that.

So we started scouting all around and around and up the hole and down; got everybody out of there, of course, first; didn't want anybody contaminated. I got about 40 feet away in one direction. My colleague got off in the other direction. Finally says, "You know, that sounds a little louder than it did." We went a little further, a little closer. "Hey, we got it. Come on let's see what we can find here."

[1:12:38]

And we tracked it down to a big metal trash barrel. So we got sheets of paper and laid it out and poured the stuff out and divided the stuff in it in a pile here, a pile there. Finally found that there was the radium. Got it back in its lead container and went dashing

off. But they got a rather unpleasant boss at the time, and when he saw me heading for the bus afterwards, he said, "What do you mean quitting with this stuff sitting out here in the plant? Don't you have a responsibility?" And we found it, and I dashed home to get home on my bus.

Callan, B.:

Oh wow! Yeah, these are very unique stories, let me tell you. As far as the safety and the handling of materials, it sounds like everybody was pretty cautious overall.

Macklin, R.:

Well, our job was you don't hunt around to see if we could find anything. As I remember there was only one place in the plant that they'd even bother to provide lead shielding around one piece of apparatus. It turned out that was a feed tank they were going to boil stuff out of and it would collect radiations while the uranium went on. They never used it.

[1:14:07]

The whole place was really very safe. They gradually got film badges that everybody would use. But at first, of course, they didn't have all of that and we were supposed to collect samples wherever we went. Actually were sent down to the thermal diffusion plant that was maybe a mile away, toward the river. See what was going on down there, take samples. They had more stuff escaping, I think, in the steam.

They told a story of one of the Army people that had climbed a 20 foot fence to get away from a broken valve or something like, spewing out some fumes.

Callan, B.:

What did you like the most about working at K-25?

Macklin, R.:

That we had a great deal of freedom in what we studied. One thing we got to do was to compare the product that was coming from the first stage at Y-12 with a product that had gradually built up to running the plant at the stage to make the same concentration of 235. The 234 that was in it, of course, was much more enriched at Y-12. So we were able to prove there was a penetrating radiation from enriched uranium. We thought gee this would be a good thing to keep as a secret. But it turned out that as soon as we got into a classified report, it got declassified by Glenn Seborg and put in his table.

[1:16:01]

But we had people building portal monitors that could pick up this radiation, even though our colleagues were telling us, "Gee, you know, it could hide that pretty fast if you put your uranium inside a lead peg." So there you are trotting out the door with a lead box. Well, of course, we would find that with a metal detector. Well you didn't have to use a method. You could use a litharge a compound of lead to do the same job. So it's not going to be perfect, even you did have a secret, nobody knew there was such a radiation, even to look for. Those days are gone. It's published.

Callan, B.:

What did you dislike about working at K-25?

[1:16:48]

Macklin, R.:

Nothing much to dislike about it. You know, it was rough and tumble and all that. At first, they had a laboratory directory and they thought that measuring alpha activity was going to be a big thing and they devoted a whole wing of the lab to that. It worked pretty well when you have very little enrichment if you're running tests on whether so and so's machine or another approach had produced some enrichment of uranium. But once you started to try and make it quantitative -- then the difference between 234 and 235 wouldn't show up very well.

So then they thought of mass spectrometers, which measure the masses more directly. And that worked pretty well except the fellow that first had done spectrometry and found that the side effect that was difficult. A man named Mosely that worked in England discovered different isotopes of elements. He found that when he first brought fluorine into his machine, it resurrected the ghosts of all the other samples he'd ever measured.

So K-25 then they found that if you tried a mass spectrometer machine on a sample that was a little different than what it had looked at before, you tended to get a little bias in your result. In other words, you're contaminating your sample with your measuring machine.

[1:18:037]

So that led to another investigation, "How can we calibrate all these things and restrict each one to a narrow range of assays correct for this?" We got into that too, to use this newer machine that I'd mentioned, Big Herman. And show that they really had

cleaned all the 235 out of the sample down to a very negligible amount for some special samples. Then they could gravimetrically combine high enrichment and low enrichment to make an exact intermediate value and use that to calibrate the various machines that they had used to maintain inventory. Of course, they were trying to live up to ever-tightening restrictions on a modest handful of uranium. You could not explain this to just where it is or what it's doing, compared to the tons that they had at the plant.

