

KEN CALKINS. Born 1926.

TRANSCRIPT of OH 1315V A-B.

This interview was recorded on February 2, 2005, for the Maria Rogers Oral History Program and the Rocky Flats Cold War Museum. The interviewer is Hannah Nordhaus. The interview is also available in video format, filmed by Hannah Nordhaus. The interview was transcribed by Sandy Adler.

ABSTRACT: In this interview, Ken Calkins discusses his work as a chemical engineer and building superintendent at the Rocky Flats Nuclear Weapons Plant from 1955 to 1989. Includes discussion of plutonium processing and recovery, safety at Rocky Flats, the 1969 fire, and the Glovebox Inerting Project.

Interviewer's questions and editorial comments appear in parentheses.

[A].

00:00 (This is the Rocky Flats Cold War Museum Oral History Project. I'm interviewing Ken Calkins at his house in Golden. I'm Hannah Nordhaus. It is the 2nd of February, 2005.)

(So, Ken, to get started, if you could tell me a little bit about your background, where you were born, what your parents did, where you were educated, that sort of thing.)

All right. Going way, way, way back, I was born on a small farm southwest of Greeley, Colorado, west of Evans. It's actually now probably inside the Greeley incorporated city limits there. Born in 1926. My father was purchasing the farm that he worked. When the Depression fell in October of 1929, very suddenly he owed more money against the farm than it was worth. So he did lose the farm early in the Depression. And the Depression years were fairly difficult for our family, although they were for everybody at that time, so I didn't really know the difference. It just seemed normal to me. After that, my father worked on the roads for a time, and then in approximately 1930, I think it was, we moved to the town of Loveland in northern Colorado, and that's where I grew up. I went to the public schools. My childhood school memories are associated with Loveland. My father then became a carpenter, and that's how he made a living during the remainder of his life. My mother never really worked outside the home, although for a time she did, during the Depression, did some babysitting and domestic work to supplement the family income.

My character, my philosophies of life, were very substantially influenced by the conditions during the Depression, as were most people my age and generation. At tail end of the Depression, of course, it was closely followed by the Second World War. That's what was going on when I was in high school. So that was again a big influence upon my nature, my character. I graduated from Loveland High School in 1944 and went immediately into the service, the Army Air Corps at that time. As a matter of fact, I was riding on the train

to the induction center on June 6, D-Day, of 1944. I was in the Air Corps, but really got in a little bit late to have any significant role in the Second World War. So I had an undistinguished military service and was then discharged in November of '45.

Following that, I entered the University of Colorado in spring semester of 1946. I majored in chemical engineering and received a B.S. degree in chemical engineering in 1949. At that time, there was really little industry, certainly no chemical industry in Colorado, so I was interested particularly in the petrochemical industry and left Colorado then to – my first job was in a natural gasoline plant in the Oklahoma Panhandle. And then the following year I married my wife, who is really a local girl, lived on a farm between Loveland and Johnstown. We were married in 1950 and went back to the Oklahoma Panhandle. I wasn't greatly enthused about the Panhandle, and my wife was even less so. The job that I had there, although it was satisfactory, it didn't appear to be leading anywhere, no real opportunities for development. So I started looking around.

In 1952, I was looking seriously. We came back to Colorado for a vacation at that time. That's when I first heard that some vague, almost mysterious, at that time, plant was being built on the Rocky Flats between Boulder and Golden. I had driven across that area a few times when I was going to college at CU. At that time, there was really nothing there, except some bare mesas with a bunch of rocks and very few trees. At any rate, they did have a local office, employment office in 1952. I did apply and was told that they had really just finished filling their technical staff and didn't have any openings there but they would keep my name on file. Well, we all know what that means. The file under those conditions is usually a wastebasket. So I kind of forgot about it and really did nothing further myself.

I had looked at a couple of other areas and did indeed submit an application at a petrochemical plant, really quite a large one, in the Texas Panhandle, a town called Pampa about 50 miles northeast of Amarillo. They hired me right away. So I went to work there in the Texas Panhandle in petrochemical production. The work itself there was very interesting. I liked that work, had a good job, the company was fine. But my wife and I really felt we did not wish to spend the rest of our life in the Texas Panhandle. We were considering some other things when suddenly, from my standpoint out of the clear blue, it must have been the late spring of 1955, I got a letter from what was then the operating contractor at Rocky Flats, Dow Chemical Company, saying they had reviewed my earlier application and wondered if I was still interested in a position. That itself rather surprised me, because as I say, I had thought that was the end of it.

I did write back and say I was interested. So I was interviewed by a fellow named Bob Hawley, he became my immediate supervisor, on his way through Amarillo, and was offered and accepted a position. So I went to work at Rocky Flats on August 8, 1955. So that's how I got to Rocky Flats, briefly, and spent, oh, just about 35 years after that.

09:23 (Want to tell me your career trajectory there?)

OK, yes. I did enter into a group which was the chemical engineering group of what was called the technical staff. The technical staff was kind of the forerunner of the research and development group. We did very little research at that time. The technical staff was mostly a development group, looking into and working on production problems related to chemical processing. Initially I did work on corrosion, some water treatment, etc. Oh, and some early chemical processing problems in the areas especially of enriched uranium and plutonium processing.

There were a few things that rather were surprising to me as I went to work there. For one thing, as I say, I'd worked in a very large petrochemical plant, and at Rocky Flats, to me, by comparison, all of the production was very small-scale. Now that's certainly understandable when you consider the nature of what we were working with, but everything was quite little to me.

Another thing was, that I hadn't thought about that kind of surprised me, was that it was basically a daytime operation five days a week. The plants that I'd been in, by their nature, when you started up the processes, you essentially kept them running a year. A year later they were shut down for major maintenance work, maybe, and then restarted. So it went 24 hours a day, 7 days a week. At Rocky Flats it was 7 hours a day, 5 days a week. So it seemed to me at that time that all that expensive equipment was sitting there idle most of the time. And again, that's the nature of the work. I just hadn't really thought about it previously.

