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OAK RIDGE, TENNESSEE

AN INTERVIEW WITH ART RUPP AND JOHN GILLETTE

FOR THE OAK RIDGE NATIONAL LABORATORY ORAL HISTORY PROJECT

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STOW: Today, we're going to be talking with two individuals who came here in 1943 to work on the Graphite Reactor. Art Rupp and John Gillette both came from DuPont and have some very interesting stories to tell us about their early days with the Graphite Reactor and about the evolution of the Isotopes Program.

I'd like to ask both of you about your first impressions when you came to Oak Ridge. John, tell me a little bit about how you learned about your transfer to Oak Ridge, or to Clinton Laboratories, and what your first impressions were when you got here.

GILLETTE: Well, DuPont was elected to build Oak Ridge National Laboratory. I was in the military explosives business with DuPont and that work was at the end in '43, so they had surplus help. I was lucky to be terminated from Birmingham and transferred to Oak Ridge.

STOW: What were your impressions when you got to East Tennessee and saw the construction and the mud and everything like that?

GILLETTE: Well, I don't know. It was just another construction place, and I was used to that, because I'd been to the munitions plant in the south of Birmingham, which was under construction. It didn't affect me really, one way or another.

STOW: Art, you came from the University of Chicago, from the Met Lab there. Tell us what your impressions were as you came into East Tennessee and saw what was going on.

RUPP: Well, the area itself, I thought, was extremely beautiful, as it is around East Tennessee. When I got out to the site, it was like many construction sites I had previously seen, but it also had a distinct flavor of the military about it, because you could see that in the standard dormitory designs and office building designs. And, a great number of the people were in uniform. The group I had at the Laboratory for a while included eight, uniformed, young fellows from the Army. So, Oak Ridge had a military flavor and I had the distinct feeling that a military site was going up.

STOW: What was the first job that you were assigned here?

RUPP: I previously had a group already building up in Chicago, but it was [up to] Miles Leverett to expand the group and do the engineering studies and measurements that were necessary for the pile [Graphite Reactor] that we were building. And, in that group we had several different kinds of engineers, some chemists, and some physicists. The work for a while was chiefly to familiarize ourselves with the mechanism of the reactor that we were building there and to prepare ourselves for the time when it would begin to operate. So, that was our main first job.

STOW: Did you believe that the reactor would operate?

RUPP: Yes, I did. Of course, I'd been at Stagg Field. My lab in Chicago was under Stagg Field, just about a few hundred feet away from the world's first reactor, which had started up about a month and a half before [construction began on the Graphite Reactor in February 1943]. So, I was very confident that the chain reaction would be achieved and that the reactor here would go ahead, because I had already witnessed a reactor operating [in Chicago].

STOW: John, tell us what your first job was here.

GILLETTE: Checking construction in, for instance, the waste tanks. They'd been completed, but another fellow and myself put diatomaceous earth in the gutter around those tanks for two or three weeks, to see if they would pick up moisture from a leakage. That was just one of the things that we did to check on construction. As the chemical separations were completed, piping and vessels were installed, and we had to check all of that to make sure they were going in correctly. We went around with a magnet, for instance, checking the pipes and the vessels to be sure that they were stainless steel. If the magnet stuck to something, that meant it had to be taken out. I guess a few pieces were in there that shouldn't have been in there, so everything had to be corrected. In terms of the construction, the chemical separations lagged the construction of the reactor. So, we finished checking on the chemical separations facility, while the reactor was up and running.

STOW: I think both of you gentlemen were present on November 4th of 1943, when the Graphite Reactor went critical.

RUPP: Yes, I was there.

STOW: Art, tell me a little bit about what your thoughts were, and whether you realized the magnitude of that event.

RUPP: Yes, I did recognize the magnitude of the event, and it was almost one of total amazement. But, I had a great deal of faith in the team of nuclear physicists under Enrico Fermi, who were doing all the physics work for the Graphite Reactor. [Fermi led the team that achieved the world's first sustained chain reaction at the pile under Stagg Field in December 2, 1942.] I was fairly sure that it was going to work. But, actually, there was a little incident, right at the beginning, after John and the other fellows had put all the rods in the channels. They tried to start the critical reaction, to make the reactor go critical, but the reactor didn't start. There was a great deal of confusion about that for a short time. Then, it was realized that the reactor had retained some moisture. And, water, of course, is a great absorber of neutrons. We couldn't get the reaction going, so we ran the reactor with some heaters to get it all dried out. It was an air-cooled reactor. Finally, we got the moisture all cleared out and down to a satisfactory level. When we retried starting the reactor, it did begin to produce neutrons and heat. That was a great relief.