Callan, B.: You're pretty familiar with the layout of the K-25 building?

Macklin, R.: The layout?

Callan, B.: Yeah. If I'm someone that has never seen the building before, describe to me what K-25 looked like and --

[1:20:15]

Macklin, R.: It looked like a U-shaped building. And it essentially followed the enrichment of the uranium. You started at a low point but not at the bottom, and you de-enriched the stuff at the bottom, and you enriched the stuff as you went on and up. It was made in circulating cells, as you went along. And the top section was most of the control equipment, and the lower section was the blowers that blew the gases through the separating equipment.

Callan, B.: Just kind of move through K-25, as much as you can recall, the different levels. And so, at the bottom, there's what people call the vaults. Describe the vaults to me and tell me what they were used for and what they were like.

Macklin, R.: Well, they were kept at a high temperature to keep the material in a gas form. We once had to go in and survey inside. They just dressed up in extra heavy clothing, carried detectors around, made samples, inside of the cell, I guess they called it. It had maybe six circulating things, feeding one another, input and output, and maybe 100 or 200 of these different cells of different sizes, depending on where you were in the plant. I think the temperature there was like 130 degrees, Fahrenheit. So we were pretty well protected in our suits; didn't stay there for very long.

[1:21:03]

Callan, B.: Those were inside what is the --

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Macklin, R.: Inside the sealed separating units.

Callan, B.: And that was on the cell floor. Below the cell floor, they've got these concrete structures they called the vaults. This was underneath --

Macklin, R.: I'm not sure what you mean. I suppose there were some things to lower down, to circulate the air, and those sorts of stuff like that. I had the impression that there was sort of -- most of the equipment was on a bunch of concrete peers to support it all because it was very heavy stuff on the main floor. And then the upper floor was just very light and had walkways and bicycle ways. We used to bicycle one end to the other. It's over a mile long.

Callan, B.: Then above the main floor, there was a pipe gallery, correct? Did you ever go up into the pipe gallery?

Macklin, R.: Oh yeah. I did.

Callan, B.: Describe the pipe gallery to me.

Macklin, R.: Well, pipes here and there, pipe railings on the walkways as they say. You could ride a bicycle down them. They're just walkways. This was the place where we'd survey the off gas traps. They were filled with carbon nodules, basically. Sort of trap you use on a steam plant, if you had a small one.

[1:23:48]

Callan, B.: What about the operations floor? No one has ever told me anything about the operations floor. What were the controls like? What did the operations floor look like? How did they work to open and shut the valves?

Macklin, R.: Two levels, I guess you'd say. One was looking at just your particular little building's worth and see if the pressures were right to feed dry nitrogen to some of the rotating parts where it would sort of flush uranium back in and air with moisture in it out. And then there was the main control room down at the elbow of the U that had recording equipment for what was going on, how much was flowing from here to there and here to there. Sorted building by building, even been some talk of trying to preserve that room. It looks about like a control room in a reactor or control room in an electric plant.

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[1:25:01]

Callan, B.:

Were most of the valves operated by the central control room just by pushing a button?

Macklin, R.:

That's another one I got into. My worst embarrassment, I guess; well, I didn't realize it at the time. I had been asked to study and see well what do we do if we had a big air leak and all this gas inside got pushed up in one place and condensed out on a condenser up at the top end. I had to cool the gas too as it got so much hotter going through all that stuff. So there were condensers all along.

Well, it would all get collected together and somehow it would get critical and then we'd have a big accident. So what should we do about that? Well that involved getting into details of how much was where and when and all that. But I came up with a prescription I thought was pretty safe. It would allow you say okay, if you put in two places, I think, of a fast-acting valve, it would separate one section of the plant from the next, just turn it back on itself. It's already spinning around and around in little eddies you might say. Anyhow, and if your block goes too quick, you can stop this sort of an accident from happening.

[1:26:30]

When my report got reported out to the management and all that, it had been through its local reviews. There was an outside review group, and here came one expert. "Oh, I never saw that graph." The equations were in the paper, locked up in a safe, of course. I guess he got to read it. And he didn't think that was good enough. So they went back and recalculated and after a while it turned out you should maybe move those a little further toward the top of the plant. That sort of cut me out of the criticality business. I wasn't safe enough.