A third thing that surprised me a little bit was there was a – the plant was very compartmentalized. A lot of that was intentional based upon the concept of security at that time. They really preferred that most people did not know all aspects of the operation. They really wanted, for security purposes, to keep it compartmentalized. But part of it was also the nature and character of some of the personnel that were operating the plant. You probably know that at that time there were four people (pause in tape) – the plant from a production standpoint was basically organized in four plants, plants A, B, C, and D. A was depleted uranium processing, headed by a gentleman named Bob Eastman. Plant B was enriched uranium operations, supervised by a gentleman named Lyle Zotner. C was plutonium operations, headed by Bud Veneble. D was assembly activity, headed by Ed Wolco. Well, these individuals—with the possible exception of Bob Eastman, who had not really come from the nuclear industry—but the other three individuals particularly were pretty strong individuals, and they really wanted to be king of their own empire. The group that I was in, the technical staff, supposedly encompassed the entire plant operations. But I found that it was rather difficult to really get to make inroads into any of those B, C, and D plants because for one thing – and I hadn't been aware of this when I signed on – they each had, particularly B and C, a little less in the assembly – they each had some of their own development and testing people anyway, and they really didn't particularly welcome our presence and they kind of treated us as outsiders. Especially if they learned that the day before we had been in one of the other plants, they were afraid we might tell their secrets or something. So I was rather surprised at those conditions. And it did take some time to kind of work into a feeling that we were

really participating as one team for the entire plant operations.

16:07 Going on from there on my assignments, later – first of all, some time in the early 1960s, maybe like 1962, there was a change in the philosophy within what was then the Atomic Energy Commission, the forerunner to the Department of Energy, whereas previously they had made it a point that they had duplicate facilities within the US for any important processing, in other words, the enriched uranium activities that we had were pretty much a duplicate, maybe even on a smaller scale, of facilities at Oak Ridge. Our plutonium production activities were duplicated particularly at the Hanford plant in the state of Washington. They had some other assembly facilities in Los Alamos. Well, some time in there, the Atomic Energy Commission changed its philosophy and recognized that this duplication was costing them a lot of money. So they de-emphasized the duplication and Rocky Flats pretty much lost all of its enriched uranium processing responsibilities. We picked up most of the plutonium processing and fabrication responsibilities, so that the activity at Hanford along those lines was minimized. We certainly did essentially all of the assembly of facilities. So there was a change in that philosophy to emphasize our plutonium work. At the same time, kind of related to but a little independent, there was also an increase in production scheduling levels. So as a result, we needed to increase our production capability for plutonium, especially. My group really began working a great deal on processes to improve production, plutonium chemical recovery operations. We worked on making continuous processes, improving them, reducing direct-hand exposure, which of course contributed to radiation, that sort of thing. So a large part of the rest of my career had to do with plutonium processing, the development of processes for it, later the design and construction of facilities for plutonium processing, the administration of the work, that sort of thing. So it really basically emphasized plutonium processing work.

(So it was research for better processing?)

Actually, after – it was something like 1962 when we did have a reorganization, and that's when the research and development department was formed. By my interest and inclination, I was not so much of a researcher as development, and there's kind of a, there's sort of a line, not a very clear line, between research and development, but I was more in the development area of the practical and productive application of research results to plutonium processing. So I really moved from the research side to the development side and then to the actual operations side in later years. I later became the superintendent of building 771, where we at that time did essentially all plutonium chemical reprocessing to produce purified plutonium metal suitable for further fabrication operations. I did the recovery work. Then I was also, considerably later, the first superintendent of building 371, which was a rather ill-fated facility intended to replace building 771 for plutonium production operations.

22:17 (It was ill-fated because it came online right when the mission was –?)

Well, it's really a little deeper than that. I think we can – that makes a nice excuse for why it never really operated, but a lot of money was spent on that facility to be a much

better, safer, whatever, improved replacement for building 771. As we actually got into the testing and startup phase of it—you know, writing procedures, testing the equipment, getting ready to operate it, it became clear that the design of the facility was really not satisfactory from an operating standpoint, and in truth, it would never have operated in its initial design condition as it was intended. It was – as a matter of fact, even before the shutdown, a large project had been initiated to rebuild it so that it would work. There were a number of reasons for that, but anyway the result was that in my opinion building 371 as initially constructed was a great big white elephant.

(What specifically wasn't functional?)

Well, there were a whole bunch of things. For one thing, you know, I mentioned previously that my surprise at Rocky Flats was that the equipment was so small. Well, in building 371, it turns out, a lot of things had been designed to be way too big. And because of the nature of the work with plutonium, you really need small equipment, for several reasons. So some of the equipment there, we had an incinerator to replace the incinerator in building 771 that was way too big. It was housed in a room that was going to be extremely hot when it was in operation.

(Hot as in heat?)

Hot as in temperature, right. Probably hot as in contaminated also. Both of those things. But it would have been extremely difficult to maintain that on a supplied air basis. Fine-exchange columns that were in there were put in very high; columns changing out the resin, unexchanged resin used in purification. It was going to be very difficult in those columns. Maintenance was a problem. They had put in the design electric (?) motors inside gloveboxes and felt that they could protect them against corrosion by applying a corrosion protection paint on the outside. We had found years ago in building 771 that that just did not work very well. So there were a lot of design features that were really very poor about it that were really going to keep it from working.

(Who designed it...?)

A lot of blame could be shared by a lot of people and a lot of organizations. Certainly the initial criteria were prepared by a team from Dow Chemical Company, the company running the plant when it first started. I was not on that team, so I can say it wasn't my fault. Whether I would have done any better is not certain. But the criteria were not well written in order to get what was wanted. The architect engineering firm was Brown and Root, out of California, and I guess I would lay most of the blame on them, but I emphasize they were not alone. A lot of the problem was them. The work itself was – the construction work in the building of the plant was really satisfactory from the standpoint that they built the plant the way it was designed, which is what the construction company has to do. I didn't have any big complaints about the construction. It was mainly the design concepts and then the detailed design that came out of those concepts that were the problem, I felt.

