

THE DEPARTMENT OF ENERGY ORAL HISTORY

PRESENTATION PROGRAM

OAK RIDGE, TENNESSEE

AN INTERVIEW WITH MURRAY ROSENTHAL

FOR THE OAK RIDGE NATIONAL LABORATORY

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STOW: Murray Rosenthal is a cornerstone in the history of Oak Ridge National Laboratory. He came here in 1953 and retired four decades later, having emerged as the deputy director of the Laboratory and having served in many capacities throughout those four decades. Today, we'll be talking to Murray.

Murray, we've got a lot to cover over the next hour. Let's start with your early interest in science and technology. What got you thinking along these lines? Was there any particular person or event that got you started?

ROSENTHAL: Well, according to the family story, I took apart and put together my grandfather's clock when I was very young. The family predicted I would end up as an engineer. They had me classified early.

STOW: So, you got the clock back together and it worked?

ROSENTHAL: No, it didn't work, but I did get it back together.

STOW: Oh. Okay. Well, I could take them apart but never get them back together. You grew up in Mississippi, as I recall, right?

ROSENTHAL: That's correct.

STOW: And, ended up going to graduate school at MIT in Boston.

ROSENTHAL: Yes.

STOW: That's a long way from home. How'd you end up there?

ROSENTHAL: Well, I ended up at MIT because, when I was in the Navy, my ship put into harbor there for a while, and I had a friend at MIT who invited me over and showed me about. As we went down the hall, he kept pointing out professors saying, "This was the man who developed an artificial rubber in the war ... "

STOW: Yeah.

ROSENTHAL: "... and here's where radar was developed," and, "This is the best place in the world for going to technical school." I think this visit influenced me because I never applied anywhere else.

STOW: Well, lucky shot then. So, you got your doctorate of science.

ROSENTHAL: At MIT ... Yes, in chemical engineering.

STOW: And came directly to ORNL at that point then?

ROSENTHAL: Directly.

STOW: What attracted you to ORNL?

ROSENTHAL: Well, I knew about the development of reactors that were coming along, and, at the time, MIT had a practice school down here where students came down and spent some time. So, Oak Ridge National Laboratory was a major subject for discussion there, and it looked like, to me, if I wanted to work on reactors, this was the place to be. And it was only 500 miles from home.

STOW: Sure.

ROSENTHAL: Reasonable climate ...

STOW: Did this place have a reputation at that point of being a bomb factory, or did it still carry an association with the bombs?

ROSENTHAL: No. I understood the difference between the Laboratory and the other plants down here.

STOW: Okay.

ROSENTHAL: I knew that it was at the Laboratory I wanted to work and not elsewhere in town.

STOW: What were your impressions of Oak Ridge as a city when you first came here?

ROSENTHAL: Well, I'll have to tell you about that. I got a job offer from down here, without ever having interviewed anyone through a professor I worked for. I was interested in accepting it, but my wife had heard all the stories about the mud and the disorder during the war ...

STOW: Yes, sure.

ROSENTHAL: And, she was very uneasy about it. So, she insisted I come down and look over the community. I had a look at the garden apartments, which were elegant compared with where we were living as graduate students, and I thought it was a beautiful community. I went back and it took me a little effort to reassure her it was safe. I thought it was marvelous. I'm a small-town boy, and big cities have never appealed to me, so it just seemed perfect.

STOW: And, where is your wife from?

ROSENTHAL: Well, she's from Mississippi, also.

STOW: Okay. So, it was a win-win for you then?

ROSENTHAL: From a town of 900 people.

STOW: Okay. Did you have any idea back in 1953 that you would end up spending your entire career and your life here?

ROSENTHAL: No, in fact, like a lot of my associates, I thought all I wanted to do was teach. I'd taught while I was a graduate student, and I really enjoyed it. So, I thought I'd come down and work here four or five years and get some experience and go back.

STOW: Yes.

ROSENTHAL: But, I loved it here, and it wasn't a place I could ever leave.

STOW: Let's talk now about how you got started once you got here to the Laboratory and what your early assignments were. At some point, early on, you were with the Experimental Gas-Cooled Reactor Program. Was that your first assignment?

ROSENTHAL: No, when I came down as a graduate student I'd worked for a very distinguished professor whose field was heat transfer.

STOW: Yes.

ROSENTHAL: I was hired to work in that area, and I did for a year or so on tasks mainly associated with the Aircraft Nuclear Propulsion Project.

STOW: Okay. The ANP.

ROSENTHAL: But during that year, I came to two conclusions. First, the ANP was never going to work, and secondly, if I was going to be here, I needed to know about reactors. So, I asked if I could go to the reactor school that existed here at the time.

STOW: Yes.

ROSENTHAL: And, the reply I got back was, "No, you can't go, but you can teach." You know the idea that the best way to learn something is to teach it.

STOW: Yes.

ROSENTHAL: I spent a year there, but I didn't learn much about what I needed to know, because I was teaching things I already knew. So I joined the Aqueous Homogeneous Reactor Program.

STOW: Okay.

ROSENTHAL: The Gas-Cooled Reactor Program came later.

STOW: Explain the difference between a "homogeneous reactor" and a "gas-cooled" reactor. In getting ready to talk to you, I found out that there have been about fifteen different reactors built here.

ROSENTHAL: Thirteen.

STOW: Okay.

ROSENTHAL: Don Trauger and I sat down and counted one day. It took a while, but we've built thirteen of them.

STOW: Thirteen. Well, it gets confusing to someone who's not a reactor specialist to understand the evolution of all of these and how one relates to the other.

ROSENTHAL: Of course, the first reactor here was "The Pile" – the air-cooled Graphite Reactor -- and its purpose was to prove that reactors could produce plutonium that could be used in the war.

STOW: Yes.

ROSENTHAL: And then after the war, led by Alvin Weinberg and others, the Lab developed water-cooled reactors. The Lab designed the Materials Test Reactor, built out in Idaho as a "research reactor."

STOW: All right.