[crew talk]

[End of Tape 1, Begin Tape 2]

[2:00:18]

Macklin, R.:

-- one was a job for people up at Chicago that wanted a special sample. We got assigned to pick up decay products of uranium in an old feed tank that sat around to build them up.

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Callan, B.:

Let's talk about the next topic that you had on there that we hadn't gone through.

Macklin, R.:

Okay. This was one was a request for stuff that was called ionium at the time. They wanted to get a sample to do further experiments on. It's a decay product of the uranium 238; its thorium 234, I think. No 230, thorium 230. Of course, it wasn't completely clear at the time. It had a name ionium. So, people suggested yes my little group could go ahead and try to get that sample for them.

[2:01:27]

So they were supplied with a tank, maybe so big and so tall and screw cap at the top. And we got up a jug of special distilled water, went over to one of the plant feed sections. Had a building like a garage with a big door and a concrete apron out front. We brought along a big wrench to take the valve off of the tank about as big as a human body, I guess. It wasn't really one of the big tanks. And it had an electric hoist to lift it up, pour some water into it, and put the cap back on. We'd take it out on this front apron, take the big wrench that we'd been getting stuff off with and put it on the concrete. We got a couple of people on one side and a couple of the other and they would roll that tank across, go from one group back to the other. And when it got to the wrench, it would give a slop and a slosh and wash the walls off well, where the deposits of ionium was.

[2:02:43]

We spent maybe a couple of hours at that, and we got tired of counting how many times we'd gone back and forth. So instead of saying, "one, two..." He said troknen, which is a German word for dry -- which is a German word for three. Then I got to the other side, and he said, "ankst" -- which is a German word for fear, which is a German word for four. And I was so astonished at that man on the other side; we all just broke down and said, "Geez, that's pretty smart." We finished up the job and then we turned our little tank over to people that were supposed to ship it. And then we didn't hear any more for a couple of days until we suddenly got an alarm call. "It's leaking. It's in an airport over in Memphis," that's on its way to Chicago by air. "Hurry, hurry -- get over there."

So we started off, me and my boss at the time. Took the government car to drive down to Chattanooga day and night to get over to Memphis to rescue this stuff and bring it back to Oak Ridge. Well, we got as far as Sweetwater, I guess it was, or about there. A fellow in front of me, apparently was getting ready to talk big time to his girlfriend and he turned into the middle of the field where there's a little entryway where tractors and trucks go in. I was trying to pass him at that point at excessive speeds, I must admit.

[2:04:39]

I only bumped the back end of him, but they told me if I had been a bus driver, I would have lost my license trying to pass him without sitting back and seeing what he was going to do.

So they shipped off another guy with a portable counter by plane to see what was going on, make sure it was safely guarded to where we got there. So we went back somewhat more sedately. And the best I remember was getting near the Memphis airport and the rain coming down so hard you couldn't see through the windshield. You had to open the side window and look out, with your head out in the rain.

But we got there, wipe this and wipe that, take it over and count it. The stuff leaking out didn't seem to be radioactive. It was in a big wooden box, and we got it in the truck and brought it along back.

So eventually, why, it turned out indeed that this container that we turned over for shipping. We carefully turned upside down and tipped and all sorts of tests done to make sure it was clean. It had been turned over to somebody else yet again to put it in this wooden box. They told them to pack it in sawdust. Unfortunately, the sawdust they used had been in a pile out in the rain.

[2:06:19]

So when the box leaked --

Callan, B.:

It was an issue of wet sawdust.

Macklin, R.:

So, there was some delay in delivery, but I later heard from the guys in Chicago it was a very fine sample and just what they needed.

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Callan, B.: That was good it was a false alarm. There was another story that you said you wanted to tell. There was another topic that we hadn't discussed yet.

Macklin, R.: Well, I guess you could say that was a little bit embarrassing too.

Callan, B.: Okay.

Macklin, R.: My girlfriend, close to fiancée, was still up in New Jersey, so we'd write back and forth. The boss' secretary had a fiancée who was in the Army over in England. She needed to be shepherded around, and we went to plays and we went to hikes and things of that sort.