STOW: I'm sure it was. John, what were your thoughts when all this was going on?

GILLETTE: Well, the technical group in the chemical separations area was told that we were going to load the reactor [with uranium fuel]. We were split up into two groups -- two twelve-hour shifts. The first group started at 8:00 in the morning, loading the slugs [of uranium] that the reactor group had in boxes. All of the slugs had been tested for leaks, and all had been numbered. They had programmed which slug was going into which channel …

STOW: Yes.

GILLETTE: ... and where in the channel. So, they told us how to load the thing. All we did was to take the slugs and they said, "Okay, we're working on this, and you're going to work on this particular channel." To put them in, they pulled the plug out from the shield. There was a channel that went through the plenum chamber into the graphite. The slugs then were put in a little channel on the outside so that we could put a rod behind them and push them through, into the reactor. The reactor group again measured the reactor gain. Somebody said, "Okay, that's where it should go." They knew how many feet into the reactor each slug should go. And, the loading started very slowly. As Art says, there was a point where things didn't look right, and they had to dry the reactor out. So, the first shift loaded, I guess, only two or three tons of fuel. And, when I came in at eight o'clock at night, they were still loading a few slugs, stopping, and taking measurements to make sure everything was going okay. Eventually, the reactor went critical in the morning [around five o'clock].

STOW: Were you aware of the fact that you were trying to produce plutonium for an atomic bomb?

GILLETTE: Yes.

STOW: Did you know the full extent of the program here?

GILLETTE: Well, I didn't know all the chemistry or all the fission products, or all the cross sections. But, I knew, in general, that we were going to have a [chain] reaction at some point.

STOW: And, did you know what was going on elsewhere in Oak Ridge -- at K-25 and Y-12?

GILLETTE: Yes, I knew the purpose of these plants.

STOW: Had you been told, as part of your job, what this was? Or, had you just surmised it?

GILLETTE: Well, I don't know. We learned it, perhaps, by osmosis after we'd been here a while. I'm sure Art had the same experience. We realized that there were two other techniques that they were working on real hard -- the one at Y-12 and the other at K-25. And, we knew the Y-12 plant was ahead of everything else, in terms of being ready to produce a product.

STOW: Art, how did you find out about this?

RUPP: Well, I had been told about the other two plants before I got here. So, I did know about those, because of the work at the Met Lab in Chicago. We got a lot of information there. As a matter of fact, the technical groups attended what amounted to be classes on elementary nuclear physics and other things that were new to us. So, we gained a lot of information on that from the work there at University of Chicago, before I got here.

STOW: Art, did you live in Oak Ridge or did you live in Knoxville and commute?

RUPP: No, I lived in Oak Ridge. For the first six weeks or so, we lived some time in a hotel in Knoxville and commuted out to Oak Ridge. Later on, we doubled up with a couple of newfound friends that we had and waited for the A house that we were going to get finished. We finally got into it, practically while they were still nailing nails into the various parts of the house. We were in a tremendous rush to get into a house being built. So, we finally got settled there.

STOW: Now, the A house was the smallest of the houses, wasn't it?

RUPP: That was the smallest. We moved in around November, just before December. My wife's baby was supposed to be born in the latter part of December, so we, especially she, were in quite [a hurry to move in].

STOW: Yes.

RUPP: We didn't have any place to live there. And, they were building the hospital in Oak Ridge at the time. It was one of the first buildings that got built. So, our baby was born in the following January, and they were still pounding around the hospital, putting it together then. So, it was nip and tuck there ...

STOW: (laughs) I can imagine. John, you came here unmarried though, right?

GILLETTE: That's correct.

STOW: And, you met your wife ...

GILLETTE: I met my wife here.

STOW: Can you tell us a little bit about what she was doing, and how you met her?

GILLETTE: She was working for the Army Corps of Engineers. She was really fresh out of high school, but she had gone to a business school in Knoxville. And, don't tell this, I shouldn't tell this, I won't tell this, but she had to take dictation from some of the people in the government buildings, including some of the Army officers. She had a terrible time taking notes because she wasn't very adept at taking shorthand, deciphering her notes, and typing them up. One time, she was going to take something home so she could work on it. And, of course, her boss said, "Nope, you can't do that." Well, anyhow, there was a bunch of young people around, and we would have parties on Saturday night. Young people always meet young people. There was only one good meeting place, and it was the cafeteria.

STOW: Yes.

