National Educational Technology Solutions LLC

K-25 Oral History Interview

Date: 5/18/05

Interviewee: Joseph Dooley

Interviewer: Jennifer Thonhoff

DOES NOT CONTAIN
OFFICIAL USE ONLY INFORMATION
Name/Org: [signature] EnP/CICO Date: 4Nov15

As a BJC ETTP Classification Office Unclassified-Sensitive (U-S) Information Reviewer, I have reviewed this document and determined the document does not contain U-S information (i.e. no UCNI, ECI, ~~or OUO~~ information).
BJC ETTP CO U-S Reviewer/Date: [signature] 6/15/07

~~OFFICIAL USE ONLY~~

May be exempt from public release under the Freedom of Information Act (5 U.S.C. 552)
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 30, 2005
Guidance (if applicable): CG-SS-4 September, 2000

~~OFFICIAL USE ONLY~~

~~OFFICIAL USE ONLY~~

[1:02:38]

[crew talk]

Thonhoff, J.: Okay, so I'm going to have you start with your name and spell it for me, please.

Dooley, J.: Okay, my name is Joe Dooley. D-O-O-L-E-Y. And I'm presently a senior research engineer at Oak Ridge National Lab -- started my career off at K-25 site as part of the U.S. gas centrifuge program in 1977. I was lucky in there because many of my senior technicians were people who had been at K-25 during the start-up years and in the real glory years in the 50s and early 60s. And so they were just a wealth of strange stories or weird goings-on. And I'm a kind of a magnet for strange stories. I'm an amateur historian, I guess to some extent.

And so those kind of things made it really interesting to be around those guys because they'd come out with these things just with, you know, no warning. And you'd go, "Whoa, that is so weird." [laughs] How could you ever get away with something like that -- and it also kind of sets the stage for lots of goings-on during the wartime years that are just so alien to our culture today that it's almost like it couldn't have happened. It couldn't have made it in fiction.

Thonhoff, J.: And so, some of the stories that the people that were there, could you tell me some of those stories?

Dooley, J.: Sure -- One of the -- one of them -- the whole thing revolving around the K-25 name. There's a lot of folklore that surrounds that. The most -- the one that seems to draw the most credence but the least documentation is that it was originally a set of map coordinates for the three sites. Unfortunately, when you look at it, it doesn't quite fit that way. You have K-25 site, you had X-10 site, and you had Y-12 site, but one of the older guys said that originally, in the very start-up period, the map grid had K-25 as U-25. And if you go V, W, X-10, Y-12, and then you're to town. And he was saying that in the early going, the security people were so paranoid about anything associated with uranium or the letter U being attached to anything with the Manhattan Project that they very quickly got away from the U designator for that site.

[1:05:16]

That would fit, if you look at it, it's alphabetical from west to east, just like you'd put it on a map. And the sites are numbered 10, 12, and 25 from south to north, like a map grid would be laid out. But nobody's been able to produce the map.

So, the story goes that the -- there are two branches to the story. One is that the Kellex Corporation, K-E-L-L-E-X was the prime contractor for the K-25 building or the building that was going to become K-25. And, therefore, they just interchanged the U designator with K and made this K, Kellex 25 -- and took the U off the table that way -- and made it be that. The other branch of the story is that originally the K-25 site, as part of the Manhattan Project reservation here, was to be the Kingston Ordinance Range, and so K-site. And this was built in 25 on the K site. And it certainly didn't help anybody that the building was shaped like a U, as well as being uranium related. So the security people had a hell of a time trying to figure that out. Sorry about that. They had a heck of a time trying to figure out how to disguise that. Because the shorthand would be, "Where do you work?" "Oh, well in the U building." Well that was going to be an immediate security bust. And at the time, the guys say about one person in four working out here was plain clothes security. And so you could find yourself in a world of hurt in a very, very short period of time in one or two statements.

[1:06:52]

Thonhoff, J.: So was it still really secret when you were there?

Dooley, J.: Not -- no, the mission was well publicized. It was the K-25 gaseous diffusion plant, which said that's what it was and other enrichment related activities or research and development were ongoing on the site. The gas centrifuge enrichment was being looked at there. The laser enrichment was being looked at there, particularly during the early 70s, while the diffusion plant operations were still underway. And of course, those were much lower profile. They were just a few labs here and there, scattered around, compared with these monster process buildings drawing billions of watts of power and creating these huge plumes of steam into the sky and all that.

So the other activities were much lower keyed than the diffusion plant operations. There was -- it was no secret what you were doing, but the big secrets were still revolving around the exact details of the process, the materials, and the mechanization of it.

And so that's carried through as a theme throughout all of the enrichment technologies through the years.

[1:07:59]

Security always has been an issue out there. It's been -- it's one of the things that's kind of drilled into you from the very beginning and it's harder for some people than for others. But they did a lot of security around the place. The old guys say that one of the best tools that the security counter-intel people had was a bag of sugar. That they would go to the locals that lived around the plant periphery and, or course, they were because of their culture, it sounds kind of bad, but they were kind of hostile and wary of strangers and outsiders of which plenty were now here already. But the counter-intel guys would go out to families and give them a bag of sugar, which was a real gift during wartime rationing to help with that. And that would ensure that if any strangers showed up in the area, the word got back to security like instantly.