ROSENTHAL: The MTR was built to produce neutrons for testing materials. Then the Lab got interested in trying to develop advanced power reactors that really followed two paths for the Aircraft Nuclear Propulsion Program. The Lab was working on a very high-temperature reactor that had molten salts in which uranium was circulated. But the alternative was to try to produce one that was very efficient in its use of neutrons and could breed more fuel than it consumed. And, the best mixture of coolant and fuel to be used then looked like heavy water with fissionable uranium dissolved in it. And, we called that the Aqueous Homogenous Reactor.

STOW: Okay.

ROSENTHAL: "Homogenous," because there was nothing in there but ...

STOW: It's all mixed together. Right?

ROSENTHAL: It's all mixed up in one solution.

STOW: Okay. Let's talk about the Molten Salt Reactor Experiment, which I think you were very heavily involved with, right?

ROSENTHAL: The MSRE was an outgrowth of the Aircraft Nuclear Propulsion Program.

STOW: Yes.

ROSENTHAL: It used a salt -- a fairly similar salt -- and operated at high temperatures. I came into it a little while after it started, not right at the beginning. The Lab had gotten approval to go ahead and build a small reactor -- the MSRE.

STOW: Yes.

ROSENTHAL: And, I became program director just about the time it started up.

STOW: The fuel for the MSRE was changed from uranium-235 to uranium-233, I think. Why was that done, and what was the significance of that change?

ROSENTHAL: What we wanted to do was to make a reactor that would breed more fuel.

STOW: Yeah.

ROSENTHAL: And, if you're going to do that, you can use two kinds of reactors --fast reactors and thermal reactors. The thermal reactors produce slow neutrons. The only way to breed nuclear fuel in a thermal reactor is to use thorium as a basis for generating uranium-233.

STOW: Yeah.

ROSENTHAL: And, that's what we were after. So, after we'd run the MSRE on uranium-235, the normal fuel, we got our hands on some U-233.

STOW: Okay.

ROSENTHAL: We processed out the U-235 from the MSRE and replaced it with the U-233. And the MSRE became the world's first reactor to ever operate fully on U-233.

STOW: And, was that the first breeder reactor, also?

ROSENTHAL: It was the first thermal breeder, except it wasn't really a breeder reactor. You must have lots of other bigger things. But, it was the first one in that series that had any hope of being a breeder. I'll have to tell you a funny story about the startup of that.

STOW: Sure.

ROSENTHAL: Glenn Seaborg, the Nobel Prize winner, had discovered lots of new transuranium elements, including plutonium and uranium-233.

STOW: Yes.

ROSENTHAL: And, he was the chairman of the Atomic Energy Commission, so, when it came time to start the MSRE up, Alvin Weinberg invited him to come down from Washington, D.C. to Oak Ridge and participate in the startup. Glenn sat at the controls and started it up. What I didn't realize was this. I had assumed that the crew had actually started it up the night before and knew it would work.

STOW: Yes.

ROSENTHAL: But, they hadn't, and when Glenn started it up, it jerked around a lot. The power went up and bounced around, and everybody got very excited. Well, U-233 is somewhat different from U-235. To start up a reactor on U-233, you have to reset the controls. So, in truth, he really started up the world's first uranium-233 reactor, with some heart palpitations on the part of himself and the rest of us.

STOW: Oh boy, I tell you, if that happened today, there'd be all sorts of congressional investigations.

ROSENTHAL: You're absolutely right. Everything would have been checked out twenty times before we did that.

STOW: Yes. Did you ever have any interactions with Glenn Seaborg yourself?

ROSENTHAL: Yes. I spent a year in Washington. It was in the '60s, I believe. He was the chairman of the Atomic Energy Commission at the time. And, I was a technical assistant to the guy in charge of all the reactor programs.

STOW: Okay.

ROSENTHAL: His speechwriters used to draw me in to help them with his speeches. They brought me one once that talked about thorium and other things, and it had some things in it that I just said were wrong.

STOW: Okay.

ROSENTHAL: They came back, argued with me, and finally said, "Dr. Seaborg says you're not right about it." Well, I assumed it was the speechwriters who were talking to me, but they were really passing on his messages, and he and I disagreed. I'm convinced to this day that I was right, and he wasn't. But, in any case, that was my first real interaction with him. I had others later then.

STOW: He was a great man. I mean, perhaps the premier chemist of the century, they say.

ROSENTHAL: Yes, he was. And, the molten-salt reactor wouldn't really have had a justification if he hadn't figured out how to produce uranium-233.

STOW: Interesting. I didn't know about that. So, you remained as the program manager for MSRE until about 1973?

ROSENTHAL: In '73 it died.

STOW: Yes.

ROSENTHAL: It was doing very well technically, but the Atomic Energy Commission had its bets on the fast breeder reactor, which produces plutonium from uranium-235.

STOW: Okay.

ROSENTHAL: And, they sort of tolerated us, but we were kind of an annoyance to them. And finally in '73, they decided we were too much of an annoyance. The Molten Salt Program actually got revived for a couple of years, and Gene McNeese led it, but it was pretty much gone and died again.

STOW: Well, '73 was a tumultuous year for the Laboratory and the nation and everything. I want to come back to that in a few minutes. In the early '70s, though, you got involved with the solar energy program, as I understand. Is that right?

ROSENTHAL: I'm surprised you even know about that, because that was a very limited thing. A professor named Aden Meinel, who was an astronomer out in New Mexico, was interested in solar energy.

STOW: Yes.

ROSENTHAL: And, he thought what you want to do is make it very efficient, which means high temperature, and he'd heard about our molten salts.

STOW: Okay.

ROSENTHAL: So, he put forward a proposal for developing a solar-heated power generating plant using molten salts.

STOW: Yes.

ROSENTHAL: Aden came here to visit, and we discovered that, although he knew a great deal about astronomy, he didn't know very much about power plants and why we were interested in molten salts. We ended up persuading him that it was a very poor idea, and he went back and recanted what he'd been doing. But, that led into solar energy, and I presented a paper on it at the time.

STOW: I ask that because it was in the early to mid '70s that the Laboratory as a whole began to move away from nuclear technologies, or, at least, to get into nonnuclear technologies. I was wondering if this venture into the solar energy area was a conscious move on the part of the Laboratory to expand its horizons.