GILLETTE: So, a lot of us became acquainted with others at the cafeteria. And, socially, there wasn't much to do, except, as I say, in Jackson Square, which had a little rec hall over what was later the bowling alley. A group of ORNL employees, or X-10ers, would get together on Saturday night, bring a date in, dance to canned music, and drink some cokes, because there wasn't anything alcoholic in Oak Ridge until ... I think about the time Art was looking for a house in November of that year. One of the storefronts in Jackson Square, which was unoccupied, got special dispensation. So, they brought in a bunch of beer, and they had a beer hall there with plywood set on sawhorses. It was a very active place that first night.

STOW: But, that was 3.2 beer, right?

GILLETTE: That was 3.2 beer, but it was beer. (laughs)

STOW: It was better than nothing, huh? (laughs) Let's come back to your jobs then. On November 4th in 1943, the reactor went critical and the Lab ultimately began to produce microgram amounts of plutonium. What did your jobs turn out to be, as we went into the year 1944? Art, do you want to help us out?

RUPP: The work at the startup of the reactor was mostly finished, so I went down to the Chemistry Division with many of the men who were originally in my group. The purpose was to build up a "semi-works," which is bigger than laboratory scale, but smaller than pilot-plant scale. So, we had really two jobs there. One was to take all of the material that we could get from around the country. Some universities had accelerators that could bombard uranium targets [with ions to produce plutonium]. The first uranium slugs that we got out of the Graphite Reactor [had traces of plutonium]. The idea was to get laboratory quantities of plutonium for testing, because most of the testing on the separations procedures in the universities around the country had been done on a micrograms scale [using tiny amounts obtained] from accelerator bombardments.

STOW: Yes.

RUPP: So, we built up a "separations semi-works" consisting mostly of tanks and centrifuges. The process of separating microgram amounts of plutonium from the dissolved slugs, which amounted to pounds of uranium material, was really a formidable task. But, researchers in the Chemistry Division here, the various chemistry labs around the country, and universities had been working on developing co-precipitation, which is known in chemistry as a "carrying procedure." Precipitated material is very similar in its chemical and physical morphology to that of plutonium. The idea was that plutonium will precipitate out [be carried out from the uranium] with the material by adhering to, or adsorbing onto, the surface of the voluminous precipitate. This procedure had never been really tried on a big scale before, so we ran different flow sheets that had been devised in various chemistry labs. I remember the evening when we worked all hours, practically all day and all night on procedures. Irvin Higgins, a friend of mine (now deceased) and I, were working rather late at night, and we made the last precipitation of lanthanum fluoride, which is a very gelatinous, fluffy type of precipitate. We found that this precipitate carried the plutonium down in the last separation in a centrifuge. We were using shielding blocks made of concrete. We would go in and take the material out of the closed-bowl centrifuges. The last bits of plutonium we massaged out of the centrifuge using big heavy gloves over our hands. Health physicists now would consider that action a horror. But, I remember, we got all the precipitate out and made the separation [of plutonium] from the lanthanum fluoride over an ion exchange column. A very small amount of a green liquid came out. In that green solution was the very first milligram of plutonium, I believe, that had ever been separated. It still needed to be refined quite a lot. We took it back to the Chemistry Division next door to the chemists there -- Izzy Pearlman, Waldo Cohn, and George …

GILLETTE: George Parker?

RUPP: … George Parker. These were all chemists who had been working on purifying the final milligram amounts. Very tiny amounts of the plutonium [obtained from the Graphite Reactor] were sent to laboratories all around the United States, so chemists could try some of the processes they had developed as stand-ins to see how they worked out with the actual plutonium material. That was one of the periods of maximum chemical activity in the project.

STOW: Glenn Seaborg, who discovered plutonium, would come down here from Chicago regularly. Did you have any interactions with him?

RUPP: I didn't personally. I knew him to talk to him, but most of my work was with people who were here in the Chemistry Division, such as George Boyd and Izzy Pearlman.

STOW: Yes.

RUPP: I don't recall too quickly now the names of the chemists who had been [active in plutonium work] in the various universities around the country. They made the final tests and purifications on the first plutonium we produced here. It was interesting.

STOW: Art, what did your job evolve into? I want to move to a discussion of the Isotopes Program.

RUPP: Well, when the work got done in the semi-works effort here, not too long after that, I was transferred to the Hanford reactor site in the state of Washington. It was just being built, also as a DuPont project.

STOW: Yes.

RUPP: So, DuPont sent me out there, where I worked with the engineering development group in getting the first "canyon" going for separating large amounts of plutonium to be used in the atomic bomb. It was all a part of the DuPont contract. As DuPonters we worked at a number of places. The one that I worked in finally there was one of the big canyons, where plutonium was further refined at Los Alamos ...