28:18 (When you took over as supervisor of 371, how did you discover it wasn't going to work?)

(chuckles) Well, actually I can remember (chuckles), as I got the assignment, let's see, that would have been in, I guess, 1976. Rockwell International succeeded Dow Chemical as the operating contractor on July 1st of 1975. I was at that time superintendent of building 771, and we thought we had operating problems there, too. But then roughly the summer of 1976, maybe a year or a little more after Rockwell assumed the contract, the construction schedule was such that we were supposed to start full-scale operation approximately a year from that time. So I was assigned as the start-up manager and then would be the building operations manager. When I went to work, several of the people who had been on the Dow or Rockwell project team previously were still there and I kind of moved in on them and they were assigned on the team. I said to them essentially, "Boy, we've really got to get to work to do this testing and write these procedures and get everything ready to start full-scale operation in a year." They kind of chuckled a little bit and said they didn't think we had to break our neck to do it, or something to that effect. That wasn't their words. But they had already begun to realize that there were some big problems. So we did get some additional technical people assigned to the team. They began working with equipment and looking at it and preparing procedures and most of those fellas, you know, when we had our technical meetings, most of the news that I got was bad news from the standpoint of startup operations.

As I began to—well light began to get through to me, I began to report this, and in the nature of the things we do, my news was not welcomed there. It was a \$250 million system that was going to solve all the nation's problems in plutonium processing. That's kind of a general statement there, but nobody within Rockwell, nobody within the Department of Energy – it had changed from AEC by that time to the Department of Energy – nobody wanted to hear that news. And I'm basically a technical person, but I recognize the politics that exist, too. It was not easy to start taking that message, saying, "Well, you know, we're not going to start up on time. We're going to need to get a lot more money to rebuild in order to operate." So it was from that standpoint not really a very good period.

32:47 (Is that where you finished up your career?)

Well, sort of. Let me speak to a few other things that happened along the way before I got there. In the notes that you had given me, you asked about a few incidents that had occurred, what I might remember. I remember most of them very well, even those going way, way back. One of my first experiences at Rocky Flats that I can remember was handling plutonium. Now, the design of the units when I went to work was an old-fashioned design in which plutonium that goes into the weapons was actually designed as a ball or a couple of parts and the total ball was, oh, maybe a large golf ball or a small baseball. We then plated it with a nickel plating. It was actually removed from the glovebox lines for use in the parts. I can recall the first time somebody handed me one of these plutonium balls to hold in my direct hand and feel its weight and its warmth. Then in later years, of

course, lots of people handled plutonium through gloves and a glovebox. But the handling of the direct plutonium ball was kind of interesting, because you really felt – you could tell the density of it, and the density is roughly 50% greater than of lead. So you could tell that was really a heavy material. And it was interesting to feel directly the warmth of the plutonium from the internal radioactive decay. So that was one thing that I recall.

Then there were a number of other incidents. The first of significance was in building 771, when we had an explosion, a chemical eruption, perhaps, in what was called the east chemline, in which a precipitator column had had a minor explosion resulting in some contamination spread. Several people – I recall the name Leonard Holmann. I don't know if he's shown up on any of your lists. But he was significantly contaminated in it, I know. I've kind of lost track of Leonard and don't know whether he's still living, even. But I know as a result of that, the group that I was in worked on the cause of that and what could be done to prevent that from recurring. We had found that it occurred as a result of some autocatalytic decomposition of hydrogen peroxide synthesized by high iron in the solution. So in our group we worked on methods to remove the iron and install a refrigeration unit to prevent that from happening again.

And then somewhat after that, we had the well-known building, or room 180 fire, in 1957, which was really a pretty big event. I was, at the time, I was doing some – not at the time of the fire per se, but the day before the fire and for some time before that – a friend of mine and I were doing some work, some development work on a new precipitation process in room 180. I can recall when I heard that, my goodness there's a big fire at Rocky Flats in room 180, I was suddenly all worried about whether or not it was something that we had done to cause that. It turns out it was not, it was in an adjoining glovebox, started in a can of chips that had been left there. But I can, indeed, recall the instant, and fighting the fire, and cleanup of the aftermath, which was kind of a big mess. That was certainly very significant. And certainly we learned something about burning plutonium chips at that time, but perhaps we didn't learn as much as we should have.

Because later, of course, in 1969, that's quite a bit later, we had the big fire in building 776, which caused major shock waves throughout Rocky Flats and the AEC system. That, at that time, maybe still, has been called the largest industrial fire of all time. I think that's pretty misleading, in a way. If you talk about the – it was defined as the largest industrial fire on the basis of the money that it took to clean up and to rebuild the facilities in a much improved manner than they had been in the first place. But from the standpoint of damage to the environment, there was really none. A tiny little bit of contamination was released, was tracked outside, but for the most part there was no effect outside the building. Nobody was hurt in the fire. Nobody was certainly killed or injured. It was a big internal problem, but in my opinion it was kind of mislabeled the largest industrial fire.

I think one thing that has not been given the attention that it should was the terrific effort that was accomplished in the cleaning up from the fire and resuming work. The cleanup was done under the supervision of a fellow named Bruce Owen. And again, I've kind

of lost track of Bruce. He had retired. I'm not sure whether he is still living. But the initial cleanup work was done by salaried people working on a volunteer basis. Maybe there was some internal pressure to volunteer, but nobody was forced to go in there in supplied air if they really objected. It was all supervised by Bruce. We went in there and started cleaning up that stuff, and it was really indeed a great mess inside.

In addition, of course, there was a large amount of plutonium spread all around the area where we didn't really know where everything was. There was an awful lot of water left from fighting the fire. Mixing water with plutonium is very undesirable from a criticality point of view, and so it was certainly within possibility that we could have had a criticality event, not just an infraction, but a real criticality explosion as a result of that. But because of very thorough planning by Bruce, by diligent work by all of the cleanup team, there were no real problems, no accidents, no injuries within the cleanup. It took a long time to get it done, but it was indeed finally done.

(Did you participate in the cleanup, go into the building?)