Well, she'd wear her engagement ring one day and some days she didn't wear her engagement ring. I eventually figured out that, you know, maybe she had different ideas about what was going on than I did. So things got sort of sticky when Jenny finally came and worked here in the spring of '45. Her trip down after interviewing and being tired, hired so forth. She was on the payroll and ready to move her stuff then, including her car. I went up and helped her move down.

[2:07:44]

So my colleagues saw an opportunity there. They put on that they were FBI agents. Got me in the front seat of the car, with a driver, and a couple of inquisitors in the back seat and so forth and details of this trip down, whether I had brought a woman across the state border for illegal purposes. And well, they didn't explain until some time after they had gotten us to write all the details down in a letter that this was supposed to be just a joke, you know. We were kidding you.

Well I said who my colleague who explained this to me when he gave me back the letter that it would be more of a joke, I could take it better if you hadn't opened the letter, explaining where we stayed in separate rooms at night and so forth.

Callan, B.: This is your wife?

Macklin, R.: This what?

[2:09:17]

Callan, B.: This is your wife that you were to marry?

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- Macklin, R.: Yes.
- Callan, B.: Let me ask you about that. You guys were dating prior to when you were working at K-25?
- Macklin, R.: Yeah, we had dated to some extent up in New York. We went to some sort of a public thing. I don't think it was a ballgame along with a friend, Harold and Harriett Vyer.
- Callan, B.: How was it that you got her to come down here and work with you and work with K-25?
- Macklin, R.: Well at least from my point of view the problem was that they started talking about drafting nurses and sending them off to the warfronts. I thought she might be more valuable down here. I got one of the M.D.s to write to her, and he extrapolated and said he thought it was a love interest here as well. I said it was. And she moved, and didn't go in the Army.
- Callan, B.: What did she think about it down here?
- Macklin, R.: Well, she's your other interview just in the other room. She can say for herself what she thought.
- Callan, B.: Okay. What about communication in general with your coworkers and communicating in a secret setting?
- [2:10:51]
- Macklin, R.: Oh, very restrictive. You're supposed to, not to tell them anything. You're supposed to – most people doing things in the laboratory were quite thoroughly aware of what was going on and whether the product was to be used for energy production as it eventually – it has largely been.
- Callan, B.: Was it hard making sure that you were communicating inappropriately with coworkers?
- Macklin, R.: We had signs all over. Don't say anything. You could see a sign with the security man here. He says, "Oh, what did I say wrong?" You can't get any guidance on that or they'd let you know what you said wrong and that's classified. [laughs] There wasn't a great deal of classified but a great deal of don't say anything, and then you'll be sure you haven't said anything.

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Callan, B.: Did you and your wife have different clearance levels?

Macklin, R.: Have different --

Callan, B.: I guess levels of clearance. I guess there was different --

[2:12:05]

Macklin, R.: No, generally, I think there was just a Q clearance; an FBI investigation and then a Q clearance.

Callan, B.: You have told me a little bit about what the physical working conditions were like at the facility but tell me a little bit more about, you know, what was it like working there? You said it was kind of hot on the cell floor.

Macklin, R.: Oh, that's inside a cell, not on the floor. The floor wasn't too bad. We wore our old clothes. Expected sometimes to get them messed up, I guess, wore mud on your shoes about died from where they not bothered to pave everything.

Callan, B.: What rules out there were important follow?

Macklin, R.: What rules important to follow?

Callan, B.: Perhaps safety-wise, security-wise. Any important protocols that you had to really pay attention to?

Macklin, R.: Well, I guess people had their most concern about was -- the lie detector tests. They'd be afraid that they'd be asked if you ever taken any uranium out of the plant. They knew perfectly well that they walked everywhere and there's probably a little bit of uranium somewhere. And the bottom of their shoes had some on it. Can they say -- about the best they could do, I guess, would be to say, "Not intentionally," and that doesn't go very well with a lie detector man.

Callan, B.: How often were lie detector tests given?

Macklin, R.: It would vary a great deal with the access one had to information.

Callan, B.: And what sort of questions did they ask? I haven't heard anything about lie detector tests.