STOW: Yes.

RUPP: And then made into metal. So, I spent a good part of the year there and then came back to New Jersey [to work in DuPont's] high-explosive labs for a while. I then decided to try to come back here, having been in contact with Miles Leverett, who wanted me to come back to the Laboratory and start up a radioisotope production program.

STOW: Let me come back to the Isotopes Production Program in a minute. John, you went to Hanford, too, didn't you?

GILLETTE: Yes, for a while ...

STOW: Tell us about that experience.

GILLETTE: I had just been married, and I think we went out in September in '44, and another couple, along with my wife, drove our car separately across the country. We were supposed to travel only about 300 miles a day, to conserve rubber and gasoline. So, we had a leisurely vacation going from Oak Ridge to Richland, Washington. And, when we got to Richland, again there was no housing. My wife stayed in one house with a bunch of girls, and I stayed at another house with a bunch of guys until, eventually, they had enough houses built so we could get a housing assignment. The town of Richland had offices and a hospital. The location of the semi-works for the organization out there was about three or four miles out of Richland. It was staffed by a group of people who always worked there. Each morning we went to the central bus station in Richland [to take a bus to work]. There were buses all around town that would take workers to this secondary area to go out to the plants. There were three different reactors at Hanford when we were there, right?

RUPP: Yes.

GILLETTE: And, there were two different chemical processing areas, which were separated by several miles. And, I guess it was about fifteen or twenty miles from Richland to the chemical processing plants.

RUPP: Yes.

GILLETTE: Again, it was shift work. Again, we were checking construction. One of the funny incidents that I remember [occurred when] I went by the fan house one day for the chemical processing area. [I heard a voice with a Brooklyn accent] in there just cussing up a storm. I had to stop and go in and say, "Ah, you must be from New York" because it seemed so strange, hearing that accent out in the middle of a desert. It caught my attention. We had a training session for chemical operators on startup. Again, we had to check all the equipment. Hanford really had a fancy construction job, as far as the plumbing was concerned in the chemical processing areas. There was a lot of ingenuity that went into it. They had a mock-up place, which was just like a cell. All pieces of pipe that were put together for a particular area in the cell had to match in their test facility. Once it got into the chemical processing plant, if we had the cells blocked off and if hot material was going through there, there was no way that you could do anything that you couldn't do with manipulators from a crane through a periscope. When something went wrong, and it sometimes did, you had to take out a piece of pipe and put in a new piece of pipe. And, sometimes, that was quite difficult to do.

STOW: Now, did they use television at all to look into those cells at Hanford?

GILLETTE: Yes. As I said, we were looking through a periscope ...

STOW: Yes.

GILLETTE: ... primarily from this humongous overhead crane. It could lift maybe fifty tons. And, its span was wider than this room. It was probably thirty to forty feet.

RUPP: It was big.

GILLETTE: And, of course, this crane would move back and forth, as well as sideways. And, there was a camera on the crane itself, so you could watch from that, to see what you were doing down below.

STOW: Well, what brought you back to Oak Ridge, John?

GILLETTE: General Electric. The DuPont contract for Hanford lasted two years. So DuPont left and General Electric took over. Some of us, at least, had an opportunity to either stay in Hanford -- and some of my friends did -- or be transferred back to the East some place. I started working for DuPont in Waynesboro, Virginia, and I guess they offered me a job there. And, then they offered me another job, just outside of Newark, where they were making nylon and Teflon. I was assigned to a group making Teflon, and that job lasted for a few months. Then they were making nylon [and using it to make] brushes and strings for badminton racquets and tennis racquets. I got involved in that work, which was, of course, shift work. And, really, Newark is a terrible place to live. And, again, I had an opportunity to come back to Oak Ridge, because of a fellow by the name of Logan Emlet ...

STOW: Oh, yes.

GILLETTE: ... who was here at that time. Logan and I were buddies. And, he said, "Come on back to Oak Ridge because this is going to be the center for reactor development, and it's going to have lots of people, and it would be a good place to live." Well, since my wife was from this area anyway, we decided to come back in 1947.

STOW: And, both of you gentlemen got involved in the Isotopes Program.

GILLETTE: Yes.

STOW: I want to hear a little bit about how that got started. I know that the Lab sold its first radioisotope, which was carbon-14 [produced in the Graphite Reactor], in August of 1946. But, there had to be a lot that went on before that.

GILLETTE: Art is the guy who should talk about that, because he was one of the first persons involved in it, along with Waldo Cohn.

STOW: Waldo Cohn.