Yes. I was one of the "volunteers." Now, at that time, most of us from a volunteer standpoint, initially, worked one day a week. We had a regular job that we fulfilled, and on one day a week we would go there, suit up in our supplied air, go in and work on recovering material. Later, after most of the plutonium had been cleaned up and accounted for, there was lots of contamination until the end, but later, after the initial stages, then indeed it became – hourly people assigned as decontamination workers started working there on a regular cleanup basis. So yes, I was one of them. I was not on the management team, just went in there.

44:16 (What was it like?)

Oh, it's hard to describe. The room itself, even before the fire, and this certainly led to some of the severity of the fire, but within the total industry, and you can see this repeated elsewhere, it wasn't unique to Rocky Flats, something is built to a certain design capacity and certain standards, and then as time goes on, you want to squeeze more production out of those same facilities without spend more money. So after the initial construction of building 776, we had really put more equipment in there than it was designed for. We had put in lots of – and this was a key. Because of some high exposures that had been encountered in earlier years, not just recently, but we installed in building 776 large slabs of – suddenly I can't think of the word – polyethylene, no, not polyethylene, I can't think of the word, anyway, large slabs of an organic material shielding to reduce neutron exposure to the workers on the outside. In later years, it turned out rather funny. We went back to see how much attention had been given to the flammability of that material, and it turns out my group had conducted some tests on the flammability of it before we actually started installing it, and found out that it was indeed flammable and if exposed to high temperatures, could ignite. But it was relatively easy to extinguish if you could do that on a small basis. So we knew about that, but nevertheless we had gone ahead and installed very large quantities of that neutron

shielding. We'd put in, crammed a lot more equipment in there. Overhead we had large ventilation ductwork held up by hangers. And in the fire, once the fire got going, initially there was a reluctance to use water because of this well-known problem of water moderating the plutonium to cause a criticality. So water was not used initially. Probably they withheld use of water for longer than they should have. By the time they did start to use water to try to fight it, then all that shielding was just burning so fiercely that the water just did not extinguish it. So the result of all of this was that glovebox windows had been burned out, plutonium spread around. Much of the ductwork, which had been up overhead on hangers, the lead anchors had melted and pulled out, so ductwork pieces were spread all over the floor. There were ashes. There were remains of this shielding. Just a – it's hard to describe. It was like a big mechanical jungle in there when we first started going in to clean it up.

(And I understand it was dark?)

Yes, right. Initially, right. There were no lights left in there. Very dark. So you would set up some floodlights. Initially they were out at the doors. They would penetrate 20 feet or so. (laughs) You had to be very careful about movement. Also, the supplied air carts that we used at that time, initially I'm not sure they even fed refrigerated air. But at any rate, you had to pull the air hose with you, which fed your mask. There was certainly no refrigeration, no ventilation within the building at that time. It also turned out that this initial work was in the summertime, when it was hot. You'd go in there, and within 15 minutes you were perspiring. I can recall when – some of the first times I went in there, by the time I came out, there would just be in my booties, and all wrapped, of course, was a plastic, impervious to ventilation, that's what you needed, but that meant that all the perspiration just kind of ran down your body and collected (laughs) in your booties, and I can remember that it was just so uncomfortable working there under all of those conditions.

We gradually got better refrigeration carts so that at least the air supplied was initially cooled off more to help out in some of this.

50:51 (When you went in there, what were you doing? Picking stuff up?)

Initially, we went in and looked for any little piles of burned plutonium. Now, when plutonium metal burns, and there had been a lot of plutonium metal in that foundry line there, when plutonium metal burns, it's a little bit like a charcoal briquette burning. You've seen that burn. It just forms kind of some white ash on the outside. If it's undisturbed, the ash just kind of collects. Plutonium kind of burns that way. It just sits there and glows. There isn't any big flame. It just kind of glows, oxidizes. It forms sort of a greenish powder. So initially, we went in and we were looking for little piles of any plutonium oxide, any concentrated areas of plutonium oxide, any metal that might still exist, but there wasn't much left as metal. We would pick up, scoop into little containers, any plutonium to package it and get it out for recovery, but recovery was not the primary concern. It was to get it out to reduce any problem of later cleanup.

Also, initially one of the big efforts was that we had a few – some underpasses, some steps under glovebox lines, and a few other little pits, if you will, some areas where water had collected from fighting the fire. And one of the early efforts undertaken carefully was to drain this water out, because we didn't really want to disturb it. Obviously, nothing had gone critical at that time, but if there was some bottled plutonium on the bottom of this water which was just barely subcritical, then we didn't want to disturb it and put it in a condition where it did go critical. Now that term is a little vague, but I mean – plutonium itself is a hazardous material, but as just a little pile of oxide, it doesn't really hurt anything. You can put your hand with a rubber glove on it, hold it in your hand, and it's no problem. But if too much of it gets in one place and it's moderated by water, then the criticality event or nuclear reaction can occur. A tremendous amount of heat is generated, and people in the near vicinity die, is basically what it is. We certainly wanted to avoid disturbing anything to cause a criticality event. So the point was that the water and some other things were moved very carefully to avoid this.

(I understand that even the presence of your body, if something is sub-critical, could make it go critical?)

That's correct. That can occur, too. You know, right now we can look back at it and say, "Well, yeah, that was pretty well done." But at that time, you just didn't know what was going to happen in the next five minutes. So it was a big occasion, and again, I'm not sure Bruce Owen and his immediate crew really got the thanks they deserved for planning this and conducting that. Certainly the whole thing was a tragic event, but at least it wasn't made any worse by the death of people or any serious injury during the recovery operations.

(Why don't we take a break and I'll change the tape?)

OK. Very good.

56:19 (End of Tape A.)

[B].

00:00 (This is the Rocky Flats Cold War Museum Oral History Project. I'm interviewing Ken Calkins. It's the 2nd of February, 2005. I'm Hannah Nordhaus. We're at Ken's house in Golden.)

(We had just finished talking about the '69 fire. I'm wondering if there are any more memorable incidents that you wanted to share.)

