Wisconsin Veterans Museum
Research Center

Transcript of an

Oral History Interview with

HUGH T. RICHARDS

Civilian, Manhattan Project, World War II.

1995

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Richards, Hugh T., (1918-2006). Oral History Interview, 1995.
Transcript: 0.1 linear ft. (1 folder).

Abstract:

Hugh T. Richards, a Baca County, Colorado native, talks about his experiences working on the Manhattan Project at Los Alamos during World War II. He describes how he became interested in nuclear physics during college and started graduate work at Rice University (Texas) in 1939. He touches on taking over classes for a professor who left to work on radar and writing his Master's thesis on measuring fast neutron energies by use of photographic emulsions. He tells of signing onto an Office of Scientific Research and Development contract and working under Gregory Breit, who was "obsessed with secrecy." He mentions finishing up his project at Rice University, driving to the University of Minnesota with a uranium sphere in his glove compartment to help them wrap up their research, and consolidating with other projects in 1943 at Los Alamos (New Mexico). He recalls hearing Robert Serber's indoctrination lectures and helping set up his team's two electrostatic accelerators. He explains how a nuclear bomb works and the difficulties posed by the need to separate enough of the rare 235 uranium isotope. He talks about spending a couple weeks measuring properties of plutonium and explains the development of implosion techniques. He discusses the security at Los Alamos: needing to have a birth certificate created because he'd been born without a doctor, censorship of incoming and outgoing mail, not being allowed to invite family to Los Alamos for his wedding, and only being allowed to talk freely in the technical area. He recalls that the scientists were kept so busy that they did not speculate very much on whom the bomb would be used against. He characterizes the Army's interactions with the scientists as not obtrusive and states he had a Women's Army Corps soldier working as a laboratory assistant. He relates his participation in the Trinity test, including measuring neutrons' time sequences and his reactions after witnessing the blast. He reflects on inflicting civilian casualties in a total war situation, the scientists' lack of concern about long-term effects from exposure to radiation, and recent radiation hormesis theories. He comments on his own reaction after the atomic bombs were dropped on Japan, which included being relieved that the war was over. After the war, he speaks of joining the Association of Los Alamos Scientists, which later merged into the Federation of American Scientists, and lobbying for international and civilian control of nuclear weapons. He states the Los Alamos scientists were generally young, characterizes scientist Edward Teller, and reflects on the effects the project had on Richards' career. He discusses his career at the University of Wisconsin-Madison, installing the first tandem-type accelerator in Sterling Hall, and his department's uneasy relationship with the Army Math Center because the center kept their doors closed and locked. He details hearing the Sterling Hall bombing and describes the destruction it caused Professor Henry Barschall's research, his own lab, and his students' research. Richards mentions his role in reconstruction efforts.

Biographical Sketch:

Richards (1918-2006) was a civilian physicist who worked on Project Y, part of the Manhattan Project, at Los Alamos, New Mexico. He earned his Ph.D. in nuclear physics from Rice University in 1942 and married Mildred Paddock in 1944. After the war, he became a physics professor at the University of Wisconsin-Madison, where he helped the physics department recover after the Sterling Hall bombing, and he retired in 1988.

Interviewed by Mark Van Ells, 1995
Transcribed by Karen M. Emery, WDVA staff, ca. 1995
Abstract written by Susan Krueger, 2011

Transcribed Interview:

Mark: Okay. Today's date is August 8, 1995. This is Mark Van Ells, Archivist, Wisconsin Veterans Museum doing an oral history interview this morning with Professor Hugh Richards who worked in the Los Alamos project during World War II, and our first civilian in our project here. Good morning. Thank you for coming in. I really appreciate it. As we spoke before I turned the tape recorder on, we've got Professor Richards' memoirs here and they're going to be on file in the library here so we'll dispense with some of the questions about early background since that's very well covered in this manuscript here. I thought I'd start out by having you tell me a little bit more about how you got interested in physics and what you knew about nuclear fission and these sorts of things prior to World War II. I mean, what were people saying about it? Was it a fantasy science fiction-type thing? Or was it something that serious scholars looked at? Those sorts of things.