RUPP: A number of chemists -- Waldo Cohn and four or five others -- were very interested in the possibility of merchandizing, or distributing, radioisotopes to various labs around the country that needed them. And, there were many chemists, all around the country, who were interested in a possible radioisotope production program. Waldo and others published papers [on techniques for separating useful radioisotopes from fission products of spent uranium fuel from the Graphite Reactor]. These papers were a kind of advertisement of the possibility of producing radioisotopes for research. Then, an ill-formed group of just a few people from what was then the Operations Division, the Chemistry Division, and the Physics Division made in a not-too-well-organized way a few of the most important isotopes for distribution. Among the group was Art Snell, a very capable physicist in the Physics Division, who built a small unit that could run ammonium nitrate solutions through the [Graphite Reactor] pile and produce carbon-14. And, carbon-14 is one of the most important of all the radioisotopes we have, because it is used in tracing biological and medical processes. So, it was of great interest. Although it does not have a very high specific activity, it was still very useful. The first shipment of a radioisotope from a reactor – the Graphite Reactor -- was carbon-14, which was sent to a hospital in St. Louis for cancer research. At the same time, other chemists were interested in the phosphorus radioisotope, so a group of people from the Operations Division and Chemistry Division made phosphorus on an ad hoc basis by irradiating cans of sulfur. These were large cans, about seven or eight inches long and two inches square. The cans were filled with melted sulfur. As a matter of fact, the cans, which were made out of pure aluminum, each had a little funnel on the top [so the molten sulfur could be poured into each can]. George Parker, who at that time was a member of the Chemistry Division, devised the can with a funnel. The separations were done in a partly emptied cell in the semi-works, where the plutonium separations charts were made. Then, there was some interest in a few of the other radioisotopes, but those isotopes associated with living, or medically important processes, were the first selected. Carbon-14, of course, is the most notable in that respect. Phosphorus was another one.

GILLETTE: Iodine ... iodine.

RUPP: And, radioiodine was of great importance. [Researchers] felt sure that iodine could be collected very easily, because it was one of the products that came off automatically during dissolution of the slugs. They had to scrub the material for safety purposes, before the air could be discharged. Iodine has been very useful in studies of the thyroid gland. So, radioactive isotopes of these elements -- carbon, phosphorus, and iodine -- were probably the earliest radioisotopes of great importance, and they were distributed on a small scale around the country.

STOW: Well, you've mentioned now two different ways of producing isotopes. One way is to irradiate a target material like sulfur to produce phosphorus. A second way is to separate a desired radioisotope from other fission products. Is my recollection correct that we obtained some of our isotopes through a Fission Products Pilot Plant of some sort?

RUPP: Well, this came much later. Almost all isotopes that were distributed early in the game were made by processes in which we irradiated materials in the pile [the Graphite Reactor].

STOW: Okay.

RUPP: As a matter of fact, one of the biggest parts of the Isotopes Program early in the game was the irradiation of materials that customers would send in. The submitted samples were encapsulated in little aluminum tubes that we inserted into a "graphite stringer" tray, which was shoved into the Graphite Reactor pile for irradiation. And then, the irradiated samples were taken out by handlers using ten-foot-long tongs and shipped back to the customers. In addition, we used the reactor to irradiate chemicals, piston rings used for wear studies, and all sorts of materials that researchers wanted to test. It was a very good way of determining wear on various materials. We also received samples of agricultural chemicals, such as potassium nitrate, calcium salts, and phosphates, which we irradiated and shipped back in radiation tubes. And, some of the chemistry was done by our customers from universities and the Department of Agriculture, which were very heavily involved at that time.

STOW: Now, we used the Graphite Reactor initially, but then other reactors were built for production of isotopes. John, can you tell us a little bit about that?

GILLETTE: Well, first, let me say that production of radioisotopes by separation from fission products didn't come along until later in the program.

STOW: All right.

GILLETTE: And, we were looking for the long-lived radioisotopes [in spent reactor fuel], such as strontium and cesium. But, the original work for the separation of those radioisotopes from the spent fuel actually came from Charles Coryell's group. Coryell and his colleagues were doing a lot of studies with the fission products. Do you remember that, Art?

RUPP: Yes.

GILLETTE: So, the first chemistry work on purification of the fission products [from spent reactor fuel] came from those guys. Now, as for the piston rings Art mentioned, there was one place in the Graphite Reactor that could accommodate large piston rings from a humongous piece of equipment, which was twelve inches in diameter. Later, in the Materials Testing Reactor in the 1950s and the High Flux Isotope Reactor in the 1960s, we could hang [large components] on a string down next to the core and irradiate them. And, we had to have special shipping containers then for those things to come out.