ROSENTHAL: Well, it was a part of a number of things developing at that time, although we ended up being rather negative about solar energy.

STOW: Yes.

ROSENTHAL: But, in the later part of the '60s and early part of the '70s, the Laboratory began to look at things other than nuclear energy. A professor named David Rose from MIT came down to lead our planning office. Dave was a very inventive, creative man and he brought a lot of people here to look at other things. The Lab, at one time, had looked into desalting water and there was a concept called the agro-industrial complex.

STOW: Yes.

ROSENTHAL: So, we had some background. Dave brought in Jack Gibbons and a bunch of other people and ran some programs. And, I think it was around '70 or '71, they made a proposal to the National Science Foundation to do more formal studies of these things. They were having trouble getting money out of the National Science Foundation, but something interesting happened. The State of Tennessee was redistricted ... gerrymandered is the best term.

STOW: Yes.

ROSENTHAL: And, we got put in the district of a very powerful congressman named Joe Evins.

STOW: I remember the name.

ROSENTHAL: Joe was the second ranking member on the House Appropriations Committee and that represented power that nobody in the Congress has today. Joe's first gift to Oak Ridge -- to this community -- was the American Museum of Science and Energy downtown ...

STOW: Yes.

ROSENTHAL: ... which he just gave to us. But, while this was going on, the head of the National Science Foundation appeared before Joe's committee. It was Richard Atkinson, who's now the president of the University of California.

STOW: Okay.

ROSENTHAL: He was on our advisory committee later, and I asked him about it, and he told me that when he appeared before Joe for the first time, Joe said, "In my district is this lab in Oak Ridge. Do you have any programs going on there?" And, according to Richard, he replied, "No, Mr. Chairman, but I'm a fixin' to!" And, he gave us -- I forget -- it may have been \$50,000.

STOW: Yeah.

ROSENTHAL: And, it started what were very important programs, because there were several of them that provided background. Roger Carlsmith led the energy conservation program, which I think is still the largest program at the Laboratory. Pete Craven, Bill Fulkerson, and a lot of others were involved in it. And, in '73, when the energy crisis began to arrive, the Lab changed direction. We built a lot on what they had done.

STOW: Speaking of '73, that was the year that you went to Washington for a portion of the year, wasn't it?

ROSENTHAL: I did. The molten-salt program died, Alvin spent a year in Washington, D.C., and Floyd Culler was acting director.

STOW: That's right.

ROSENTHAL: And, he made me the acting deputy director, which meant I didn't have anything to do.

STOW: I don't believe that.

ROSENTHAL: (laughs) The people in the AEC were preparing a report called the Dixie Lee Ray Report that the President asked her to do on the energy problem in the country. And, they didn't have a lot of experience either, so I got asked if I'd come up and help, and other people went with me. I spent most of the summer there. Jere Nichols, Chuck Coutant, Roger Carlsmith, and others spent a lot of time that summer helping write that report. I discovered that people at the Laboratory already knew a lot about various forms of energy. I didn't, but I learned a great deal that summer, and when I came back, Herman Postma, who then became director, asked me to say what ought to be done with those various programs that were around. At that time, those and other things were all attached to the director's office. So, working with Sam Beall, I proposed the creation of the Energy Division, and Sam moved to X-10 and took it over. We created the Fossil Energy Program led by Jere Nichols, and later, Gene McNeese. Later, the Energy Conservation Program was formed with Roger Carlsmith as its director. After Sam retired, Bill Fulkerson became director of the Energy Division. And things that were going on then really changed the direction of the Laboratory from a nuclear laboratory to the broad energy laboratory it is today.

STOW: And, I guess a driver for all that change was indeed the energy crisis stemming from the Arab oil embargo, right?

ROSENTHAL: It was a driver, but it was also an opportunity for us.

STOW: Sure.

ROSENTHAL: We wanted to do research like that and here was something we believed in. Alvin Weinberg once called me in. I was leading a program, and I was very slow to change it to something that he thought was important and wanted done.

STOW: Yes.

ROSENTHAL: So, Alvin pushed me some and said, "We must find time for the important things." Well, this was an example of how the Laboratory could find a way of doing the important things. The important thing at that time was addressing the energy problem very broadly.

STOW: Weinberg certainly had foresight and ability to look to the future.

ROSENTHAL: He was always looking at what's important. It's very easy to get distracted by what you're already doing, or new things that are fun. He constantly pushed us to do things that were important to the country and the world.

STOW: In the mid 1970s the Atomic Energy Commission was dissolved and ERDA took over the energy research, and NRC was formed, and so on. I don't even remember what year that was exactly, but it was around '74 or '75.

ROSENTHAL: '74 or '75 ... Probably '75.

STOW: Did that have an impact on the Laboratory and the way our programs functioned here?

ROSENTHAL: Well, ERDA brought together lots of agencies across the government that were involved in energy and, because we then became an ERDA lab, it gave us direct ability to work on those programs. So, yes, it was important.

STOW: Yes.

ROSENTHAL: ERDA was just a transition. I think the ERDA period was one with the greatest disorder I've ever seen in government, because the people who were put together didn't know each other. We ended up knowing lots of them, and were able to bring them together.

STOW: You could be the glue ...

ROSENTHAL: ... be the glue or the communications link. But, yes, ERDA, which ultimately became DOE, allowed the Laboratory to become reshaped into what it is today.

STOW: What were some of the greatest challenges that the Laboratory faced during that transitional period? You say it was kind of a mess in Washington.

ROSENTHAL: It was easy for us, surprisingly easy I found, to change to new subjects. Chemical engineers and physicists knew how to do things, and changing the subject really wasn't all that hard. I think the challenge was to show good judgment. We had opportunities to undertake things that we concluded weren't going to pay off and turned some of them down. We were asked once to head an effort to produce power using the heat of the ocean.

STOW: Yes.

ROSENTHAL: It's hard to turn down money, but we turned down that opportunity. There was also a concept called "magnetohydrodynamics" -- a way of generating electricity directly in a flowing gas -- and we decided that wasn't going to work. We were asked if we would take it over. We said no. We looked at shale oil and decided that the environmental problems were too severe. So, really the major thing for us was to decide which energy options were the ones that would pay off. And, choosing energy conservation was the best decision we made.