Hugh: Well, in college I started out majoring in chemistry but the sophomore year I took organic chemistry, and there seemed so much to memorize and so complicated. And at the same time I was taking a physics course, and that seemed too neat and very little to memorize—you reasoned it out—so I decided to switch to physics and I've never regretted it.

Mark: It's a purely practical concern in other words. An immediate sort of --

Hugh: Oh, I loved the chemistry but organic chemistry was more than I wanted to memorize. I did take some more chemistry though in college. I took a physical chemistry course and the textbook they used was by Ketman (sp??) and Daniels—Daniels was a professor here at the University of Wisconsin—and the last chapter in the book was on nuclear structure, and it discussed in detail some of the work of Professor [Raymond G.] Herb and the physics department at the University of Wisconsin and his accelerators and some of the results on that, and I was very interested in that then. So I was interested in nuclear physics before the discovery of fission which occurred in 1939, the year I graduated from college. And I went to Rice University for my graduate work largely because—I would have gone, I had an offer, a WARF fellowship from Wisconsin which I would have taken except for the fact my father was ill and had to quit teaching. He had Parkinson's disease and had moved to Louisiana for a place to do subsistence farming, and so that was one reason that I accepted an offer from Rice for graduate work. And the other reason was that they had just completed a copy of Ray Herb's Wisconsin accelerator and I thought it might be good to get in the ground floor of exploiting that and it turned out that was a good strategy actually.

Mark: Yeah. Now, I get the impression Rice also had a very good graduate program.

Hugh: Oh, yes.

Mark: It wasn't a secondary choice necessarily.

Hugh: Oh, no. It was, and is, a very good top-rated school. In fact, the recent, well, discovery of the Buckminsterfullerene in chemistry was at Rice, and the recent discovery of Bose-Einstein condensates as another phase of matter was done almost simultaneously at Rice and was in the *New York Times* about that. So, no, they have a very good physics department. Small but it's good.

Mark: Yeah. Now, you started graduate school just as World War II broke out in 1939, is that correct?

Hugh: That's right, that's right, yeah.

Mark: Now, if you would perhaps, if there is a connection—I'm only assuming that there is—could you perhaps describe how your graduate work sort of gelled with this sort of, the military applications of the nuclear fission program.

Hugh: There was no connection initially at all. It was, I just did the regular nuclear physics program. The first real effect of the war on the program was when my major professor, Tom [W.] Bonner, took leave from Rice to go to MIT to work on radar and I took over his courses, teaching in his office, and that was my first, the first effect of the war on that. And then of course, that was in 1940, I guess, yeah, or '40, no, I guess that was spring of '41. But then in the fall of '41, well, the summer, we went to give a physics paper at Brown University, and that was my first time in the East. And we visited with Bonner at that time. He was working at MIT on radar. And then of course in December of that year there was Pearl Harbor. Bonner had urged me to apply for a National Research Council fellowship for post-doctorate work and I had done that but he wrote me after Pearl Harbor, he said, "Forget about that. There's not going to be any nuclear physics done." Cal Tech, where I wanted to go, or Wisconsin, were my two choices and he said, "We'd be happy to hire you here at MIT on radar work." Well, that was agreeable to me but then in January the head of the department, H.A. Wilson, called me and another young instructor in and asked whether we would be willing to undertake a project on measuring fast neutron energies. He said it was known from intelligence that the Germans were working on a fission bomb and that, it wasn't of course clear that such a thing was possible but even if they could produce a lot of radioactivity it was something which could have tremendous shock value for troops and civilian population.

Mark: Now, to interrupt, I'm sorry, is this the first time that you realized that your work might have these military implications? Or was this something that had been kicked around the grad student --

Hugh: Oh, as soon as fission was discovered everyone speculated, in 1939, that if you have some way of releasing this energy, it's millions times more than chemical energies, that it would be a tremendous source of energy either for ordinary use or for explosives if you released it quickly, and so all physicists I think were aware of the potential and as I said, at the time, 1941-42, that I got involved with the project, fission papers and the physical review were conspicuous by their absence which meant to everyone that it was secret and there was work being done on it, so I was not surprised at this at all. In fact, of course, we'd all done back of the envelope calculations on what might be if you could do it.