And so basically, a bag of sugar became one of your key counter intelligence tools and security tools during the wartime environment just because of its scarcity. So, you know, lots of strange things went on during the time period this thing was in operation -- weird things, weird comings and goings occasionally.

People didn't -- security was tight, but sometimes it kind of took a laughable turn. One old fella would leave every day and he was working masonry/concrete construction. Again, it's one of the tech stories. This gentleman would leave at quitting time. He would go out at the end of the day and he had his concrete working tools and his lunch-box and his wheelbarrow and he was pushing it out. And of course, they were inspected everybody. They were shaking everybody down. They were checking your lunch-box, make sure nothing was being stolen -- or anything like that.

[1:09:47]

And security got suspicious, you know, over and over. And they were shaking him down every day, patting him down. They were going through his stuff every day. And finally, they said, you know, they pulled him aside and said, "We think you're stealing something. We don't know what. But we think something is going out of here with you." And the old guy kind of got, you know -- he went silent because this was good work, good pay, you know, good hours and all that comparatively. And so they said, "Look, we'll not press any kind of charges or anything if you'll just

tell us what it is you're taking. And quit doing it." And the old guy kicked back in the chair and he says, "Wheelbarrows." And they said, "What?" And he said, "I'm taking wheelbarrows out every day." He said, "I'm selling them and make a bunch of money." And what they didn't realize was that he came in, in the morning and there was a shift change on security and evidently the gate assignments were fairly well fixed. And so they didn't see -- the morning shift didn't see him come in carrying his tools. And the evening shift always saw him leaving with his tools and lunch box and a wheelbarrow. And so it was the most natural thing in the world, the assumption being that he had brought them in, in a wheelbarrow earlier in the day. [laughs]

[1:11:11]

So bright and inventive people will beat most any security system you try to put in place.

Thonhoff, J.: Oh no!

Dooley, J.: [laughs] -- The whole place was designed for one mission originally. The U building for enrichment of uranium, the weapons grade levels. And it functioned in that from the time it came on line about '43. It took a while for it to get up to good production. But it had -- it had it a tremendous hunger for electrical power. And all of the motors that drove the place were synchronous. That means they are keyed to line frequency. And one of the ways that they could -- one of the uniqueness that the Oak Ridge plant had was that it was powered by its own steam plant for a while, located on the Clinch River, a little bit further west of the plant, hooked directly to the plant. And that was the only variable frequency, high voltage generating facility in America. It was keyed to the plant because one way to trim the output to modify the product enrichment level was to change the power level, which was dependent upon at how fast stuff was pumped through the system. If you pump through a lot slower, you get a better product out of the thing.

[1:12:38]

So this, for a while, the K-25 building was keyed to this power plant, and they could adjust the entire speed of operation of the whole building just by varying the frequency that the generator system, located in their dedicated power plant ran at. And that was kind of lost over the years as other ways of controlling motors and power systems and all that came along. But it was a very unique

piece of the work that was put in place out there during that time period.

So, kind of a technical oddity -- I don't know how much of that has been out there, but that's basically one of their features.

Thonhoff, J.: I haven't heard of that.

Dooley, J.: And strange things happen occasionally. One of the more colorful stories is the haunting of K-25. There's -- there was rumor, legend, of a ghost whose name was Andy, and when you were working night shift, particularly the evening shift, late in the evening, there'd be strange noises coming from this facility -- doors open and close. When you went to look, nobody was there. It was really -- and I'm not a big believer in a lot of this stuff -- but Andy was there a few nights when we were working late.

[1:13:59]

It turned out that Andy was supposedly a suicide -- who was despondent, was working late and hung himself in the piping gallery and was not discovered for quite a number of hours back there in the war time years. And so from that time forward anything that was unexpected, unexplainable, Andy was responsible for it. And I will tell you that strange noises happened out there. There was a lot of that on off-shift, and I don't know what was going on. [laughs] So you gotta believe, I guess.

Thonhoff, J.: What kind of strange noises?

Dooley, J.: Usually, it was doors opening and closing or things being dropped or shuffled around. You know how sometimes people, when they walk, will drag their feet or you get some clicking. But usually it was doors opening and closing or some of the old windows that would pivot out and come back. You get that kind of a squawk/thump kind of thing from it. And I don't know. [laughs] I can't dismiss it. I can't confirm it other than say we heard it. And that's all I can say. [laughs] It must be real.

[1:15:12]

Thonhoff, J.: Yeah. Well, you said he hung himself in the pipe gallery. Could you kind of describe that area for me?

Dooley, J.: Okay. The K-25 plant was built on multiple levels. It looks like one big monolithic building from a distance, but it's really a steel

framed building with asbestos siding. And when you get away from it, it -- all that gray runs together and looks like a big concrete structure.

The basement level was what was called the transformer alley. And basically that's exactly what it was. It was a roll of big power transformers -- double row down through a basement hallway that fed power up to the process floor. That's where the compressors and the actual enrichment and all of the work was done up there. Then just above the operating floor was what's called a piping gallery. This was an area of catwalks, tubing, all that ran the interconnections between all of these productive units. You had thousands of compressors and what were called diffusers. They called them converters. Again, that's a hold-over from the old security things. They didn't convert anything to anything -- all they did was permit the diffusion process to separate. And these all had to be piped together and then they also had to be set for the ability to isolate a section for maintenance, if you needed to make some repairs.