There are some, yeah. I could waste a lot of time on a lot of little details. But actually, maybe I should move on a bit. The '69 fire, although certainly very unfortunate and regrettable, did lead to an assignment for me that turned out to be an interesting assignment. After the fire, the Department of Energy requested certainly an in-depth safety review of a lot of things, including how to rebuild the lost production capability, but also any other potential hazards that were around that might create the next catastrophe. A number of projects came out of that, and one of them was that during this period in which I was working on cleanup of building 776 one day a week, my group was asked to look at ways to minimize the possibility of further fires in fabrication areas. Included in this was the examination of different atmospheres that would prevent a fire from occurring. So we did studies on what they generally call inerting of production systems. As a result of these studies, then we submitted a project to apply an "inert" atmosphere to certain fabrication facilities where the potential for fire was significant. This project was approved and then I was appointed as a project manager for that project, which was called the Glovebox Inerting Project.

In our initial studies we had looked at various materials that might be used. We had recommended in our studies that certain fabrication facilities where plutonium was in a form that could be fairly easily ignited be supplied with an inert atmosphere. We recommended nitrogen atmosphere. Nitrogen is not truly an inert gas. Nitrogen will form compounds with other materials and it does – well, it will react. Other gases—argon or helium, particularly—from the standpoint of inerting, would be more effective, but they're also far, far more expensive and for the purposes that we encountered, we determined that nitrogen was really quite satisfactory.

So I became project manager for the project to apply that inert atmosphere. We modified a lot of the boxes and then extended that to building 707, 779. On that project, we did contract with a private company, Air Products and Chemicals, Inc., to build and operate an onsite nitrogen plant whose only purpose was to supply nitrogen to our facilities there. That was itself an interesting project. It took altogether four years to design, build, put in operation. We came out quite well on the schedule and the costs. I got to have a few experiences there that I wouldn't otherwise have had. I worked with Dow's engineering and construction division in Houston on that. The archetype engineer that was selected was a company, their name then was Ralph M. Parsons Co., from California, who did our design work, a very capable team. And of course I got to work with the nitrogen plant constructor, Air Products and Chemicals, Inc. I got some experiences that I wouldn't have otherwise undergone. So that was, as I say, rather interesting.

06:23 One little – from my own personal viewpoint, this probably wasn't any benefit to Rocky Flats, but to me it was an interesting part of my memories. At about the time the – shortly after our project was completed there and put in operation, successfully, with few startup problems, we'd just closed a project, and I had then been assigned, I was an assistant production superintendent in building 771, one day I got a phone call from the plant manager, it was Jim Haynes at that time, the general manager of the plant. His call was rather vague. He just said he had a call on another line that he was going to transfer

to me, and all he wanted to tell me was that, whatever they wanted, give it to them. Then he transferred the call, and it turned out to be from the plant manager from another Dow plant, this was still in the Dow Chemical Co. days, in Stade, Germany. Stade is a town, a city of Germany on the Elbe River about halfway down the river between Hamburg and the Atlantic Ocean. It turns out that the week before, the Stade plant had had an explosion and fire in a metal cellulose plant, and as a condition of resuming operation to the German government, they had agreed that they would apply an inert atmosphere to their facilities. The plant manager had heard that Dow had an inert facility going at Rocky Flats, so he was interested in trying to get information. So the net result of all of that was that he asked me if I could come to Germany to consult with him on this for a few weeks. I remembered Jim Haynes had said, whatever he wanted, give it to them. I said I thought I could, and arranged that. Two days later, I was on the airplane going to Germany for a couple of weeks. We worked on that, but then at the end of my business there, I also took some time off in Germany and visited friends in Norway and went to England for the first time. So that was a little personal memory that I got from that association with that project. The German plant ultimately did indeed successfully install their project also.

09:48 Where else was I? That then brought us back to about the – that's when I resumed work in building 771, became building superintendent. And then, to building 371 there. And really, although trying to start building 371 was probably my final major responsibility, from an operations point of view, when it became apparent that that wouldn't run, Rockwell—this was now in the days of Rockwell International—initiated another construction project to rebuild the facilities, and Jerry—what's-his-name?—came in to head that project.

I became a technical staff assistant to Bill Weston, the plutonium operations manager at that time. Then we initiated a project that – the whole complex, the whole plutonium recovery complex within the DOE was having trouble, partly because of the failure of building 371, partly because of the aging of 771, partly because of some other problems, they were having trouble recovering the plutonium from various types of residues, we call them. Residue is essentially anything that contains some recoverable amount of plutonium, but it has to be processed in order to get it back and purify it. The system was having trouble getting that done, so a committee was formed to look at nationwide capabilities, establish – well, we already had this, but was kind of expanded, what were called “economic discard limits” for determining what was recoverable and what wasn't. It's sort of connected, but not directly, some technical committees called JWG's (Ed. Note: pronounced "Juh'wogs"), Joint Working Groups, were established with the English, United Kingdom Atomic Energy Agency. So I was a member of a JWG group for plutonium processing, which included the other facilities within the United States and also some English facilities. And that was also interesting. It turns out that we would usually have one meeting per year in America and one in England and would review and discuss operating problems with the facilities and how we did things and help each other with problems. Working with the English and visiting there was also interesting from my own personal standpoint. And we probably helped, I think, the complex in plutonium processing problems.

14:04 (When did you retire?)

I retired from full-time work the end of February, 1989, just about 16 years ago at the end of this month. However, I also did some consulting after that, for other companies, but also for Rocky Flats for a time. As a matter of fact, (chuckles) I recall that in one of the jobs I was doing, there was, primarily for Bill Weston, who was the director of plutonium operations, I guess his title was, we had scheduled a review of my work and I was reporting on it and getting ready to complete that on whatever day it was in the summer of 1989, it was August or whenever. At any rate, I got out there a little ahead of time and stopped to speak to a few old friends of mine and went into Bill's outer office a little bit before our meeting to say hello to people. Bill's secretary at that time commented that Bill was acting for the plant manager, Dominic Sanchini, today as acting plant manager, and he was going to be delayed a little bit. About that time I kind of observed without paying too much attention some kind of commotion, some action out in the hallway that I really didn't pay too much attention to. The time kind of dragged out, and it really kind of went through my mind that Bill was a little bit rude to keep me waiting so long. About that time, his secretary came out and said an emergency had come up, and Bill just wouldn't be able to meet with me that day. It turns out that day was the day of the infamous FBI raid, if you call it that, at Rocky Flats. So I was there that day, but I didn't really have any direct further participation in that.