Mark: Now, this meeting you're describing, you were selected for this for some research you had done previously.

Hugh: Yeah. Well, my Master's thesis I had developed a new technique of measuring fast neutron energies by use of photographic emulsions. My major professor, Bonner, was the world expert on fast neutron energy measurements, and he had used cloud chambers for measuring this and he pointed out some of the disadvantages of the cloud chamber technique and suggested that if we could work out the photograph emulsion technique, there would be advantages. Of course everything has advantages and disadvantages. But I did succeed in my Master's thesis of developing the technique and doing a thesis on it.

Mark: And this applied then to your work in the Manhattan Project.

Hugh: Yes. Well, long before the Manhattan Project. In fact, I started work in January of 1942, long before the Manhattan district started, on an Office of Scientific Research and Development contract to measure fast neutron energies. The person in charge of all that part was Professor Gregory Breit at the University of Wisconsin but he was so obsessed with secrecy that there was a great deal of disaffection with the people working—that he wanted to compartmentalize things too much and he was always threatening to resign. And he threatened once too often, and in May 1942 in Compton that the _____ Chicago accepted his resignation and hired Oppenheimer to take over so that was when. But when I started, Breit was the one who had initiated it and his, our contact was only through H.A. Wilson who was the head of the department. Breit was very security conscious. But then after Oppenheimer took over we got word that in order to facilitate—well, there were about nine different neutron measuring projects at different places—Wisconsin, Minnesota, Purdue, Rice, and Carnegie Department of Crystal Magnetism, and places like that—that were working on various measurements that were relevant to parameters for fission and Oppenheimer thought that in order to promote interactions and to simplify security situations it would be well to have all of these concentrated in one location. And so in the summer of 1942 we were told that our Rice project we should finish up and in the fall go up to the University of Minnesota and try to help them finish up their neutron scattering measurements so that we could all meet at a central location in the spring. And Los Alamos hadn't even been chosen at that time but it was subsequently chosen. So in October I took the uranium sphere that I was using for the source of fission neutrons in the glove compartment of my car and drove to Chicago, the Met Lab, where I was briefed by both John Manley and Edward Teller on the project and then went on up to Minnesota where I indeed participated in the neutron scattering measurements and carried on the measurement of the fission neutron spectrum at Minnesota.

Mark: Right. And then if you'd just trace the steps to Los Alamos and then I'll go back and ask some questions.

Hugh: Okay. Well, there were, in our project at Minnesota, there was Bennett and I from Rice, and Professor Williams after whom the sports arena at Minnesota is named.

Mark: Oh, is that right?

Hugh: Yeah.

Mark: I didn't know that.

Hugh: And he had two, three graduate students who helped him, so that was the size of the project there. So we were a considerable addition to the project and we got the cross section measurements made. But we all knew we were to be reassembled some place else and so we put up a map on the wall of the lab and sold pins as to where we were going to go 'cause we hadn't been told. But we got a rumor that Oppenheimer had a ranch in Arizona so we had a lot of clustering of pins around Arizona but, of course, it turned out his ranch was in New Mexico so we missed it.

Mark: At the same general part of the country anyway.

Hugh: Yes, yes. And before we left, the Manhattan district came and packed our scientific supplies and the Army inspector of packing it didn't of course know what anything was so he had to put down whatever we told him. But when he came to small hand tools, oh, he just blossomed forth because he knew those and we had to be very specific with whether the pliers were slip-joint, gas pliers, or what but we got those taken care of. Then I drove down to Los Alamos arriving there about April 1, 1943 and was amongst the first there. And there wasn't housing ready for us at that time. There was only the Old Ranch School for Boys (??) and the Manhattan district was building housing and labs and so forth but they weren't very far along so we had to live at dude ranches around Santa Fe and drive up each day which was an awful drive because the mountain roads were terrible and so they let some of us bachelors stay in one of the Ranch School for Boys (??) old dorms called the Big House and this was great because it saved that drive each day which was terrible.