STOW: And, that's a program that Roger Carlsmith headed up.

ROSENTHAL: For which he got the Carnot Award, a very high honor.

STOW: So, it sounds almost like the federal government was almost grasping at straws at that point ... looking for opportunities ... for ways to generate energy from new and different sources.

ROSENTHAL: Well, if you remember the gasoline lines of 1973 and 1974 ...

STOW: Oh yeah, I remember those.

ROSENTHAL: You're exactly right. The government was undertaking everything. In retrospect, some of the energy options look foolish, but, at the time, we wanted any way we could to get independent of imported oil.

STOW: Okay. I think the report you guys put together, *The Nation's Energy Future*, when you were in Washington, recommended energy independence by the year 1980.

ROSENTHAL: I don't think that we believed ... (laughs)

STOW: How do you look back on that now?

ROSENTHAL: Well, even at the time, I don't think we believed that. That was just a political document. No, we understood enough to know you couldn't do it that fast.

STOW: Do you think our country ever will have energy independence, or should we have energy independence in that sense?

ROSENTHAL: I don't know that we need to be completely independent, but we need to be not so dependent. And, following the embargo, we shuffled where we get oil, which helped. We badly need to find ways of cutting down on our use of oil. One of the things that our program would recommend over and over again is to find some way of not building such gasoline-consuming automobiles.

STOW: Yeah.

ROSENTHAL: And, right now, we build lots of them that consume too much gasoline. Yes, that's a terribly important problem.

STOW: Well, I mean we're going to have to cut down on dependence on hydrocarbons.

ROSENTHAL: We're going to. It's only a matter of time. And, the greenhouse gas problem is going to drive us to cut down on use of fossil fuels or find some other way to deal with CO₂ emissions.

STOW: I want to come back to this topic toward the end of the hour because I want to talk a little bit about our energy futures and your perspective on nuclear energy. In 1974, you were named as associate lab director, I believe -a position that you held through 1990 or '89, or somewhere in there.

ROSENTHAL: I think '88 or '89.

STOW: That was a big transition for you and your career, was it not?

ROSENTHAL: Well, it was turning from one thing I knew to things I didn't know.

STOW: I wanted to ask you how you reacted to that.

ROSENTHAL: Particularly fusion. Herman was the Lab director at the time, and he suggested I pull together some areas of research, and these were areas I'd been working on. Then suddenly, at the last moment, he came along and said, "I'd like you to take charge of the fusion program also."

STOW: Okay.

ROSENTHAL: And, I knew nothing in the world about fusion. The truth is, I got through school without ever having had a physics course, and so, I had to learn fast.

STOW: You're kidding.

ROSENTHAL: It seems odd. Well, I spent ... I got part of my education in the Navy. And, in all of that, I never had a physics course. So, I had to go learn about it. I never learned a lot, but I ended up actually acting as program manager for fusion with all the responsibilities.

STOW: Yes.

ROSENTHAL: And, it turned out to be one of the most exciting things I ever did.

STOW: Well, you had responsibilities for both the Fusion Program and the Fusion Energy Division, as well as the Energy Division. What else?

ROSENTHAL: Well, there was a separate energy conservation program. As you know, the Lab has this mixture of programs and divisions.

STOW: Yes.

ROSENTHAL: Also I was responsible for the Fossil Energy Program and programs on alternative energy sources that all had program directors. Our budgets grew rapidly so employees in these programs were spread across the Laboratory.

STOW: Okay, so this started in '74 and, that's, of course, when we were pouring more and more money into energy development in innovative ways.

ROSENTHAL: We had some very entrepreneurial people who were able to create lots of activities. And, they went beyond energy. As a result of their skills, they got into other areas. For example, in one conservation program, we undertook to do some subcontracting for the Department of Energy.

STOW: Yes.

ROSENTHAL: Hiring other organizations to do the research for us was a new thing. We had some problem in getting the DOE system to approve our doing that. But, that turned out to be very useful, and so, we began to do research for parts of the Defense Department, as well. And, out of that grew a whole new style of operating that continues at the Laboratory today.

STOW: You say "new" in the form of subcontracting, but we've subcontracted for decades out of this ...

ROSENTHAL: This was not subcontracting for services that we needed to assist our research. Rather, we were subcontracting large programs that the Department of Energy and the country wanted.

STOW: That the sponsor wanted, okay.

ROSENTHAL: And, we managed the subcontracted work for DOE. So, it really was a change, and it didn't come without lots of worrying about the impact on us.

STOW: What was the benefit to Oak Ridge National Lab for subcontracting these programs out?

ROSENTHAL: Well, we insisted that in any programmatic work we subcontracted out, we'd take a certain percentage of the budget for work in-house. And, we learned about real problems, as we became more and more involved with the industry. And, we began to understand more and more about what restraints there were and what their capabilities were in areas like energy conservation. Thus, we ended up getting industrial people to develop more efficient compressors for refrigerators and freezers and such. It wasn't anything we could do because we didn't know the business, but they did. However, we knew the technical aspects.

STOW: Sure.

ROSENTHAL: And, we had motivation. So, our partnership with industry turned out to be very valuable. Refrigerators and freezers in use today are much more efficient, I think, because of work that came out of our program.

STOW: And, of course, that's something that we benefit from today at the Laboratory, because our interactions with industry and cooperative research and development agreements have really blossomed over the years.

ROSENTHAL: Right. And, I think there was somewhat of a genesis of that in that area, at the time.

STOW: That's interesting. I didn't know ... I'd never realized that before. To me, I just assumed that we'd had those interactions all along.

ROSENTHAL: No ... I do recall our difficulty in persuading what was then, the Union Carbide Nuclear Systems here, that Laboratory interaction with industry was a good idea.

STOW: How was Union Carbide as a managing contractor here? Did you have much interaction with them?

ROSENTHAL: Almost invisible to the people at the Laboratory. Union Carbide undertook management of the three government plants in Oak Ridge as a service to the government ...

STOW: Yeah.