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Macklin, R.: Well, probably the sorts that you ask too, disarming sort of ones and then they'd pop a real question in somewhere along the line. How do you like it here? Is anyone giving you a hard time? And on and on.

[2:14:32]

Callan, B.: What was your supervisor like?

Macklin, R.: I had several. The ones that were close to me did just fine. I liked them pretty well. A little further up the line they had a laboratory head who had invested a great deal of his technical interest I guess in the alpha process or alpha counting process extended to -- finally wound up to be just qualitative. He left as soon as the war was over, I think. His assistant who moved up to be lab director was rather a difficult fellow.

I had a supervisor in between me and him for a while, finally about 1950 or 1951, he started trying to tell me things to do directly and bypass the intermediate man. I felt my insulation was growing too thin. So I began to look about too when they said, "Well, we've decided we're going to reorganize, and your little physics department back here in the back of lab "A" is going to get down to two people. And you and Jerry Knight can stay with us and all the rest will be moved into other groups or otherwise reorganized."

And I thought, well there are people here at X-10 doing work that I would be much more interested in doing, developing new detectors and studying radiations. I think it's time I left. So I got fairly stubborn. I was not going to accept reassignment at K-25, if they were willing to move me, okay, but if not, I was out of here.

Callan, B.: Okay. What about your coworkers? What were they like? Did everyone pull their weight more or less?

Macklin, R.: Oh, absolutely! Maybe one or two were a bit slower than the rest - - some of them, particularly the Army men -- were very bright fellows. They were drafted into the Army and then assigned to work here.

[2:17:18]

Callan, B.: So I guess you had people working at this one facility that were workers from different, employed through different companies and also you had the Army folks out there as well. Is that correct?

Macklin, R.: Generally, the Army people, I guess were ones that they felt had special training or college graduates and things like that.

Callan, B.: What kind of health facilities were available to you?

Macklin, R.: Health facilities?

Callan, B.: Uh-huh (affirmative).

Macklin, R.: [laughs] We had a medical clinic basically. I remember one time I had gotten a bad head cold. The boss had sent me over to the medical department and I think they thought I was drunk, but I don't drink at all. So, they sent me back over to work and the boss would say, "Gee, he's just dragging around here. You better do something for him." And they'd send me back over again. Eventually, I think I got sent home early that day. It was close to New Year's too so they probably had suspicions. [laughs]

[2:18:46]

Callan, B.: Did they do regular health monitoring? You did a lot of testing on the facility, but was there regular health monitoring done to people while they worked there and what kind of monitoring did they do? Did they do like regular physicals?

Macklin, R.: Oh yeah. We had physical exams. As I mentioned earlier, they fairly rapidly started distributing film badges to detect radiation. They developed those further and further to where they'd record neutron exposure, as well as gamma exposure.

Callan, B.: Okay. You were working out there during the Manhattan Project. You were out there in 1944. Did you pretty much understand what the function of the K-25 facility was at that time?

Macklin, R.: Yeah.

Callan, B.: Did most people out there have a pretty good idea of what they were doing?

Macklin, R.: My wife used to tell -- maybe she told them again. Her tale of first coming and seeing the plant with some dead trees out a lagoon nearby, said, "Oh, that must be the periscopes on the submarines they're building." [laughs]

[2:20:18]

Callan, B.: What about on August 6, 1945, and that was the day the first bomb was dropped?

Macklin, R.: I don't think many people got a lot of work done that day.

Callan, B.: Well tell me about that day. Tell me --

Macklin, R.: I don't even remember that day.

Callan, B.: You don't even remember? Do you remember what the atmosphere was like or what people were doing?

Macklin, R.: Newspapers, much hoopla when you got home. What had been on the radio, who said what.

Callan, B.: Were people pretty excited?

Macklin, R.: Oh yeah, they were excited, but I didn't hear of any going mad.

Callan, B.: What did you think? What were your thoughts when the first bomb was dropped?

Macklin, R.: Well, I guess -- most people and I were sympathetic with the Army people that were not going to have to invade Japan. Of course, that wasn't entirely clear with the first bomb.

[2:21:27]

Callan, B.: How do you think that history will view the Manhattan Project and its outcome?