Mark: I'm sure.

Hugh: And then the project had been planned for about 100 scientists and in April a fair fraction of that 100 were already there and we had a series of lectures to indoctrinate us. One of the advantages of central location was that you could freely talk and all were cleared so Professor [Robert] Serber gave the indoctrination lectures.

Mark: What did these lectures consist of?

Hugh: They're published in a book now called the "Los Alamos Primer," the University of California Press republished that a couple of years ago and it's called the "Los Alamos Primer" by Serber, and it goes into as much as was known about the problems and goals at that time. It was, of course, very interesting and sobering especially since this was the first time I had seen a really thorough, careful detailed, theoretical treatment of it. As I say, we had done back of the envelope calculations but the --

Mark: And you were obviously very impressed by the wealth of knowledge that was evident already.

Hugh: Oh, yes. Bethe, who headed the theoretical division was and is, he's still alive, one of the most impressive scientists I had seen and I certainly gave me confidence that it probably wasn't all a wild goose chase, which many people of course thought it was.

Mark: So this is April '43 now --

Hugh: Yeah.

Mark: -- and you're there. When did your actual equipment get there and when did you start doing research?

Hugh: Well, my first job was to worry about the construction on the laboratory, which was to house the two electrostatic accelerators, which were to be on loan from Wisconsin which hadn't come yet. They came the middle of April, but I worried about facilities and things like that in that building. And the Wisconsin accelerators came down the middle of April and we had one of them working within a month, I think, and the other in June, certainly, so we had them operating, and the Wisconsin crew was big enough so with the Minnesota crew we could operate them around the clock.

Mark: Okay. I'd like to interject here a little bit because we're starting to get into the technical part in your role in it so perhaps we can just take a break and perhaps you could explain, in the dummy's point of, explain to the novice, such as myself, how the nuclear bomb works. I mean, what are the sort of principles involved, how does it work, and where in that process was your research focused.

Hugh: Well, of course, most of the mass and energy in any atom is in the nucleus and the heaviest of the ordinary nuclei is uranium and it has 92 protons (it gives the charge) and the rest of the mass is neutrons so the two, to commonize it, the two major isotopes in uranium are 235 and 238. Now the 235 is only about less than 1% of the ordinary uranium so most of it's 238. Now discovery of fission turned out it was the U235, rare isotope, which fissioned with slow neutrons. You had to have fairly energetic neutrons to produce the splitting of the 238 one and so that's why uranium itself isn't explosive or gnarly. But of you could separate out the 235, we measured the cross sections and knew indeed that could be explosive because any fission produced at least two neutrons, some of them produced a little bit more but on the average it's a good approximation that there are two neutrons released for each fission. So if you send one neutron in and get two out, of course the number of neutrons multiply rapidly. And so if the process doesn't take very long, the fission--and to go from a neutron that's produced to one that is captured in fission you can have the energy released in a very, very short fraction of time, and that is crucial if you are going to get a high efficiency explosion. And it looked like, indeed, if you could take the U235, the rare isotope, and concentrate that, it would indeed be an explosion, explosive. And that's what the Oakridge National Laboratory was set up for in order to separate this rare isotope in enough quantities so that it could serve as a bomb material. And we were so sure of our measurements on those properties that that was a simple thing to build a bomb on it; just a gun shooting part of uranium into another uranium 235 plug, and that was never tested. And that was the one that was used over Hiroshima. The delay on making that bomb was entirely the process of separating out enough U235, which took tremendous effort and lots of people, and the Oakridge was the center on that separation. But that determined the time scale on that then. Also that was the only one you had so you didn't have any chance to test it. You wouldn't have a bomb if you'd, to use, if you had tested it. So on the other hand, one had learned that you could made a nuclear reactor, not a bomb, but if you used slow moving neutrons, slow the neutrons down, you could make a, moderate them, a call it a nuclear pile or nuclear reactor, and Fermi accomplished that in December 1942. In fact, I was on my way from Rice to Minnesota—I stopped for a briefing at Chicago and saw his assembly. It wasn't yet complete but it was, that was in October and it went critical in December, I think. But that opened up a whole other possibility on bomb arrangement because the U238 in the pile tended to capture neutrons, especially slow neutrons, resonant neutrons, so that that changed the U238 to a U239. It had an extra neutron. That had a short half life and decayed to neptunium, 93 protons, and then another neutron change, fairly short life, to a proton, so they ended up with 94 protons which is called plutonium and that has a long half life, 20,000 years or so. So that is what you were doing in the pile were converting the U238 which wasn't a good bomb material into plutonium 239 which had even better properties than 235. And of course, many of our early jobs were to try to measure these properties of the small amounts of plutonium which were produced. The, well, our first experiment done at Los Alamos while I was there was one with the accelerators where we had a few micrograms, 100 or 200 micrograms of plutonium which was the world's supply then. It had been made in cyclotrons (??) at WARF (??) University in St. Louis I believe. And we had that for a week or two and we were to discover, or to measure, the number of neutrons a minute per fission because you have to have more than two, or you need certainly more than one, and it turned out that it was even better than 235. And then we had to determine as many other of the relevant nuclear properties that you'd need for designing the amount of material in the bomb in it. So we had that for a couple of weeks then it went to the chemists and metallurgists 'cause they had to try to design procedures for handling it and so forth.