ROSENTHAL: ... and had some people down here who oversaw it. They pretty much left us alone to do things, as long as we didn't foul it up. It was a real difference with what followed later.

STOW: With Martin Marietta running it?

ROSENTHAL: Yes.

STOW: Yes. You were named, I think, as the chairman of the committee to look for a new laboratory director in the late 1980s.

ROSENTHAL: Yes.

STOW: Tell us a little bit about who was involved there and which challenges you all faced.

ROSENTHAL: Clyde Hopkins became president of the Martin Marietta Energy Systems in town, and he did it with a provision that Herman Postma would come over and be his senior vice president. So, Herman came into my office one day and said, "I'm going to go over to Y-12. In the meantime, Alex Zucker will act as the director of the Laboratory."

STOW: Yeah.

ROSENTHAL: "And, I want you to organize a committee and find a new Lab director." And, it turned out to be an awfully interesting exercise. Because the members of my committee were George Jasny, who had been a classmate of mine at MIT and who was vice president over all engineering at ORNL, and Jack Reese, who was chancellor of the University of Tennessee at the time. Dave Reichle, Mike Wilkinson, Loucas Christophorou, who was the head of the Corporate Fellows... Beverly Wilkes, who was a very bright woman who worked in planning, and served as our secretary. We met weekly in my office for a time and became very close friends. We worked very hard at it. We invited people to suggest names. We went out and searched around ourselves. We set up a very rigorous and formal way of making sure we were fair to all candidates. I should say that the first thing we did as a committee was to make a list of attributes of what we wanted in a director, such as scientific ability, integrity, and other standard attributes. Al Trivelpiece was one of the people we thought of immediately because of his recent role in Washington as head of basic energy research at DOE.

STOW: Yes.

ROSENTHAL: Pretty near the top of our list was someone who knew the Washington scene and had the ability to bring new research facilities to the Laboratory. We'd been on a "drought" in facilities here. And, so, that criterion was high on our list. So, Al was a strong candidate, but Al had just taken a new job as head of the American Association for the Advancement of Science.

STOW: Of the AAAS.

ROSENTHAL: So, he wasn't available. But, as we went along, a friend of his brought word that if we would approach him, they thought maybe he was getting interested in a change. So, we introduced him into our system.

STOW: Okay.

ROSENTHAL: And, of course, he was picked to be the Lab director. All our committee did was offer advice to Clyde Hopkins (president of Martin Marietta Energy Systems, which managed ORNL for DOE) or Herman Postma (ORNL director).

STOW: Yes.

ROSENTHAL: And they in turn had to get the approval of DOE. They had a veto but our committee made the recommendations. I made some great friends in that. It was a marvelous occasion for us, and we felt very good about what we did.

STOW: How long did that process take to identify Al as the candidate and hire him?

ROSENTHAL: You know, I'm not sure, but it was at least half a year.

STOW: Okay.

ROSENTHAL: It was a really major effort because we had so many names of people around the country, and we had very high standards for what we wanted.

STOW: So, Al Trivelpiece came here in the late '80s, as our Laboratory director.

ROSENTHAL: Al came in January of 1989.

STOW: Okay. And, he fairly quickly appointed you as deputy director in charge of operations, right?

ROSENTHAL: Well, of everything. We only had one deputy then.

STOW: Yes.

ROSENTHAL: So, I oversaw both the scientific and the administrative activities. We hadn't had a deputy for some time. Herman didn't have a deputy.

STOW: Yeah, that's right.

ROSENTHAL: But, coming from outside, Al felt like he needed one, and surprised me by one day saying he wanted me to be it. What I wanted to do was take a strong interest in scientific affairs at the Laboratory -- that's what I had done for years -- but I found very quickly I was going to be dealing mostly with operating issues, so I had almost no time for the research programs. As you may remember, that was a period of "tiger teams" and audits.

STOW: We will never forget that.

ROSENTHAL: And, I hate to say it, but being deputy director was the least fun of anything I did at the Laboratory because we were constantly under pressure to look at environmental issues and safety issues. At times, we had -- I've forgotten the numbers -- like 150 audit groups here in the course of a single year.

STOW: (laughs)

ROSENTHAL: And, it got to be that every time an audit group was here, they wanted to have the director or the deputy director come address them. I learned how to speak to audit groups, something I never really desired to do. That whole period was very stressful partly because ... Well, let me just back up and say how we got into that.

STOW: Okay.

ROSENTHAL: A problem had been discovered at the Rocky Flats arsenal, which handled plutonium in the weapons program.

STOW: I remember that now.

ROSENTHAL: The serious safety and environmental issues at Rocky Flats caused the Department of Energy to look at all its labs. DOE discovered that things were not as good as they would like. We hadn't had the resources for years here, and so, we were told we had to fix the problems. No money came.

STOW: Yes.

ROSENTHAL: None for us. So, we had to take the money to do that out of the overhead, which cut into the research funds and made people very unhappy. One of my jobs was to tell the research divisions you've got less money and then constantly figure out how to deal with all our safety and environmental issues. So, that wasn't a very enjoyable period. We were retreating all the time rather than advancing.

STOW: But, we made it through there.

ROSENTHAL: We made it through and provided the base from which the Lab could spring forward.

STOW: You've changed career directions several times. For instance, we just talked about the time when you took on the deputy director position and got into ES&H (environmental, safety and health) issues, and so on. Have you done this consciously, or have they just been opportunities that have come your way? And, you said, "Well, I'm tired of what I've been doing so I'll try something new."

ROSENTHAL: In none of these positions did I ever ask for what I was given. The Lab said to me, "Go do that." Somebody commented to me once that I didn't seem to be able to hold a job.

STOW: (laughs)

ROSENTHAL: I just kept changing. But, each time it looked like something exciting for me, and it was new and different. I think I managed to avoid one or two along the way, but there were always things that I wanted to do.

STOW: Speaking of things you wanted to do, you've been very active throughout the years at the Laboratory, but at the same time, you were active in the community and still are to this day. Tell us a little bit about your community outreach activities -- what you've done out there and how you've balanced those demands against your demands back here on the job.

ROSENTHAL: Well, trying to do both takes a lot of time.