[1:16:32]

And so the piping gallery provided this level above the operating floor. Didn't interfere with traffic and normal work down on the floor, but it brought the piping up there -- very confusing mess. Put it in its own area, and so there were lots of protrusions and cat walks and ways.

And then as you went on above the piping gallery, you came to what was called the operating floor. And the operating floor was just exactly that. It was a big empty expanse sitting on top of the piping gallery but had hundreds, thousand, probably of valves, manually operated valves that actually did the control of the process. They were horizontal hand wheels, looked a lot like a steering wheel on a bus or one of these railroad car brake handles. And that's where the operators who ran the plant worked during the Manhattan Project.

So they would be up on the top floor working the -- you know, the operating floor, obviously -- working all the valving to make the process operate.

[1:17:36]

And so the piping gallery -- a lot of maintenance work was obviously being done in there and so that's -- but it's also -- unless

there was a need for maintenance, there wasn't a lot of people. There wasn't a lot of traffic in there. And evidently old Andy found him a nice private place and hung himself from some of the gallery in there. And that became one of the -- he became the resident ghost of the area. So, [laughs]

We had -- you had a real mix of people here. One of my -- one of the techs was a lab tech then, was just starting out. And you had locals who didn't have a big technical background and you had some of them who were really good who were doing kind of technical work under supervision of people that they didn't know could even be a Nobel laureate kind of guy. The guy working next to you could be a Nobel Prize winner and you'd hardly know it.

And so you had this mix of people. You never knew exactly who was going to be what. One of my techs was working in the lab and with some liquid nitrogen. That's a real novelty during the World War II period. They could make it and they made -- obviously made liquid oxygen because the Germans were using it for rockets and everybody knew it. And if you make liquid oxygen, you'll get liquid nitrogen as a byproduct. And because it's real low temperature, it's really useful. But if you just see liquid nitrogen in a container, it looks like water, except that it's boiling. And it has this cloud of white vapor coming off the top of it. And so, if you don't know what you're looking at, it looks like you're boiling water without a flame.

[1:19:20]

And my tech was working in the lab and the task sheet said get through the liquid nitrogen, pour it in the flask -- do this, do that -- -- went through the procedure. While he's working, one of the janitorial staff is putting the eye on him pretty hard. And he's watching this whole process. As he gets toward the end of it, he takes the flask of liquid nitrogen and gets his gloves and dumps it down the drain. It's hard to tell the difference between gloves to protect you from cold and gloves to protect you from hot. And he dumped it down the drain -- BOOM, big cloud of vapor out of the thing.

And he's putting the stuff up. He's finishing his documentation. The old janitor kind of comes easing on over and the janitor is known informally as a moon-shiner. Kind of the rumor is. He kind of comes easing over to the tech and says, "I gotta a quart of the finest white lightening in this end of the state over in my locker," which was a violation. [laughs]

[1:20:30]

He says -- and the tech says, "Well, okay." And the guy says, "It's yours if you'll tell me how you get that water to boil with no flame." Because if he could manage that technology, his moon-shining was going to get a whole lot easier real soon. [laughs]

Where else do we need to go? What do we need to do?

Thonhoff, J.: Do you have some more stories about some of the older people that worked there?

Dooley, J.: Well, the -- when they reached the end of -- after the war, a lot of the people who had worked there had done -- had not been back physically. They specified what should be done and they kind of -- some lived there on the site and got it done. Others wrote up the engineering requirements and sent them in and that was kind of like all they knew about it.

[1:21:39]

So after the war, again one of the senior techs was with a tour group that came back from some of the design groups. I believe it was from the guys from Columbia University who was the big brain trust on fusion. They were walking through the process area down there, and of course the whole place is throbbing and running and at the -- at certain stations along the way, there were flow balance valving, where they would make adjustments in how much flow was going where into the cascade.

And the guy said -- the designer from Columbia, Ph.D., a bunch of degrees and all that. Looked at all the gauging up there and he said, "That's not the way we designed it." And the old operating tech said, "Yeah, Boss, but that's what makes her work." [laughs] There was a much greater emphasis on getting it done and getting on with it during that environment than had -- than worried about the details of what was going on. And you see that even in the building itself. If you take a real close look at the building, you can see that it was started from the two ends of the U and built this way and when they arrived together, they were three feet off on the top floor and on the operating floor. But the piping gallery, the operating floor, and the transformer floor were all dead on. Somebody, somewhere, in all of the rush, goofed a measurement on two stories of that building, and you can see there's a three foot

drop in there and today that would be a major quality incident. I mean, you would have investigation and everything.

All they did was pour it a ramp and bend all the piping to fit and got on with getting it done. But to this day, the windows are off three feet, the roof is off three feet, the floor is off three feet -- but the working parts, the important parts, are all dead on inside the building.

[1:23:33]

So there was a drive to make it go that it just transcended all obstacles.

Thonhoff, J.: Do you think that that's what really made the whole facility run and work -- that drive?

Dooley, J.: Yes. There's no doubt about it. Those people were motivated. You know, they were getting it done because -- they didn't know exactly what was going on. All they knew that it was powerfully important, that a tremendous amount of resources were being poured in to the place and that it was not something that they were going to -- may not know it all.