Mark: So in your specific work you were working with these accelerators?

Hugh: Yes, yes. I ran shifts on them and in addition I had the responsibility still for measuring the spectrum, the energy distribution of the neutrons from fission, and so I would expose photographic emulsions to these neutron sources and as 235 got concentrated more and plutonium became usable you could then try to find out about the spectrum of those. Those were in addition to my running shifts on the accelerator on all these other projects. Yeah.

Mark: I was wondering if you could explain the accelerator a little bit to me.

Hugh: Yeah.

Mark: What does it do?

Hugh: Well, the electrostatic accelerator, it's also more properly called Van de Graaff accelerator, but that's actually a trade name of a high voltage engineering corporation. And Professor Herb at the University of Wisconsin made Van de Graaff's idea of electrostatic accelerators feasible for nuclear physics, and that was in the 1930's. And basically, well, the basic principle of electrostatic accelerator, you spray charge on a belt or on some roll of insulated pellets or something like this and the charge is carried mechanically up to a, inside a hollow metal sphere or dome and the charge is taken off there and it distributes to the outside of the dome. Now, you have to do mechanical work to carry the charge up against the electric field that's there and that means you've raised the electric potential of the charge in the dome and you can achieve electric potentials to the order of millions of electron volts, millions of volts then, and so if you have an evacuated tube connected to this high voltage source, if you start a ion of charge particle down that vacuum tube, it can be repelled, accelerated from, say, two million volts down to ground. It requires two million electron volts of energy and requires velocity then, which gets to be a fair fraction of the velocity of light. These have enough energies that they can be used then to probe the inner nuclear structure of the atom's nuclei and it can also be used to produce neutrons from particular nuclear reactions which can then be used as a separate probe to study how the probability of scattering or fission or various things varies as you vary the energy of the neutron, which is very important if you're going to calculate what's going to happen in an explosion, in an actual fission assembly. Well, the other thing that developed about the plutonium was that, in the manufacture plutonium in a reactor, you also have enough neutrons around so that some of the plutonium 239 captures a neutron and that makes plutonium 240. Now this is not a good thing because plutonium 240, which was found at Los Alamos, has a very high spontaneous fission cross section. That is, it will explode itself in a relatively short enough time that this then becomes a source of neutrons because when it fissions it releases neutrons too. And so if you have plutonium 240 mixed in with the plutonium 239, you always have a source of neutrons present and this means that it's very difficult, conceptually, to assemble a bomb because as soon as you get to a critical mass in size the reaction, there's a neutron to trigger the reaction, and so the reaction starts going quickly before you've really assembled it and it blows it apart with a fizzle. It may be 60 tons TNT or something but nothing; you don't convert a large fraction of the mass into energy. So that posed great problems for Los Alamos because the gun method of assembly turned out just not to be practical for plutonium. And this was the stuff that you could mass produce and then separate out chemically, and it wasn't like the U235, which had to be electro-magnetically separated and very slow and expensive, so that posed special problems for the lab. And so they had to come up with a method of very rapid assembly of the plutonium, and that was achieved by the implosion technique, which they used essentially explosive lenses to converge the shock wave at the center and actually compress plutonium's sphere very quickly to high densities, and that could do the assembly fast enough so that it was hoped if the assembly was symmetric enough and so forth that it would go off. But the tests on the implosion lenses and so forth, the problem was difficult enough that it wasn't at all clear that these problems were solved until really very late. In fact, because of the high probability of unsuccessful tests the laboratory did have a big container called "Jumbo" which was originally planned to detonate the bomb in so that in case --