(Did you feel that it was warranted?)

Well, I really thought the whole thing was kind of absurd, kind of foolish. I have never seen any official report. I don't know the real basis, just from what I have heard, I understand that the FBI had gotten some information that the building 771 recovery incinerator, which I think was the focal point of the whole thing, was being operated at midnight. Well, of course it was operated at midnight. It was also operated at 10 o'clock in the morning and 3 o'clock in the afternoon, because that incinerator, by its nature, takes about three to four hours, really, to get going on an equilibrium basis. When you're through burning, it takes another three or four hours to cool off and remove the material, and so on. So if you only operated during the day, you'd get about one hour of production for a day's work. So when it was started up, usually on Monday morning, it was just operated for a full week until Friday evening. At that time we operated 24 hours a day, 5 days a week. So we'd shut down Friday evening. So if the implication was that anything operated at midnight, there must be some skullduggery afoot, that's ridiculous in the beginning. It had to be.

I also understand that they'd taken some infrared photos from a helicopter and found something was operating in a building. Again, from a technical standpoint, that's rather ridiculous. When we hear the term "incinerator," we generally envision some big hot facility, but that building 771 incinerator was a very small little box, and the amount of heat generated from that incinerator was much less than a lot of other sources within the building, from the reduction furnaces, even from ventilation fans, etc. So infrared photos

on that building would not have revealed anything about the incinerator operation.

And then, another point—this, I guess it was technically true, but I heard later that the charges were that some waste was being incinerated which should not have been incinerated, because we were doing it to “avoid EPA regulations.” Well, maybe it was technically true, but it showed kind of a misunderstanding, perhaps on our part. I mentioned earlier that we had done a lot of work on what was called economic discard limits, which basically determine at what point some contaminated residue must be recovered or recovery and reuse of the plutonium versus where it is so dilute that it should be discarded as contaminated waste. At Rocky Flats, we really always interpreted these limits as minimum limits, that is, if it's above our discard limit, the residue had to be reprocessed. If it was a little bit below the limit, however, then we had an excess, maybe the incinerator still had a few hours it could run that week and we had a residue that was slightly below the limit, we didn't think there was anything wrong, as a matter of fact, we thought we were doing something good to go ahead and recover that plutonium even though we weren't officially required to do so. So we thought recovering something under the limit was a good thing. We didn't realize that it would be considered a violation of EPA rules to do that. So the result was, I thought that whole incident was a little bit absurd from the standpoint of what it did, and whether that justified shutting down an entire very expensive production facility.

22:43 (What did you think about the decision to shut it down and stop production?)

Well, I thought that didn't need to be done. Of course, to a – let's see, that was before the collapse of the Soviet Union. Somewhat later, when the Soviet Union collapsed, that did rather decrease the competitive pressure on the United States to maintain its lead in nuclear weapons. But I really thought it was unnecessary to shut down the facilities and abandon them and indeed a tremendous capability is being wasted.

(Even given the aging facilities and the difficulty in getting the new building up and running?)

Certainly building 771 itself was aging and it had passed its prime and shutting down building 771 itself, I can't argue against that. Also, and I recognize that I just said that building 371, which was supposed to be the replacement for 771, was not a real viable production facility. So something else needed to be done. And whatever else was done was indeed going to cost a lot of money. So there is a gap there. I don't disagree with shutting down and removing building 771. But I think the total complex did not need to be lost. And indeed, DOE is now working on some alternate and reduced capacity facilities that would cost a lot of money anyways, someplace.

(What about the argument and the fact that the area became so highly populated that it was a very different place in 1990 than it was in 1953?)

Well, certainly, if you were considering siting a brand-new facility now, you wouldn't put

it out there at Rocky Flats. It would be someplace else. I notice, however, that wherever the DOE considers siting any facility, there is tremendous resistance. I don't know if you're familiar with the Yucca Mountain waste repository. It's hard to imagine any place more remote, any more useless ground within the continental United States as Yucca Mountain. And even that has tremendous opposition being voiced. The waste isolation pilot plant, no longer pilot plant, near Carlsbad, New Mexico, for waste again, that area is not good for much of anything else. Well, that's not a good thing to say, but it is quite remote there, and it has tremendous opposition. The point of that is that I'm not sure where they can build any facility in the United States without getting great opposition. The question is whether Rocky Flats is enough of a threat to this area that it really needed to be abandoned. I personally think, although lots of others might disagree, that it was not a threat. I think it never has been.

I personally believe, although there are others who believe otherwise, that no member of the public has ever been injured as a result of operations at Rocky Flats. Now, some years ago, what was his name? Dr. Carl Johnson, from the Jefferson County Health Department, he did studies and he issued information saying that whatever it was, five people in the Denver area had contracted cancer as a result of Rocky Flats' operation. But that's a very statistical basis, and nobody can really say who those five were and whether that really occurred or not. And the five is just my own made up number. I don't know that.