STOW: I know.

ROSENTHAL: But, when I first got here, the county government was very corrupt. It was well known to be corrupt, and a group of us here got together and decided that we were going to do something about it. And, we were able to get the community of Oak Ridge to align behind us.

STOW: Yes.

ROSENTHAL: We managed to elect a new sheriff -- an honest sheriff -- and replace all the office holders in the courthouse over in Clinton. And I take great pride in that. It's lasted to this day. In fact, some of the people that we put in over there -- their descendants are now in office in Clinton.

STOW: Is that right?

ROSENTHAL: We changed the tax assessor, the county court clerk and all of them.

STOW: Shame on you. (laughs)

ROSENTHAL: Yes. (laughs) And, like most reformers, we did it for a little while, and other people then stepped in, but in this case, the gain lasted. That got me into community affairs, so when the idea of incorporating Oak Ridge approached, I got heavily involved and was a member of the committee that wrote the charter under which the city formed, and I participated in a lot of other studies. Later, I was a chairman of a charter committee to look at revising it. The community voted down most of the things my committee proposed, but they were adopted later. We were a little early.

STOW: All right

ROSENTHAL: I served on something called the Human Relations Advisory Board, whose role was to try to get rid of the last vestiges of segregation in the community. Again, I didn't have great success. I put forward a proposal for a fair housing act, which City Council turned down.

STOW: Yes.

ROSENTHAL: We were too early. Later, I formed a committee and tried to get the city government to build an auditorium and a conference center using some money that the city got as a windfall from having been able to tax uranium that the Japanese stored at K-25.

STOW: Oh, yes?

ROSENTHAL: You may remember that money. I said to the City Council, "When you get a windfall, you shouldn't just use it for your ordinary things. You ought to do something special."

STOW: Sure.

ROSENTHAL: Although some great people got together, we didn't succeed in that. So, I had a lot of failures along the way. But, one of the most successful was my role in creating the Oak Ridge Institute for Continued Learning.

STOW: ORICL, right?

ROSENTHAL: ORICL. Which is going on today and is very successful.

STOW: Well, I know. I'm supposed to talk to ORICL next week.

ROSENTHAL: That's right. I'm aware of your speaking there. And, I'll be there. (laughs)

STOW: Well, you can grill me then.

ROSENTHAL: (laughs)

STOW: Let's talk a little bit more in philosophical terms for a moment. Over the years that you were with the Laboratory and with your community outreach, you've interacted with a wide diversity of people in many different capacities. You've had to manage programs, people and budgets and negotiate sticky situations politically and programmatically back here. What are some of the philosophies that you've developed that enabled to successfully work with people over the years?

ROSENTHAL: Well, I've mentioned one already. You ought to do things that you believe in and think are important.

STOW: Yes.

ROSENTHAL: And, that's been typical of this laboratory from the day it was created. But, I discovered that with the good people we have here, you mostly just have to get them started on something, watch them at first, and then leave them alone. I think the reason I was able to participate in lots of programs in which I had little knowledge was that the Lab had an awful lot of people who knew a lot, and they didn't need much in the way of direction. My job was to help them raise money, keep up with the progress, and be a cheerleader.

STOW: Yes.

ROSENTHAL: I think that's what management's role is in a good institution. That may not be management's role in an institution that has problems. But, in one like this, you don't have to do a lot of directing -- mainly, just make sure you do important things.

STOW: I'm going to put you on the spot for a moment, Murray. I want you to describe yourself. Who is Murray Rosenthal? Come up with some adjectives that will tell us really what you think of yourself and how you've handled your career.

ROSENTHAL: (laughs) I will have to think about that. I don't think of myself as being a very strong engineer or scientist.

STOW: Yes.

ROSENTHAL: Partly because I never stuck with anything long enough to really get into it. I like people and I like working with them, and, I believe, that my skill perhaps is interacting with people and guiding them. I find it exciting to do the things we do.

STOW: Yes.

ROSENTHAL: And, I probably display some enthusiasm for them.

STOW: I went out and asked people on the street out here at ORNL about that and got the same answer, so that was a good response.

ROSENTHAL: They'd say I wasn't a very good scientist or engineer. (laughs)

STOW: No, I wasn't referring to that part, but the latter part. (laughs) Over the years, you've rubbed elbows with a wide variety of premier scientists and engineers, and you've mentioned one or two in our discussion. Is there anybody who has remarkably influenced your career or that you have extremely high regard for that you'd like to mention?

ROSENTHAL: Can I mention more than one?

STOW: Do mention more than one, by all means.

ROSENTHAL: Floyd Culler, who was a deputy director here, really had a strong influence on me. Floyd was a lovable man. He was interested in everything at the Laboratory and enthusiastic about it all. I think I developed my wide interest in things here just by being associated with Floyd.

STOW: Okay.

ROSENTHAL: H.G. MacPherson ...

STOW: Yes.

ROSENTHAL: "Mac" was deputy director also, and he had a remarkable incisive mind and an objective ability. I realized that every time I would go talk to Alvin Weinberg, Mac was there. Before Alvin would make a decision, he would ask Mac what he thought, and as I grew to know Mac, I understood why. He was really very good at that.

STOW: Okay.

ROSENTHAL: And, he really helped me realize you've got to stop and think these things through carefully. Sam Beall, who was director of the Reactor Division, was a remarkably warm and understanding man, and he led the division in such a way that everybody there felt good about what they were doing. So, I used to pay attention to how Sam did things.

STOW: He's another individual whose career changed in various ways.

ROSENTHAL: Well, it did, and when he took over the Energy Division, he was at the point of retirement and wanted to undertake something else. All these people were a very strong influence. Bill Manly, who I was fortunate to work for for a while, taught me how to manage things. I had an office next to him in the reactor program and I learned a great deal about how you get people to work together. And, my secretary, Virginia Lee.

STOW: I remember her. Yes.

ROSENTHAL: I had marvelous secretaries over the years. And, for the last 15 years, Virginia was my administrative secretary. I would not have survived and gotten anything done without her. She managed to take care of a great deal of the things that needed to be done in my office.