Macklin, R.: [laughs] I guess there is some truth to the saying later that the Manhattan Project felt that it really had to make a big splash like that in history; otherwise, they'd be raked over the coals for ages for having spent so much money. So they sort of felt they had to go through with it, some of them.

Callan, B.: If you could relive those years that you worked here or relive those years in Oak Ridge and K-25 during the war, would you change anything?

Macklin, R.: I wasn't in a position to change anything except myself. I was a small cog.

Callan, B.: After World War II, and this is where a lot of the people I've interviewed, they call this the expansion program or expansion period. Do you know much about the expansion period? Where does that begin and exactly what was that?

[2:22:53]

Macklin, R.: Oh, I was on a couple of review committees so they kept me informed of how things went, some things at least.

Callan, B.: What was the expansion program?

Macklin, R.: Building more buildings to process more uranium. Eventually, they went to Paducah and Portsmouth in Ohio. They almost started to build a --

Callan, B.: I think Kentucky -- isn't Portsmouth in Kentucky?

Macklin, R.: Kentucky, as what? Portsmouth is in Kentucky.

Callan, B.: Right. Go ahead.

Macklin, R.: Two more plants were built for diffusion work. They started to build one for centrifuge work and called it off at the last minute.

Callan, B.: The function was to enrich uranium. The original role was to win the war. What was the purpose for producing this uranium after World War II?

Macklin, R.: Well, advertised purpose, and I guess the thing that motivated Washington was the struggle against communism.

[2:24:12]

Callan, B.: Do you remember any stories or recurrences that happened during this period?

Macklin, R.: Well, I remember one I'd heard of. Somewhere in middle to late 50s, I guess, the plant was shut down by a fire in an electrical transformer. So we had no power and everything simmered down and got cold and the uranium precipitated out, turned solid. I had heard that the chemistry lab had discovered a treatment which allowed them to get the things going again afterwards. And in retrospect they said there actually was an electric power line that

went over to the X-10 plant that could have kept things moving in warm. They didn't have the sense at the time or the planning to have realized that they might need that. Misuse of it.

Callan, B.: They forgot about the simplest answer, probably being the best at that point?

MACKLIN, R.: But, of course, they didn't want to let out that their plant was shut down for a period of time, that wouldn't have fitted into their cold war scenarios.

[2:25:49]

Callan, B.: Right.

Macklin, R.: Comfortably.

Callan, B.: What are your thoughts now about how the activities accomplished at K-25 revolutionized the world?

Macklin, R.: Well, history is an ongoing --

Callan, B.: Well, we got five minutes on this.

Macklin, R.: No more tape?

Callan, B.: No, we got five minutes left on this one. Go ahead and talk.

Macklin, R.: That's five fingers.

Callan, B.: Yeah.

Macklin, R.: [laughs] Who knows what the future will bring.

[crew talk]

[End of Tape 2, Begin Tape 3]

[3:00:09]

Macklin, R.: I think we got through most everything I had.

Callan, B.: Is there anything we didn't cover?

Macklin, R.: I had a few more details and tried to find why --

[crew talk]

Callan, B.: There were a couple of topics on your list that we didn't cover, and I wanted to go back to those and make sure that you had the opportunity to talk about those things. The floor is yours.

Macklin, R.: Well, they brought in an expert from out of town at one stage there, educate everybody on statistics. And he tried to make this important to us; the results were duplicate analyses.

[crew talk]

Macklin, R.: That's four raps. Only four minutes left.

Callan, B.: Right. Okay. We're going to go ahead and restart that story for us.

Macklin, R.: They brought in an expert to teach us about statistics. First practical example he gave us of why it should be important to us was a linear regression analysis on duplicate samples, which is as the enrichment of uranium went up scatter between them went up and as they go down closer to the bottom of the plant, they got less. And he fitted a nice straight line to this and showed how the statistics should vary and what should be this and that. People finally pointed out to him that extra scatter down at the bottom end of his graph was because the feed point wasn't at the bottom; there was, after all, some uranium 235 in the natural uranium. And that the depleted stuff at the bottom of the plant you should expect another line down there where the scatter would spread.