Anyway, I don't think Rocky Flats was ever a hazard. I think it was operated very safely. If it was a hazard to the metropolitan area, then it indeed must have been a much greater hazard to the employees working there, and hardly any of the employees working there ever, I think, considered it a hazard. In fact, I have read in the paper that your state representative from Boulder County, what's his name? wants a sign put up saying – there was a bill, on the hiking trails on the wildlife refuge out there, we should put up a sign that says that it's a hazardous area. And I don't know. I'm not demonstrating against that, but I think even that is kind of pointless. If that's considered a hazardous area now, then for those individuals like me and ten thousand others who worked at Rocky Flats full-time, you would have to say that we were either unaware of the hazards of working out there, of the hazards of radiation and contamination, or else we ignored the hazards, we discounted them. Well, I'm sure there were some who didn't really, weren't really aware of the problem. But for most of the people who worked there, professional people fully understood the hazards of radiation materials, of radiation, of contamination. We understood them far better than almost any of the protesters, certainly far better than an FBI manager does. So I don't think there's a valid point that we were unaware of the hazards. So if not that, then they say, well, we must have ignored the hazards to work there. But you know, I don't know anybody at Rocky Flats that was ever suicidal. None of us wanted anything to happen to us. None of us wanted anything to happen to our families who might live around that area. But we were completely convinced that the operation was safe and that no ill effects were going to be gained. Now, yes, there were several fires that were unfortunate, but even those fires were contained within the limits of what we'd established as a barrier for protection.

32:14 (Were you ever exposed to any contamination?)

Well, certainly to contamination. And again, this is an area where people don't understand very well. There is certainly a relationship between contamination and radiation, but there is a difference between contamination and radiation. Contamination within the industry we consider is a direct contact with material, and in this case we're talking primarily plutonium, of course, on the body in some way. If the contamination is on the outside, it is not penetrating, a little piece of plastic, certainly, the dead skin on your hand prevents contamination itself from entering the body. The problem with contamination to you lies if it is ingested and particularly if it is breathed into the lungs. Then some percentage of it will lodge in the lungs and can cause cancer. If it goes through the stomach, then less of it will be lodged, and it will be excreted. If plutonium simply gets on your skin, and then going back to your question, have I been contaminated, yes, I've had plutonium contamination on my hands, more so in the early days when we didn't have quite so many barriers. If it's washed off fairly promptly, why, nothing bad results from it. The few incidents that I believe were serious and did affect some employees were cases in which for one reason or another some barriers failed and they breathed in or – also I didn't mention, if you cut your hand and there's plutonium in the cut, that can be – it'll stay in your body and cause some cancers. But those are the situations that are of concern in contamination, in which plutonium is ingested and lodges in the lungs and stays there.

In radiation now, radiation is generally a little bit different and comes from either neutrons or x-rays, particularly, or gamma rays that are penetrating and can actually penetrate through forms of matter, including through your skin and your body and can penetrate to damage internal organs. If I have had some of that, nothing very serious compared to others. As a matter of fact, I've pointed out that we receive that type of radiation, to a limited extent, all the time from the sun, from any x-ray that you might get in the course of examination of your body or treatment of the body. Along the way some time I picked up some pneumonia. I'm not saying from Rocky Flats. I just got a case of pneumonia. The treatment had a number of x-rays to see how the pneumonia was developing. It turns out I got probably more radiation from that pneumonia treatment, which turned out very well, and I'm grateful for it, but I got more radiation from that than from my work at Rocky Flats. So I have had some of both contamination and some penetrating radiation at Rocky Flats, but nothing serious and not as much as quite a few of the employees had received.

(Did it worry you at the time it happened?)

No, not really. Like getting a serious cut on your finger. It's possible you could get an infection in there and lose your whole arm, but it's pretty unlikely, so you don't spend any time worrying. And I didn't worry much about it.

(How were you exposed to the radiation? Do you remember specific incidents? Or did you just test positive?)

Oh, let's see, I can't really remember specific incidents. Mostly, see, you're probably aware that anybody working in what we called the hot area, where plutonium is, wore a film badge to monitor and record forever and ever the amount of radiation that you did receive. And over time my film badges have shown some, picked up some penetrating radiation. I don't really recall specific things that might have caused that. In the technology having plutonium fluoride, it does indeed cause plutonium – and there was a time in development work when we were working with plutonium fluoride to try to develop some processes, and that was probably the source of some radiation, but I don't recall any big incidents.

39:10 (The broader picture: How did you feel about working in a plant that produced a key element of nuclear weapons?)

Well, basically, fundamentally I felt quite good about it. I think one of your earlier questions, was there any problems? I couldn't discuss my work with my family, because in the early days security was much more restrictive than in later years. Although it wasn't a security infraction itself, essentially you didn't even mention the word "plutonium" to your families or your social friends and so on. And this, oh, it might have been just a little bit of an annoyance, but it didn't really bother me very much. We just didn't do that. To be honest, most of the public doesn't understand what chemical engineering is about anyway, so even if my work had been in something else, I probably wouldn't discuss that work with social friends, to an extent. But the security aspects, internally, you know, security aspects can significantly reduce efficiency. But from any external standpoint, the security didn't especially bother me. You know, the job satisfaction and rewards, I felt it was a good place to work. The salaries were certainly fair and good. The rewards of working there were rather intangible, but you really got to feel that you were part of something very significant. There was a time when I believed seriously that I was among the top 100 people in the world in my knowledge and understanding of plutonium design and processing facilities. Well, 100 people in the world sounds pretty good. It turns out there weren't very many, (laughs) so that's not too great. But you did feel, at least I felt that I was part of something significant. Back when I was in college, one of my part-time jobs was producing sugar in a sugar factory. I know producing sugar isn't very significant or glamorous. Maybe working with plutonium isn't glamorous, but it's at least different. And I felt going onto more of the social and the responsible citizen viewpoint, that I feel very confident that because of the work done at Rocky Flats, the United States has stayed a free country. Certainly no country would dare attack us when we had the capability that had been produced largely at Rocky Flats, or a lot of it at Rocky Flats, not exclusively, but we were a part of the complex that produced a great deterrent to any threat.

43:16 (I forgot to ask you early on, you had said when you first heard about Rocky Flats, you didn't quite know what it did. When did you figure out what you were going to do? What was your initial response learning about the mission?)