In fact, the security was almost air tight in most areas. For instance, the operators up on the top floor, they had no clue about what was going on, on the operating floor below. All they knew was that the phone from central control would ring and tell them adjust this -- adjust that -- set this to one thing or another. One of the old timers said that in many cases, the indicators were just marked off 0 to 100. Your job was to keep it in the green band on there and if it went up, turn this to bring it down. If it goes down, turn this to make it go up. If it won't stay in the green band, call your supervisor. It might be a pressure gauge, it might be a voltage gauge, it might be a flow meter, it might be any kind of an instrument at all -- even that was not marked on the face of many of them so that people couldn't tell, even if they wanted to go out and tell you what they were doing, they had no clue about what it was they were doing.

[1:25:03]

And his supervisor may very well be a Nobel Laureate. He just wouldn't know it. And so people were dedicated to getting it done, but there was a real tendency not to ask too many questions beyond what your immediate job was. This place was a void

during the wartime environment, things just went in here and disappeared.

One of the guys we worked with had worked up at Westinghouse Electric outside of Pittsburgh in Pennsylvania. And he says, you know, it was a real hoot to come out here and go to work because during the war we didn't know where in the heck this place called Elza and Blair were in Tennessee. But we put train loads of electrical gear out the door and all that was marked on the box car was Elza or Blair. And we couldn't find it on the map. And in point fact it's not on the map. Elza and Blair are the names of the two railway sidings that served the Oak Ridge complex. Blair was up by the K-25 site in kind of a serpentine little run through the mountains. And Elza was down on the extreme east end of Oak Ridge. It was a tunnel through the ridge and into the east end of the complex.

And people that were living around in the area said that trains full of stuff would be left out -- on the siting outside either at Blair or Elza. After the railroad left, some time during the night, they would run a switch engine out from the plant, pull the train in, unload it completely, scrub off all the destination marks, put the cars back on there, and when the railroad train came through the next morning to pick it up, you had entire car of -- train full of empties that used to have the equipment that had shipped in the day before. And it was just continuous, day after day -- Stuff coming in, stuff coming in -- nothing perceptible going out -- really a bizarre, bizarre operation.

[1:27:07]

And the security on it was just mind boggling that something like that, even a major user like that -- that could absorb most of Westinghouse Electric's production and could not be identified, and their people couldn't even find it. All they did was fill the purchase req and dispatch it to Blair or Elza. So it was!

Thonhoff, J.: That's incredible.

Dooley, J.: I'm trying to think what else. Really, that's about -- those are about the best ones we can get into here. [laughs] There are a few --

Thonhoff, J.: Do you have some that are not the best? I'd like to hear those too.

Dooley, J.: Well some of them are -- you know, some of them are later model kind of things. Some of them went -- go classified --because you -

- to tell the story you can not go there. And so that's just the way it is.

Thonhoff, J.: No, let's not do those.

Dooley, J.: Yeah. Let's don't do those. We all like our jobs too well the way it is. So we won't -- [laughter] As the guy said, "We could tell you, but we'd have to shoot you." [laughs]

Thonhoff, J.: (indiscernible)

Dooley, J.: But I think those are about the best ones, unless there's some specific that are buried in there, getting it done. Of course, you always have the people that are drinking and hiding the evidence. [laughs]

Thonhoff, J.: Tell me about some of those stories.

Dooley, J.: Well, you never know exactly when you're going to turn them up. We were doing an excavation for a modification on one of our buildings and the U building, the center of the U, down the middle, was filled, basically built at the basement level and then filled it to the center and left the back open. And some of our buildings -- excavation.

[1:28:56]

And as we got to digging through there, we found all kinds of whiskey bottles with dates on them. Little fifths -- kind of size bottles, hip flask shape bottles in the muck and mire underneath the buildings. So clearly the ban on alcohol on site was somewhat flexible -- at least at the working level. But we found several bottles that were from there, and I understand since then there have been some stashes of stuff. It's not spoken of in polite company because it was a safety violation and all that. But where people are, particularly people that are under stress and working those conditions have tendency to let it out somewhere.

Thonhoff, J.: Yup. It's gotta come out.

Dooley, J.: And so -- but we uncovered some of it in the course of some of our excavations for building mod -- kind of interesting -- little time capsule underneath there -- totally unexpected.

Thonhoff, J.: Wow!

Dooley, J.: But the operating staff, it was -- the operating staff never knew what was going on, on the -- the operators didn't know what was going on the floor below them. The maintenance people working on the operating floor had no clue about what the operations people were doing above them, nor did the electrical people, down in the basement, have any clue about what was going on up above them. They could hear that there were motors running and all that kind of stuff. And they got phone calls down to do this and do that. But most of the place was running in very tightly compartmented fashion and that was intentional to prevent the possibility of leakage.

Thonhoff, J.: The operations floor is also the cascade, correct?

Dooley, J.: Well, the operating floor was up top above the cascade, with all these hand wheels and those were -- those were pretty well removed later on, as the process was automated further.

[1:30:50]

During the war, there were about -- the guys tell me there were about 5,000 people actually doing the controls up on the operating floor. By the time the war was -- or by the time they finished modifying stuff later on in the post war era, three people could run a whole building. It was all remote and had switched over to air operated servo valves and all that kind of stuff. Remote operated, and so you didn't need that work force. You just couldn't sustain that kind of level in a non-war emergency environment.