STOW: Well, what were some of the precautions that we used in shipping the radioisotopes out? I understand there was a catalog of isotopes also, right?

GILLETTE: That's correct. I brought a catalog along. The containers to ship radioisotopes were developed by the Isotopes Division, and Art was a major force behind the design of shipping containers. This catalog, for instance, has a listing of radioisotopes and sketches of practically all of the shipping containers. One type of containers had a very small shield inside. Another type had a fairly heavy lead shield in it, and it weighed probably ten pounds. And, the radioisotopes went out in cans like this, which were sometimes placed in a cardboard box or in a wood crate, with special bracing to keep everything in good condition. Sometimes radioisotopes were placed in large lead casts, which each weighed maybe 500 pounds and were difficult to handle. But, all these shipping containers, even the large lead casts, were like what we used to ship material from Hanford to Oak Ridge National Laboratory. These containers were about five feet in diameter and about six feet tall, and they were tested in every conceivable way. Even the tie-downs that had to go on the rail cars were tested. We got some flak from the Atomic Energy Commission about the security of these containers. Art suggested -- and I thought it was a good suggestion -- that we get two railroad locomotive engines to collide over at the K-25 site [to test the integrity of the containers]. But, our managers didn't want to do that. They figured that we didn't have to go that far in testing. But, many of these casts were hauled up on a derrick and dropped onto a concrete pad, and then they were examined for signs of damage. In addition, we developed a testing procedure in which a gun crashes things into a stable mark, or target, so we can see what would happen to them. Later, we were sealing and welding containers, and we had help from the Metallurgy Group, which did some very fancy welding, to ensure that the containers were leak tight. And, these also had to be tested.

STOW: Were there shipping standards that you had to live up to at that time? I know we have them today.

GILLETTE: Yes, these standards are under the Department of Transportation today. But back in those days, standards were less accepted.

RUPP: Wasn't regulation of shipping containers [partly a responsibility] of the railroad association that handled high explosives?

GILLETTE: Yes. But, some of the containers of radioisotopes had to be shipped out on truck. Many of the shipments we took to the airport ourselves. We made a daily run to the Knoxville airport to ship radioisotopes out by air. Other isotopes were picked up by truck here at the Laboratory. And, we would have to devise a tie-down on these trucks. We would drill holes in the bed of the truck to get down to the frame to really tie shipments down. To this day I worry when I'm on the highway and see some guy driving a truck down the road with car carcasses, stacked several layers high. I look at those loads and I rapidly drive around them, because I'm always afraid. I know those car carcasses didn't get inspected and weren't tested to the extent that we tested our shipments before making them.

STOW: I feel equally unsafe on the highway when I pass one of those trucks, believe me.

GILLETTE: (laughs) Yeah.

STOW: So, were either of you fellows involved with the Stable Isotopes Separation Program using the calutrons over at the Y-12 Plant (now called the Oak Ridge Y-12 National Security Complex)?

RUPP: John knows about that.

GILLETTE: Yes, Chris Keim had a group at Y-12, which was operating the calutrons. A decision was made that this effort ought to be transferred from Y-12 to ORNL's Isotopes Division, so I became responsible for the calutron operation. And, when it was in a B track, which is a long strip -- I think there were about twenty-four machines in each one of these tracks -- we could use only one element at a time for stable isotope production.

STOW: Okay.

GILLETTE: So, the business looked like we should be able to do better, and the guys who had been running the calutrons were very clever. They came up with the idea of removing two opposing tanks in one of the tracks and putting in additional steel. In this way, each section had a different magnetic field. We arranged it so we had about four different sections. As a result, we could run several different elements on the calutron track at the same time, producing four different stable isotopes.

STOW: Let me ask each of you a question about your personal views of your careers here, as we wind down. Art, as you look back on your career at Oak Ridge National Laboratory, what would you say would be your greatest contribution to the progress that was made here over the years? I want you to brag a little bit about yourself here, if you can.

RUPP: Well, I think that I pushed the radioisotope program through. It was not always the most popular program with the Laboratory administration. We had to pretty much stand on our own feet. The budgets, of which John is familiar, that we had in the early days, were not really too good. And, almost all of the money we spent for radioisotope development we earned from the sale of radioisotopes. Because the government forbade the Laboratory from making a profit on the sale of radioisotopes, we plowed the money we made into our radioisotopes development work. I'm proud of the progress we made in the radioisotope development program, because, whereas the project was working essentially with one or two elements, we were working with something on the order of sixty or seventy of the elements, doing procedures that individually were as difficult as the big plutonium process might have been. This was all done with a minimum expenditure of money. We had, I believe, no cases of radiation injury or exposure in the thirty-some years of development and production there. So, I'm proud of the fact that the program yielded so much for a very little expenditure of taxpayer money. To my knowledge, no one in all those thirty years of handling really enormous amounts of radioactivity was ever really injured. Isn't that true, John?