Well, before I went to work there, I did hear that it was a part of what was then the

Atomic Energy Commission weapons complex. That's really about all I knew. So you knew that. I don't think I even knew it would involve plutonium and uranium until after I went to work there. Even if I had, I didn't know much about those materials, so it might not have meant anything to me. But back then, you didn't really find out much of anything until you did go to work and get into it. From one standpoint, maybe that was too late, but other than a few surprises, I think I adapted well. I accepted the challenge of just another industry to work on. Although I do know, and this is kind of amusing when you look at it in retrospect, back before I went to work, like any whatever I was, maybe 28 years, when I went to work there, I was I guess an ambitious young man. I was looking at a career there. I knew that even though I didn't understand fully the difference between weapons technology and nuclear power technology, certainly they are related, I knew that, and I really felt that nuclear power was a great future for America. And by getting in here I'd have access to that industry as a career. Well, it turns out that the nuclear industry hasn't really developed as many of us thought it would anyway. And I also probably didn't fully appreciate the difference between weapons work which we did and nuclear power work, which is where I thought the future would be. I didn't appreciate that, but a number of other companies that were a lot bigger and with more resources than I did also failed. For instance, Dow Chemical Company operated the plant as a public service, but they and other of the contractors at that time thought that they were getting in on the ground floor of nuclear technology, which they expected to ride for success in the future. And almost all of them have bowed out because they see it as hardly any benefit financially and a great big detriment from the standpoint of public recognition.

47:22 (Speaking of public relations, how did you feel about the protests?)

The protests? Well, again, I thought they were kind of misguided. I thought many of them did not – although I'm sure they were sincere, I thought they greatly overestimated the hazards of Rocky Flats to anybody else. I thought they didn't understand very well, as I thought I understood, and I'm not saying I was right, I'm just saying I thought there was a difference, but they didn't understand our need as a nation to maintain a position in which we could not be attacked, and especially back when the Cold War was really a cold war, when there really was a competition in how fast and how good you could go with these things. So I thought the protesters were just kind of immature in their viewpoint on how the world is conducted. None of them ever really bothered me personally, even on the demonstrations right outside Rocky Flats, they didn't really hinder us from our work. We could go in. So they weren't any significant problem to me. I just didn't really agree with them.

49:14 (I wanted to ask you one question and then if you just want to wrap up whatever else you have to say. As a building supervisor, you must have had a lot of dealing with the union.)

Yes.

(I wanted to get your perspective on union-management relations and maybe how that changed

from Dow to Rockwell and EG&G.)

OK. You know, that was another difference between operations at Rocky Flats and previously. I had – as a matter of fact, you know, back when I was in college, I was on summertime jobs and so on, I had been a union member. My father had been a union member. My brother, well, he became a superintendent, but he had been a union member. I didn't have any problem with the union concept of joining together to have a stronger economic voice in dealing with companies. Even in the early days at Rocky Flats, we didn't have any big union problems. We could get along quite well with our staff. I'm not sure when it really started. There was no specific dividing line, I don't think, but gradually indeed, union activity did get to be more and more a problem. To me, I think the problem is, it became very divisive. When you're operating a facility, whatever you need, the effort and the services of everybody from the top down to the fellow that cleans out the bathroom all the time— It got along the way sometimes as if you could hardly even speak to some of the people unless you had a union representative there to make sure that – So, I saw in there some obstacles to getting the work done when I thought we all really ought to be on the same team. Dow, by its nature as a company, Dow tended indeed to be rather combative against the union. And you can see some justification. They had their unions, which were much bigger in Midland and Freeport, Texas, and commercially they couldn't afford from back there to give the employees at Rocky Flats any special breaks because they knew the unions would then come back and demand that in their private operations. So even though maybe DOE would be paying for it at Rocky Flats, they could still see it being expanded to their private operations. So Dow tended to fight back against the union. And that was one of – I don't think it was a controlling thing, but one of the things that caused Dow's departure from Rocky Flats.

Rockwell tended to be a little more accommodating to the union. I say "a little bit." Rockwell also found that it wasn't easy. You couldn't just completely give in to anything they said. Rockwell still had to manage the plant. So maybe the conflict between Rockwell and the unions wasn't quite as great as with Dow. But there was still some there. And I certainly have had a lot of good friends who were union members, and we got along very well. But also had some very difficult times when some union members would just fight right up to the last minute for their "rights" or whatever it was. So yes, in operations the union activities did give us some problems.

54:27 (We've got about five minutes. If you have anything else –)

Well, let's see. I don't recall anything special I haven't covered along the way. I think in summary, my work at Rocky Flats I believe was satisfying to me. I'm proud to have been a part of it. I think we did some good work for the nation. I don't think that we have injured the public along the way in doing that.

(What do you think were the best and worst things about working there?)

Well, I don't know. Probably the worst was that '69 fire and its aftermath, which caused a

lot of things. I don't know the best. It's hard to pick out something. A lot of good friends, of course, but you meet them every place. I don't think that's unique to Rocky Flats. But I'd have a hard time picking out the best thing.

(It's all good. Anything else?)

Oh, I think that's all I can think of to say.

(Great. Thank you very much for participating. We really appreciate it.)

56:10 OK. I did think of one other thing, and this is the general nature of the safety of operations at Rocky Flats. I think there was a time when it was recognized as the safest place to work in the state of Colorado. Back before OSHA was the official safety organization, an organization called the National Safety Council was rather the umbrella organization under which safety was measured and conducted. And Rocky Flats very often won the award as the safest place to work in the state of Colorado. That was usually measured by the number of lost-time injuries, safety incidents, deaths, if any, etc. We very often led the pack. We received a lot of safety awards, just physical little gifts that weren't big, but just to keep safety in our thoughts. We would have safety teams with certain milestones. We'd have a safety dinner dance at some nice offsite place. Everybody on the team would come with spouses or friends, whoever it was you brought. This was just to keep safety in the forefront. Even way before all the public pressure, we were required to have a monthly safety meeting to discuss any potential hazards in the area, to make sure that we were doing things as safe as possible, probably safer than most other industrial facilities.

OK, that's a primary focus of what I wanted to say.

(Thank you again.)

(Ed. Note: video of interview ends with view of safety awards.)

(The safety blanket. OK. Let's see if I can focus in. This is the safety spoon, for 19 million man-hour safety award, June 29, 1962, engraved on it.)

59:03 (End of Tape B. End of interview.)