And so, that was one of the big economies, as -- but the transition was kind of delayed as the cold war revved up and you had Korea and the real high tension in the 50s and 60s. But eventually it reached the point where there was -- very few operation -- very few of the hand wheel stations still survive up on the operating floor. There are some areas that have more of them than others. But it was a manual operation when it was first in business. And it was -- they were able to make it work. That's just an amazing engineering triumph.

[End of Tape 1, Begin Tape 2]

[2:00:07]

Dooley, J.: -- in one of the oldest hotel -- kind of in town is converted that stays Einstein stayed there. And if he was in town, I guarantee

you, he went to one or the other or all the plants -- as did Oppenheimer.

Male: (indiscernible)

Dooley, J.: Okay, I never encountered it. It seems possible.

Male: (indiscernible) I just heard this. The other thing I thought might be a --

Dooley, J.: -- around those guys that much. The senior management was off doing its thing and I mean I recognize Mr. Winkle when he would come by because he was this huge bear-like, almost god-like creature that would move through the ins of the plant over there. You'd see him occasionally in transit between the offices down in the ad building and cafeteria areas. But as far as most of us were concerned is a mythical creature. The plant manager was seldom seen by the mere mortals [laughs] on the workforce unless something went wrong and then you'd probably get to see him in extreme -- in excruciating detail. But [laughs]

Thonhoff, J.: Well what was he like?

Dooley, J.: He had a -- his appearance, the times that I saw him was very forbidding. He was a very tall, massive individual, and he -- you know, the kind of person that looks good wearing a uniform of a leader, you know, and tends to gravitate toward that. When he smiled, he was just an utter charmer, but very seldom would he seem to smile. And so [laughs] it was one of those -- again, and I wasn't going to bother him certainly for anything if it wasn't really important or really necessary. And so most of my experience with him was just kind of seeing him around and with his group and in presentations or something, group meetings, or all hands meetings kinds of things where he was going to be a speaker. But he had a deep rumbling voice that really -- you know, again, it was all the things that you want a leader to be, imposing presence, looks good wearing a uniform, you know, seems to know what he's doing, you know, have a vision for where he wants to go. But too far away for me for much in the way other than, oh, yes sir. [laughs]

[2:02:37]

Thonhoff, J.: Was there any other people back from the old days that you remember that you heard stories about or you experienced, you know, anything?

Dooley, J.: Well, one other weird one from the getting it done days. One of the old guys, one of our old maintenance guys, was a fella named Shorty. And he was a pipe-fitter. This was out of the leadership area. Shorty was a pipe-fitter and a lot of the work was done on, you know, do this, do that, let's get on with it kind of thing. Shorty was a pretty good pipe-fitter, and he could measure by eye. He could just the tell guy, "Cut me a length. I need it 12-3/4" long and I need it threaded an inch and half on both ends." And he'd holler out to his assistant and the assistant was outside the work -- you know, in the area where he could get pipe out there to work with, and he would saw it to length and put the cap or the threads on it and pass it on to Shorty.

[2:03:46]

They were doing one run one time, a real hot job, getting fixed up, and they had had to open a hole in the wall so that Shorty, who was the smallest guy and obviously he was around five feet tall. He was the smallest guy there. So they just opened the minimum size hole to get Shorty in there. So Shorty dives down into this hole and he's hollering out for pipe and hollering for this, that, and the other. And they're passing stuff into him as fast he's hollering for it. And what they don't realize is that -- at least Shorty doesn't realize it but he's walling himself into the area where he is. He's built a pipe tree across the entrance way to this thing. And they just -- the guys in there were seeing it happen as pieces were closing up his entryway, pipe forming a cage across the thing. And they just kept on feeding stuff down there to him and said -- the whistle blew, shift change, and that was the first time Shorty turned around and looked and saw that he couldn't get out. They said he went freaking nuts down there in that hole. It wasn't so bad when his mind was focused on the job, but when he realized that he was trapped and worse yet he was trapped at shift change. But he went kind of crazy for a couple of minutes and then he said, "Does this count for overtime, boss." [laughs] And so by the time he worked himself out of there, he was knocking down some time and a half just to get himself loose from the hole that he built himself into. [laughs]

[2:05:17]

But again, a lot of this stuff was done without drawings. It was field fit, measure and field fit to the situation that was there. And that was exactly what Shorty was doing. It's just that he was so intent on doing it. He walled out his only way out. And so -- and of course his buddies bore a little bit of the brunt for that since

they didn't bother to warn him that he was doing that to himself. But hey, that's all right. That's what makes good stories.

Thonhoff, J.: I (indiscernible). If they would have warned him, we wouldn't be here talking about him.

Dooley, J.: And Shorty wouldn't be a legend.

Thonhoff, J.: Exactly. And when Gary came in, he said you talked about the (indiscernible). Can you explain that to me?

Dooley, J.: Well lots of -- the whole nuclear business, you know, really was kicked off dead center in the mid 20s with the discovery of the neutron. And it's really one of those amazing things that once that piece -- that was the missing piece of the puzzle was there, that nuclear physics as we know it today really took off and for practical purposes at the engineering level, the neutron, the proton, and the electron, the three basic particles are still where you're working.