GILLETTE: Well, that's pretty much true. We had some incidents involving perhaps a repair job where some people got more radiation than they were supposed to have for a particular week.

RUPP: But, they were not really injured.

GILLETTE: No, no.

RUPP: Those were just trivial amounts.

GILLETTE: It just exceeded the normal exposure rate, so we had to take them off their tasks and give them something to do outside a radiation zone for perhaps a month, to get their exposure level back to what it should be legally for the year.

STOW: Okay.

RUPP: Some of the amounts of radioactivity [we had to handle remotely] were really monumental when you think about it. The largest I remember was a collection of isotopes with 300,000 curies of radioactivity.

STOW: 300,000 curies ...

RUPP: ... of cerium-144, when we were working on a project for the Air Force. We were collecting cerium-144 from the F3P, the Fission Products Pilot Plant.

STOW: Yes.

RUPP: We had a hot cell with 60,000 curies of strontium-90. You hear people go off their tops practically, talking about microcuries, millionths of curies, and 60,000 curies of strontium-90 in a cell. One of the interesting things about strontium-90 is that its tremendous beta activity [emission of electrons] can generate lightning in a cell. One time I saw strikes of lightning come down inside a cell containing strontium-90.

STOW: My God!

RUPP: These projects were carried out, by and large, with great success and with a minimum expenditure of money. My only regret is that most projects were not reported and recorded in a detailed manner. I'm afraid that a lot of valuable information [on isotopes and the history of their development] has been lost.

STOW: Lost forever. Art, a couple of historical feats happened at the Graphite Reactor that we'd like you to tell us about. One incident involved Logan Emlet. Logan and some others were involved in the production of the first electricity from a nuclear reactor. A small amount of heat from the reactor produced steam that drove a toy engine, generating electricity. Can you give us your recollection of that incident?

RUPP: Well, Logan, who had charge of the pile operations, and a few of his associates, just wanted to demonstrate the production of electricity by the Graphite Reactor, the world's first continuously operated reactor. After all, everybody had been talking about nuclear power. So, they got the idea of putting an aluminum trombone tube in a graphite stringer and placing it into the reactor. A stringer is a piece of graphite that can be slid into the side of the reactor. The little steam engine was attached to a little device that generates electricity. So, the heat from the reactor easily generated some steam to turn the toy engine, producing a small amount of electricity. It was purely a demonstration. Logan, himself, knew that it might come under the heading of a "stunt."

STOW : (laughs)

RUPP: But, nevertheless, it was an interesting, very practical demonstration for a lot of people who saw or heard about it. Logan really did make some steam from the reactor, demonstrating the possibility of nuclear power. So, it was not meant to be any kind of a scientific experiment. It was actually just a demonstration of the possibilities in a very graphic way.

STOW: But, nevertheless, the Graphite Reactor was used for the first generation of electricity using heat from a nuclear reactor, as far as we know.

RUPP: Well, we think so. Yes.

STOW: The other incident that occurred at the Graphite Reactor was the discovery of the new element promethium, or element 61. Do you have some recollections on that?

RUPP: Well, actually, of course, element 61 was one of the fission products made in the Graphite Reactor. But production of promethium was not the object of that particular irradiation. The researchers led by George Boyd in the Chemistry Division were working on a new ion-exchange process for separating the elements and their radioisotopes that were among the fission products, including the "rare earths," a group of elements in the periodic table that were very difficult to separate. The periodic table, built by Dmitri Mendeleev, indicated the periodic table had blank spots, and one of them they knew was element 61. So, in one of the hot cells in C Building, after a period of separating rare earths from fission products, they finally came across a new element that they identified by a spectroscopic method and other ways to be element 61. It was later named promethium.

STOW: Do you recall where the name promethium came from?

RUPP: It was suggested by Mrs. Grace Mary Coryell [the wife of Charles Coryell, who teamed with Jacob Marinsky and Lawrence Glendenin to discover the element in 1945]. It is interesting to me, personally, that a great deal of attention has been given to promethium, because the name came from Prometheus [the Titan in Greek mythology who stole fire from Mount Olympus and brought it down to mankind.] Prometheus is represented by a statue at Rockefeller Center in New York City, but in Oak Ridge, there is no mention of the element or Prometheus. What is significant is that George Boyd's group was one of the first involved in using the ion-exchange process for separating chemically close elements [among fission products]. Promethium is an element that does not really exist on Earth. Its discovery in Oak Ridge is something that has just been forgotten.