STOW: Well, that's an interesting suite of individuals, and I know of most of them anyway and have met many of them. As you look back over your entire career, what would you say is the greatest achievement that you personally have accomplished that you're most proud of?

ROSENTHAL: Oh, there are lots of things I was involved in. Not all of them have come to great success. I think the thing that was perhaps most influential on the Laboratory was the change in direction in '73 and '74 from nuclear energy to other areas of research. And, I guess of the things I've done, that was the most lasting one and perhaps the most useful. For the others, I think, their time will come. Fusion energy is going to begin to grow again. Working on fusion was perhaps the most exciting thing I ever did.

STOW: Yes.

ROSENTHAL: It was the most difficult technically and the brightest people worked on it -- and that was great fun. Nuclear energy, I'm convinced, is going to come back as the world faces up to the energy shortage and the global environmental problem.

STOW: So, getting the Laboratory from almost strictly nuclear to non-nuclear programs in the '73-'74 time frame is what you would tag as one of your greatest contributions?

ROSENTHAL: Well, it wasn't just my contribution.

STOW: No, I understand that.

ROSENTHAL: But, one I was involved in, yes.

STOW: What about an opportunity that you missed or that you tried and didn't succeed in. Was there anything along those lines?

ROSENTHAL: Well, I was just mentioning the ones we tried, like the Molten Salt Program.

STOW: Yes.

ROSENTHAL: Everything we did in the Molten Salt Program was successful, except our ability to keep the program going.

STOW: Yeah, but look at what spun out of the MSRE -- our materials science and instrumentation programs, for example.

ROSENTHAL: I think that's true.

STOW: Yes.

ROSENTHAL: You know, for a while, I led a Pebble Bed Reactor Program at the Laboratory. And, I was somewhat responsible for its death rather than its continuation, because when I took it over, the Atomic Energy Commission was prepared to build a Pebble Bed Reactor down here. This was something the Germans were beginning to pursue. And the United States was going to go into it. I became responsible for the program, and we conducted a design study and did something shocking. We told the Atomic Energy Commission it was going to cost twice as much as they had been told earlier it was going to cost.

STOW: Yes.

ROSENTHAL: And, they said, "Thank you." Our reputation went up a lot, and we lost the program.

STOW: (laughs) So much for honesty, huh?

ROSENTHAL: Well, later we got some benefits from it. I discovered later in the things I was involved in that when we told the AEC what it would cost, they believed it.

STOW: Okay.

ROSENTHAL: So, buying that reputation had some value.

STOW: Bought some credibility. All right.

ROSENTHAL: Some credibility ...

STOW: Let's look toward the future a little bit here. Where do you see the Laboratory, ORNL, ten years down the road and twenty-five years down the road? I realize I'm asking a tough question there, but give me some thoughts on what you see to be the areas that we're going to develop into and grow into.

ROSENTHAL: Well, let me say first that I'm very optimistic about the Laboratory. The new management here is very vigorous. The UT-Battelle management team seems to be extremely good. And, the Laboratory, which was in the doldrums when I left, is really moving ahead. It's very exciting for me to come out here and see it. The rebuilding of the infrastructure was just almost necessary. I used to think that we couldn't possibly hire a biologist here once they saw the buildings they had to work in. And, that was true of some other programs.

STOW: Pretty bad ...

ROSENTHAL: I think the direction is already set for ten years. Things don't normally change that fast. The SNS, nanoscience, nanotechnology ...

STOW: Yes.

ROSENTHAL: The new materials building for the microscopes.

STOW: Sure.

ROSENTHAL: And the rebuilding of the biology complex, and the continuation of the energy conservation program. I recently saw some numbers when I left. The conservation program was the biggest at the Laboratory and it still is. I think all of those are pointing the direction that the Laboratory will go in ten years.

STOW: Okay.

ROSENTHAL: You can't say what the specific things will be. Going beyond that, I think we may be back in the nuclear energy business. A whole new set of people will have to learn again. I'm an enthusiast for fusion -- it's terribly difficult to do. I decided when I was in it that it would work -- the physicists knew how to make it work, but it was going to be what the engineers did that would make it succeed, and it's going to take some effort to do that. I hope the Lab is able to get back in it, because in technology and engineering, this is as good a place as any in the world to work on it.

STOW: Is our greatest challenge in fusion energy a theoretical one or a materials one?

ROSENTHAL: Well, I accept the theorists' views ...

STOW: Okay.

ROSENTHAL: ... what I can understand of them. No, I don't think it's that, but, if they can do

things better, it makes it easier for the technology.

STOW: Yes.

ROSENTHAL: I thought when I was involved that the greatest challenge was building something that could be maintained. They're very big, very complicated structures. And, they do become somewhat radioactive. So, making one that you can operate as a power plant is probably the biggest challenge. There are physics arrangements that will work but maybe they not the best yet.

STOW: So, you think fusion energy has a future for us?

ROSENTHAL: I noticed recently that people now say thirty-five years. I don't know that it will succeed, but I think it ought to be tried with enough resources. And I really hope the Lab can play a strong role.

STOW: What do you see as the future for conventional nuclear energy? Fission power, for instance?

ROSENTHAL: Well, as we were saying earlier, there is a greenhouse gas problem. I think most people seem to agree that it's real. It's going to have to be dealt with, and, at the moment, the best way of dealing with it is to use nuclear energy. And, I wouldn't be surprised at all to see the United States turn back to nuclear energy. And, in doing so, it won't be the reactors we were building, and initially, it probably won't be really revolutionary ones.

STOW: But what's it going to take? The population of the United States is pretty adamantly opposed to nuclear energy, to nuclear reactors.

ROSENTHAL: The things I see suggest they may be a little bit less opposed than they were. I think it's going to take the changes in climate that we're beginning to see.

STOW: Okay.

ROSENTHAL: But, over time I think they'll see that we're going to have to do something. Turning to nuclear energy won't quickly reduce our dependence on imported oil. So, we must find an alternative energy source for transportation. You know, President Bush recently talked about hydrogen.

STOW: Yes.