Now the physicists got lots more of them. There's layers and layers and tiers and tiers, all kinds of storage things going down there. But once the neutron was discovered, it was kind of the key to unlocking what was going on in the nuclear business. And the neutron is what made the explanation for isotopes possible. That is, they're the same element but they have different numbers of neutrons on them and so the interesting isotopes spiraled up just tremendously because they had been separating some of these things. Lawrence and some of these guys had used a modified cyclotron, which runs charged particles around in a circle, but the circle is diameter and depends on heavy the particle is. And so if the particles have different weights, they'll take a different radius around this circle. When you only took them partway around the circle then you could separate by weight. And so that -- with the neutron explaining why that was going on, then they were able to separate materials and measure their behavior at the nuclear level with the sample.

[2:07:45]

And so basically nuclear physics took off in that time period from the mid 20s on up to World War II. And so lots of Nobel Prize work was done during that time period all around the world. There were all sorts of experiments ongoing. Some of these guys had started out very fundamentally. Lawrence was out at Berkeley in California, and Uri and his people were up at Columbia. And

forget who the -- well, Fermi and his crew was working in Chicago on a reactor business. And so, you know, there was so much fundamental work that was done to explain things that had puzzled them for centuries almost actually that all fell into place with this.

And so, the people that were working at the leading edge, the Nobel Prize winners, were the ones who were actively involved and they were the ones that Oppenheimer went after for his operating staff both at Los Alamos and at the other facilities. And of course, Groves could pretty well get anybody that he needed into his program just by -- almost by mandate. And so you had by definition you had the cream of the crop, the brainpower at the top end of this thing prescribing what needed to be done. Now, what they couldn't prescribe was the engineering mechanization of it. And so -- and that's why you have physicists and you have engineers. The physicists can write, you know, can describe what it is they need and then they go scratch up some engineers to make it real.

And so what the Manhattan Program did was it put the physicists much closer to the engineers and the hardware than was typical on a big scale project. Physicists would get close to their experimental hardware but in production kind of stuff, they were very seldom that close to the environment, the engineering people. In this case, Manhattan Program had them right there but didn't bother to tell anybody because the first thing that happened, if you look back through the history of all this, was that as the tensions picked up, you'd see -- after -- in the late 20s or early 30s, you'd see photos of seminar attendance, big conference in London or big conference at Princeton University or like Columbia. And it would be an international cast of characters. You'd see, you know, obviously U.S. people. You'd see Japanese. You'd see Chinese. You'd see, you know, people who the cut of their clothing indicated they might be British or German. There were, you know in that time period, there was kind of almost stereotype but the sterotypes have a rational thing.

[2:10:30]

As the world tensed up through the 30s and we started the run up to World War II, all those people disappeared from the conferences. And the conference pictures then are full of nobodies or unknowns, wannabes in our current vernacular, as the people were sucked into their respective national programs. And then could not show up on the radar. And so that then caused a number

of -- you know, the number of Nobel Prizes to kind of likely dwindle a little bit. It opened the field, I guess. It's an opportunity if you were like a second tier researcher; you know had a prayer [laughs] because the top line was off somewhere else doing something that you didn't know about. But it was really remarkable if you look at some of the photos over that time period to see how the population just -- boom -- disappeared into the covert programs that everybody was running as they got into the nuclear business.

[2:11:31]

And so Fermi was down at the Oak Ridge complex. He and his people had written the requirements for reactors for plutonium production. Uri and I forget who his associate was at Columbia, proposed diffusion as a way to do separation. And basically that plant, the K-25 plant was built based on a desktop pilot unit and the sample of the barrier material in that was about that big, a little tube about that big that they were able to make, do some separation on a bench scale. And they launched into a bundling a mile long, 300 or 400 feet wide, seven stories tall. And that was just an incredible leap. Concurrent engineering was done in space during that program. And again the emphasis was to get it done. People were dying.

And every year we have our annual nuclear protesters show up on the 6th. And they are genuinely surprised when a counter protester shows up and says, "Harry Truman and the atomic bomb saved my daddy's life." They forget that what was going on in '44 or '45 and that this brought it to a conclusion. And most of your -- everybody didn't really know what it was. They knew their little piece of it, but there was not enough interchange for anybody to really form a coherent picture about what was happening outside of the community here.

[2:13:18]

And even plants were isolated. The workforce that worked at K-25 was pretty much separate from the workforce that worked at Y-12, separate from X-10, to minimize the possibility of cross communication about what was going on. And so they were compartmentalized in your job. You were compartmentalized in your geographic location, and the whole program was compartmentalized inside the Department of Defense, War Department at the time.

Thonhoff, J.: What was it like coming into the community after the Manhattan Project and after that time era? What was it like to kind of step into the community? What was the feeling?

Dooley, J.: Awesome. Really, to see what these guys had done. My experience with it had been outside, outside the fence. My uncle had worked here. He had some -- you know, some of the war stories and stuff that he had, you know, okay, okay, sure. But to finally get in and you come in and you just see the scale of it. You didn't appreciate that from the outside because you couldn't see the whole thing as an entity. But when you get in here and you drive past a building that's a half mile long, you know, and this thing has been there for, at that time, 30 or 40 years, you know, and realize that this thing was built without a blueprint. I mean, only the shell had a blueprint. Nothing else did. All the rest of it was cut to fit. And then they documented it after the fact.