STOW: We'll look into getting more publicity and recognition for this discovery. John, I understand that your career took a different swing and you ended up in security. Can you tell us how that came about?

GILLETTE: There was a management decision made to dissolve the Isotopes Division, with some of the work going into the Chemical Technology Division and the sales of the isotopes going into the existing Operations Division. I was assigned to the security group at ORNL.

STOW: How long did that persist?

GILLETTE: For five years.

STOW: As you look back on your career, what highlights are you especially proud of? What do you think were your greatest contributions?

GILLETTE: I don't know that I had any impact but I had fun doing something new. I enjoyed scheduling [isotope shipments] and producing and purifying isotopes that went out to the general public. We used to make 12,000 shipments a year, so that was a lot of activity. I helped hold everything together under the supervision of Art Rupp and Mansel Ramsey. I got a kick out of our efforts to make thin films of various stable and radioactive isotopes for research. That was a new field. We even made a target out of curium one time. We were nervous about handling it in a vacuum chamber because of the potential difficulties but it worked out.

STOW: You were at the Graphite Reactor on November 4, 1943, at 5 a.m. when it went critical for the first time. Did you have special feelings at that moment when you recognized what was going on or were you so busy with the control rods that you didn't know what was happening?

GILLETTE: That was the end when it went critical. We knew it was gradually building up energy. It was no surprise when it went critical. There was a question of whether it would go critical. I had the feeling that the guys who designed the reactor knew what they were doing. There might have been some untoward thing that would stop it but I was confident it was going to go.

STOW: Art, I want to get your recollections on an incident with the Isotopes program. It is my understanding that at times great quantities of radioisotopes, such as 50,000 curies of strontium-90, might have been accumulated. Can you reflect on those incidents?

RUPP: That was a one-time incident. We made strontium-90 in final pellet form (inch and a half in diameter and quarter of an inch thick) in a hydraulic press. The pellets were made with various chemical compounds of strontium-90. I have a photo of the strontium "tablets" that were collected together and put in a hot cell with a heavy glass window in the Fission Products Pilot Plant. They were in a ceramic tray that insulated them from the stainless steel floor and sides of the cell. The beta particles that the radioactive strontium gave off are the same as the electrons in an electric cable. An electrical charge developed between the ceramic holder and the stainless steel chamber and bolts of electricity flashed across it. I certainly had never seen anything like that before. It was a graphic illustration of the tremendous amount of strontium-90 that had been accumulated there. As a matter of fact, you can use any alpha or beta emitter and isolate it electrically to collect charges. That is one of the ways that radioactivity is measured in a tiny form. I doubt that this effect will be seen again.

STOW: That's scary by today's standards.

RUPP: Another incident related to that was when we put lots of radioactive cobalt-60, a powerful gamma-ray emitter, in a cell made of glass. The cell was two feet by six feet. After a period of time, the electron structure in the glass was so disordered that there were electrical discharges. One time Gene Lamb brought a camera at night to take a time exposure of the glass when all the lights were turned off. When the film was developed, we saw flashes that looked like little discharges of electricity all through the glass structure. It is a unique photo that may have been published. I had never seen anything like that before. It showed the displacement of the electrons in the glass by the gamma rays from the large amount of cobalt-60 we had in the cell. The gamma knocked the electrons out. There have been a lot of interesting experiences with very-high-level radioactivity that were noted in the Isotopes program where extensive accumulations of radioisotopes were involved that were seen then and reported briefly. These effects may never be seen again. We handled over 30 years hundreds of thousands of curies of radioactivity of all kinds and, as far as I know, we never had a serious accident. I'm quite proud of that.

STOW: I happened to read that in 1957 the Isotopes Program handled 375,000 curies of radioactivity with 104,000 shipments of isotopes.

RUPP: A program as big as that was has gotten so little attention that it just amazes me.

STOW: Gentlemen, we thank you for your time today and for your cooperation. This is a good mark in history for us.

RUPP AND GILLETTE: Thank you.

--------------------END OF INTERVIEW----------------------

Note: **Ion exchange** is an exchange of negatively or positively charged ions of chemically similar elements for the purpose of purification and separation of isotopes or decontamination of aqueous solutions. In an ion-exchange column one type of ion binds more strongly to the resin (ion exchanger) than the other type, resulting in purification or separation of the two types of ions, which may differ in size, charge, or structure.