ROSENTHAL: But, you've got to find a way of getting hydrogen cheaply. For years, we said the best way to do it was to use nuclear energy and electrolyze water to get it cleanly. Those opportunities exist, but you're right. It isn't something people are going to accept rapidly. It will have to begin to develop. But, I just read that there are 444 nuclear power reactors in the world right now. I had no idea there were so many. So, they're continuing to be built at a low rate elsewhere.

STOW: Elsewhere, but not here. There hasn't been one built in this country or started in what, twenty years?

ROSENTHAL: A long time, yes, but you know, they're running very well now. They're running economically.

STOW: Yes.

ROSENTHAL: They're running with a limited number of problems.

STOW: Are there any things that we've not touched on here that you'd like to kind of expand on a little bit, going all the way back to 1953 or even earlier?

ROSENTHAL: Well, you know I said when I retired that coming to Oak Ridge National Laboratory was the second best decision I made in my life. My wife was there, so, you know what the first one was.

STOW: Yes.

ROSENTHAL: And, it's really true. I just feel fortunate to have come here. I had opportunities over the years to leave the Laboratory and go to other jobs, and some of them seemed very attractive. I just could not leave the Lab and my family, and I couldn't leave Oak Ridge. I think we're going to be here till the day we die.

STOW: Well, I think the Laboratory is the beneficiary of your having been here for those years.

ROSENTHAL: Thank you.

STOW: What's the future hold for you?

ROSENTHAL: I just retired from ORICL, which was taking a good fraction of my time.

STOW: Oh, you did? Okay.

ROSENTHAL: I "retired" in that I'm not on the board anymore.

STOW: Yes.

ROSENTHAL: I take about five courses a semester. I'm going to be taking the course in which you're lecturing, and we travel as much as we can. We don't know how long our health will hold up, so, a couple of times a year we go abroad and do some interesting things.

STOW: Okay.

ROSENTHAL: And, one of the nice things about retiring is time to read. I don't know about you, Steve, but I didn't get an education when I was in school. I learned a technical trade and then was working. I didn't have much time. So, I really enjoy reading. And my friends out here will point out how I detested email and computers because of what they brought in ...

STOW: It hasn't gotten any better I can assure you.

ROSENTHAL: But, today, I stay in front of the computer looking things up. I just enjoy the opportunity to learn new things and continue to. The nicest thing about retirement is getting up in the morning and having time to have coffee and read the papers.

STOW: Well, we all look forward to that at some point, don't we?

ROSENTHAL: We could talk about our review of a reactor by Admiral Rickover.

STOW: I meant to ask you about Rickover when you were talking about going to reactor school and so on. I slipped on by it.

ROSENTHAL: Let me tell you what it was about. One time, in one of my jobs, I led a kind of planning group at the Laboratory, and we got called upon to do a big review of all the advanced reactors that the Atomic Energy Commission had, so they could kill some of them.

STOW: Yes.

ROSENTHAL: And, they did. As we started into that, we got asked to review a reactor proposal by Rickover.

ROSENTHAL: It was called the seed-blanket reactor and it was to go in a nuclear power plant. Rickover wanted to develop it for an aircraft carrier reactor, but the Navy wouldn't approve it.

STOW: Yes.

ROSENTHAL: But he also had a position in the AEC. So he said, "Okay, it's a civilian power reactor."

STOW: (laughs)

ROSENTHAL: The AEC people didn't want to deploy it either. So, they turned around and said to us, "Ya'll evaluate it." That led to a lot of interactions with Rickover's organization.

STOW: Well, did you meet Rickover?

ROSENTHAL: Yes, later. And I discovered when I met him that he knew that I was responsible for the negative conclusion we had reached.

STOW: And, how did that evaluations reactor go? I mean, what was the ultimate end result?

ROSENTHAL: What happened is that our study got a great deal of attention, and we said that the seed-blanket concept would not make a good civilian power reactor.

STOW: Yeah.

ROSENTHAL: Rickover's people were really shocked because, you know, they were superb technical people, and they got very upset. And so they said to me, "Don't publish that report."

STOW: Yeah.

ROSENTHAL: That was a different day. I said, "I'm going to publish it, unless Alvin Weinberg tells me not to." Alvin didn't, so they set out to try to stop it, and Rickover went before the Joint Committee on Atomic Energy, the highest authority in the land.

STOW: Yes.

ROSENTHAL: And, he presented his story and got them to say that we were not to publish our report with his section in it. He said we must cut it out. And, then when he was walking out with the general manager of the Atomic Energy Commission, somebody overheard him say, "When I want a study done, I don't get it done by a bunch of college boys!"

STOW: (laughs)

ROSENTHAL: An indication of how young we looked to him at the time. Later, when I was in Washington, the project was cancelled.

STOW: Okay.

ROSENTHAL: I used to go to all the commission meetings that related to reactors, but when I got to the door, they wouldn't let me in for that one.

STOW: Your reputation preceded you, right?

ROSENTHAL: Well, they knew that I'd been involved in it. But Rickover was a great man. The country owes him a great debt. But, he was just wrong on this one.

STOW: He was a crusty old fellow, wasn't he?

ROSENTHAL: He was crusty.

STOW: He came here to the reactor school here at ORNL, did he not, in what the late '40s, was it?

ROSENTHAL: The naval reactor programs originated in the reactor school. Rickover didn't only come down, he brought a team of people.

STOW: That's right.

ROSENTHAL: Some of them are also very famous now.

STOW: Yes.

ROSENTHAL: And, they did a study that led to the naval reactors. They were going to try and build a gas-cooled reactor, but Alvin and others persuaded them that it ought to be a water-cooled reactor ...

STOW: Okay.

ROSENTHAL: ... which was a very major thing.

STOW: And, that ended up directing the program for the Navy and reactor technology, didn't it?

ROSENTHAL: That ended up in leading them to what protects us today in the world.

STOW: Nuclear-powered submarines.

ROSENTHAL: Yes. That experience with Rickover down here is perhaps one of the Laboratory's major contributions.

STOW: Interesting. Okay, good. Thanks! Thank you, Murray. It's been an extremely interesting hour, and we appreciate your taking the time.

ROSENTHAL: It's been a pleasure to talk to you about it all. Thank you.

STOW: Thank you, sir.

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