[2:14:52]

But the amazing accomplishment that they had and then as I got to working with people, the more senior techs, the older techs had been there for a long time. Many of them started out as laborers, construction laborers and they stayed, stayed there working and worked their way into lab tech jobs from construction or from maintenance and then some of them were senior lab supervisors. And they never really kind of forgot where they came from. But they carried all of that information with them. And so you could go to them and you could find somebody that had done something there, you know, and even though it wasn't running at the time, the U building was shut down in '64 or '65 timeframe -- still an awesome thing. And you could walk through it and the old guys would point out this and that and you -- what's this and what's that. Oh that was this and that and the other. And all of it makes sense. And they still remembered it all. They still remembered what all was going on there -- remembered the details of a thing.

[2:16:02]

And then one end of the U building was still in operation. They called it the purge cascade. It was used to take lights, which are reaction products that migrate very quickly up the cascade because they're so light, they flow very quickly. And this place took them off. And that end was still running. It was one end of the U building was still running. I think that's one building up there, two or three quarters, and it was just screaming. The equipment was so noisy and all that. And to imagine that, multiplied hundreds of

times around this entire facility or to go over to the big enrichment buildings, 29, 27, 31, 33, and the entire building is throbbing with the process. Noise, heat, feel it going around, moving back and forth, purposefully and yet just very few people actually performing the operation, the actual control.

[2:17:03]

Everybody else is there just to make that happen. And then, you know, you see that all of that was -- you see the evolution as you went through the buildings; 25 was the first, 27 was almost identical to 25, you can tell that from its look, and then 29 was built on the end of 27. I don't know why they picked odd numbers. Nobody's ever been able to tell me that. And it was more modern. It was really 50s kind of lay out of the equipment. Much bigger, same basic concept, but different mechanization of it -- different layout out of it and then 31 and 33 buildings were early to mid 50s kind of construction. And you can see the similarities in the way that the building was structured. You could see similarities in the way equipment was in there, but the layout, the details of the layout changed over the years and then Portsmouth and Paducah share features of both of the -- all four of those generations of plants that are on the Oak Ridge site.

So, K site was a just a history book waiting there. The administration building was the original building, the library, medical, cafeteria, and several of the other lab complexes were still the original World War II buildings. You look at them and you can tell they were originally temporary buildings. But the work that was done there, you know, is just amazing. You couldn't believe it. It just took a while to absorb it. And it's just one of those things that -- everybody had a story if they had been there any length of time. They just -- and some of them funnier than others but some of them -- you know, some of them you couldn't tell in polite company again because classification issues or [laughs] -- or things. You know, some were violations that would happen inadvertently, some of them just accidents. For a while they had mounted patrols out around the plant perimeter and the security guys were laughing.

[2:18:58]

This one old guy that was still there and they had plenty of wild animals around. This was still a pretty rural area and one of the -- one area out there they had wild cats. And they weren't supposed to bother the wild life. The wild life wasn't Nazis or anything like

that. So you weren't supposed to bother them. But you know, if you got a nice shot at a pretty good looking trophy. You know -- who's going to notice a bullet here or there. [laughs]

And so, the story is that this guy was on the mounted patrol late one evening and as he -- he decided that he's going to collect one of these wild cat skins that would look really good in his den. He eases his pistol out and starts to come down on the thing. And just as he squeezes the trigger, his horse goes, [makes a nay sound], and he drills the horse right though the back of the head [laughs] instead of the wild cat. Horse collapses like a ton of bricks. And now he's underneath the horse because it's fallen on top of him. And so he's now going to have to figure out how he's going to explain to his supervisor: a) why he pulled his weapon; b) why he took a shot at a wild cat in violation of rules; and c) how's come his horse is now dead. [laughs] -- and hope he keeps his job. [laughs] -- He did. Fortunately, he did. He was the guy telling us this story [laughter] 30 or 40 years later.

Thonhoff, J.: Did he say what he said to keep his job?

[2:20:26]

Dooley, J.: Evidently after they got over the "oh darn" part of it, everybody got a good laugh out of it and Mr. Horsey got buried and that was that. You never know exactly what may happen and particularly when you have thousands of people running around all this kind of stuff.

Thonhoff, J.: Absolutely. Well you said there were some accidents and things that happened. Could you tell me about some of those?

[2:20:58]

Dooley, J.: Better not. Some of them get into process.

Thonhoff, J.: Okay.

Dooley, J.: And so --

Thonhoff, J.: (indiscernible) have anything to do with process?

Dooley, J.: Not really because again, you know, that's -- you know, some of them were oh-ohs. You know, some of them were the result of the speed with which everything was done and a lot of things were done based on the possibility or the likelihood that this is going to

just be a temporary thing. At the time they did it, nobody knew that -- you know -- what the situation was going to be. And so, you would get odd failures or things of -- big releases of UF_6, which created a huge plume of smoke. It looks like -- except it's uranium particles in the air. And so, you know, as they work their way through that, failures and those kind of things. And your workforce then became more knowledgeable over time. As some of the classification kind of dropped away, people relaxed a little bit and kind of got into it. And you know, one of our -- they really thought it was going to be temporary.