But analysis of variance was a strong thing in those days and when they -- periodically, I guess at least twice, had a sudden increase in the variability in their alpha counting process that they'd spent so much time and effort on. They got one of the experts in statistics to analyze all the steps there where they split the sample they got in half and then they'd split the sample pieces that they'd gotten from that. And then they would finally count everything twice and so forth. So there were stages in the alpha analysis involved in weighing the samples for instance for very thin layers, and they had to have micro balance to do that and had some uncertainties in it and so forth.

[3:04:04]

Mr. Bailey went through all this and when he got through all he could say was all the variability is right there at the beginning. Can't find what's going wrong. But finally somebody remembered well they'd started a new batch of samples holders, I guess you'd call them. They're like big coins, maybe a couple of inches across. And they were made of nickel and they'd order these things from some plant somewhere. And they'd come in a wooden box and they'd use them from the box until it was finished and then start another box.

This big recent change in variability had come on when they started using the new box. So they got somebody to take a look see. And indeed the way these things work, establish electric difference potential essentially put a battery across it set to a higher voltage. Two metal plates, one with the sample on it and one with the collector. And then the radiations that it would emit, in this case alpha particles, would knock apart molecules of the gas in between. You'd get an electric signal that's a current that would flow, eventually very little. And the thing would spike when the electrons got to one side and a smaller spike afterwards when the slower spike, when the ions got to other electrode.

And this depended upon the assumption this was a flat, uniform field. So in every visit, the sample showed the same chance of making electricity. But these here nickel plates, the new ones at least, were giving the trouble were not as smooth as the old ones were. So they had little spikes on them, tiny miniscule things, but enough to disturb the electric field uniformity.

[3:06:08]

So, I had to change their procedures a bit and electro polish all those discs before they'd use them. That cured the problem finally, but the statistics didn't find it.

Callan, B.:

You said you had one more as well that you didn't.

Macklin, R.:

I don't think so. Well it had to do with some outpatient work. Essentially, they made criticality measurements on samples of material, where you'd say bring a -- moveable cart and a remote control close to another one so an artificial radioactive source nearby would produce some neutrons and see whether the neutron level went up because of multiplication and certain size and material. And they did the same thing for liquids and containers and try and establish guidelines for how big a can of stuff you

could have and how far away it needed to be from other ones and so forth.

Callan, B.: That's interesting. You just kind experimenting to see where criticality issues would -- what were these carts like? Were they like little --

[3:07:49]

Macklin, R.: Where would you do that?

Callan, B.: -- this little remote control car with this thing taped onto, get them close together.

Macklin, R.: Well, it was a special building well away from the plant down toward the river.

Callan, B.: Okay.

Macklin, R.: Later we became a much bigger industry and moved to former vault, as you call it around the hill above Y-12.

Callan, B.: What would you say was your most difficult assignment of your career?

Macklin, R.: I don't know of one. Oh, I used to courier.

Callan, B.: Or maybe the most difficult.

Macklin, R.: Anything connected with K-25 was not too difficult.

Callan, B.: What would you say was your most significant accomplishment at K-25?

Macklin, R.: Publications. We were able to publish much of our work. And of course, a lot of it just died on the vine in classified reports.

[3:08:49]

Callan, B.: What sort of publications did you publish?

Macklin, R.: In Physical Review, studies of radioactivities produced naturally from uranium, studies of gamma rays from enriched uranium for instance, which inadvertently got published by Seborg having put it in his tables.

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Callan, B.: We're just going to get to some of my wrap-up questions, big picture perspective type questions. Describe what you think future generations should remember about K-25? What should they know?

Macklin, R.: The date when it started.

Callan, B.: But as far -- you know, let's say we were writing the history books and this is going to be a chapter in this history, how would you describe the significance that people should remember when they reference K-25, or if I were to look up K-25 in an encyclopedia, how would you describe that? What is significant about this place, if you were tasked to write --

Macklin, R.: It started the nuclear age. Up till that point, automobiles were an advance on horses. From here on out, you got the possibility of electric power from the atom that will last for centuries.

[3:010:36]

Callan, B.: Is there anything else you would like to discuss or expand upon before our interview ends?

Macklin, R.: No, sir.

Callan, B.: Okay. Well thank you very much, Mr. Macklin. It was a great interview.

[End of Interview]