[2:22:05]

A lot of the people did. One of my senior techs said he took a job at K-25 in 1945, about middle of the year, just before it happened. And when the bomb was dropped and all the word got back, he figured well that's pretty much that. You know, they shut us down now since the war is over and all that. And he said, well, you know -- they said, "Well, why don't you stay on. We got a job offer." "Well, okay I'll stay on," he said." He said to himself, you know, if this goes away, I can always go back and farm. And figured that there would be recalls or something like that. When he -- you know, he farmed and lived in the area up above Clinton there. So he said, "You know, I'll farm when I need to and then when they call me back, I'll come back and work and I can always go back to farming any time I'm laid off." And he kind of chuckled. This was in 1983/'84. And said you know, I ain't farmed a day since 1945 [laughs] because it was just one thing after another. And so the work force stayed there. And that was one of the hallmarks of the whole Oak Ridge complex, was tremendous stability in the work force.

[2:23:19]

In general, you didn't -- when one plant was up, the others might be down. And there tended to be a migration of the work force back and forth. So you'd have people that worked lots of different places and so they were a resource that you could go to, but most of them had little, you know, odd things that happened along the way that some of them we can talk about and some of them we can't. [laughs]

Thonhoff, J.: You said there were lots of temporary buildings, the cafeteria and the health facilities. Could you describe some of those?

Dooley, J.: Well they were -- they looked like -- well, the standard government barracks type buildings. You've seen them in your old Army movies and all that kind of stuff. And the only difference was what they put in them basically. The shell was evidently standarized. They were intended to be bolted together, planned to have a life of about five or six years. And by the 1980s, they had a lot more years than that on them since they had been constructed essentially over night. But they were all -- pardon me. They were all the asbestos siding, which, you know, became a (indiscernible) in the later times, but it was a very quick way to make a reasonably low maintenance building. They were either on slab or on a short pillar foundations under most of them. A few of them had basements. Some of the lab areas, where they were going to have laboratory facilities above, had pretty much a full basement under the buildings, but most of them were kind of slab type buildings and you could look at photos of Los Alamos, you can look at photos of Hanford, you can look at photos of Fort Riley, Kansas, or Anniston Army Ammunition Depot, or any of those places you'd see almost exactly the same buildings. They differed only in what went into them. And they could be divided up internally.

[2:25:13]

It was really amazing too is how nice the wood was that was in there. There was some wood in those buildings that would fetch a lot of money these days. Nice, straight grained. A lot of them were oak. For a temporary building, they were really nicely, nicely made stuff. But they were all made to a template so they could be bolted together and erected in a hurry for whatever mission had to be. And so over the years, the outside pretty much remained the same. They picked up a coat of white paint. The window arrangements pretty much remained the same, but internally the buildings were refurbished and revamped a number of times and, boy, no resemblance whatsoever to what they'd started out as.

Thonhoff, J.: And then -- let's see.

Dooley, J.: And then one of the slogans was that there's nothing as permanent as a temporary building or a temporary tax. [laughs] And those buildings proved it. They're just now -- actually right now, they're in the process of tearing down the old cafeteria and library complex out there. The ad building went down two or three years ago. So the buildings were erected in the 40s and remained until the turn of a new century.

Thonhoff, J.: Temporary.

[2:26:34]

Dooley, J.: Temporary buildings. [laughs]

Thonhoff, J.: Well are there any other -- any things you can recall from just talking about some of those stories that you remember that you can talk about?

Dooley, J.: We're kind of to the end of knowledge here. Again, you know, I'm really sorry that you guys didn't get here a few years earlier. There have been a lot of deaths here in the last few years, just from aging out of the population.

Thonhoff, J.: Right. We had mentioned earlier Oppenheimer and Einstein and, you know, to your knowledge do you know if they were here?

Dooley, J.: There is a historical marker up at the old Alexander Inn, which if you go up there, you'll see is at least the main part of it is another old temporary building. It was one of the original dormitories erected during the Manhattan Program, was converted to a hotel and was one of the few hotels in Oak Ridge actually. And so the historical marker up there claims that both Oppenheimer and Einstein visited the site. I can't confirm that independently or anything, but I would -- you know and never have gone looking, but the fact that those guys were there and the fact that almost any -- everybody who anybody had visited almost all of the sites that were involved at one time or another. Yeah, they were probably here. So I gotta believe the historical marker and if he was here, he probably go the grand tour of the place since basically it was his work that laid the ground work for what was getting ready to happen.

[2:28:20]

The others, I wouldn't know and again most of my people would not have known them by site because the physics community was such a closed little community or -- not really closed, rarified. There weren't that many people that were working theoretical physics during the 30s, 20s and 30s, so that was a real rarity, almost a joke. Among the workers, the worker bees, academicians have a bad reputation for not having much in the way of common sense. You know, like they can't find the door in a brightly lit room. [laughs]

But there was this grudging recognition, well -- it was kind of yeah, not grudging recognition, just an acknowledgment, yeah, these guys know a bunch of stuff we don't. But when it comes down to getting dirty, we know a lot more that they don't. And that was kind of the genesis of why, you know, it's not like we designed it, but that's the way we had to make it to get it to work kind of things happened throughout.

Thonhoff, J.: To sum up the whole thing in just a few words, what would you say to capture --

Dooley, J.: It was an awesome engineering accomplishment. It was an awesome triumph of science. It's just amazing to see it for real after seeing it for decades just from outside the fence, to really be able to walk down through there. And then appreciate the connection back. Just amazing.

Thonhoff, J.: That's good.

[End of Interview]