[TAPE WAS INTERRUPTED]

Mark: Okay, I think we're back.

Hugh: -- but the implosion techniques improved over time and by the time the tests were scheduled we had enough confidence in the implosion technique that "Jumbo" wasn't used which simplified things a lot for the first test at the Trinity.

Mark: Okay. I'd like to go back a little bit and _____ some other topics. First of all, security considerations.

Hugh: Yes.

Mark: You make some reference to those sorts of things in the memoir but I was wondering if you can perhaps expand upon --

Hugh: Well, my first contact with it was that I needed a birth certificate, and I had been born without the benefit of a doctor, and so I had no birth certificate. The doctor hadn't arrived on a cattle ranch in Colorado. But the doctor who came late and my mother were still alive, so they got together and made out a birth certificate, and it's witnessed 23 years later but it took care of that. It has some mistakes in it but it -- (end of thought). The security, of course, was important and at Los Alamos had the advantage, of course, that you could allow a non-compartmentalization, talk between scientists, because the security border was the outside of Los Alamos. So they were very strict about breaching that barrier and indeed all our outgoing mail was censored. We had to put it in an unsealed letter and if there was something they didn't like they would return it to you. Our incoming mail we didn't know was censored until after awhile people found that the stamps were not sticky and they were suspicious of it, and finally they admitted that they were censoring incoming mail and so they indeed marked it censored and we have that.

Mark: But originally you weren't informed of that.

Hugh: That's right.

Mark: They didn't tell you.

Hugh: Yeah.

Mark: Was it the Army that was doing the censoring? Or was there some other sort of government official?

Hugh: Yeah, Army. Army, yeah, did the censoring. Yes. And I met my wife at Los Alamos. She was secretary to the head of the metallurgy division and we were married there and we couldn't have family to the wedding. They allowed to have it in Santa Fe but, in fact, we had even trouble with invitations, what could be put on the invitations and they wouldn't let them, my mother-in-law mailed them to our guests at Los Alamos because they didn't want anyone to see the list of the people, and so she had to send them to us and we distributed them by hand to avoid a list.

Mark: As I was reading this I got the impression that you were still able to jump in your car and go for a day in the mountains or something like that?

Hugh: Oh, yes. We weren't restricted to Los Alamos. Of course we'd been cleared and I'm sure there were intelligence people, lots of them in Santa Fe certainly and at various other places so they were always looking for violations.

Mark: Or the thing that occurred to me was that one of you could have been, you know, kidnapped or something. Had information taken from you that way. That doesn't seem to have been a concern apparently.

Hugh: I never heard of kidnapping being worried about. It was, of course, release of information and there were, of course, breeches of security. One person in the British mission who came to Los Alamos, Klaus Fuchs, turned out to be a spy and he was convicted later. And then there were some low level people, the Rosenbergs, who were found guilty of something. But none of the high level people, except Klaus Fuchs was the only one I think—that was the British one—that was ever involved in.

Mark: Did you, I mean other than the mail censoring and that sort of thing, in your every day work did you get a sense of being observed, people looking for these security violations? Within Los Alamos itself. You know, conversations you had with your colleagues for example, did you speak freely?

Hugh: Well, in the technical area only cleared people could go in the technical area where we worked and so there you were free to talk to anyone at all and in fact we had physics colloquial where things were discussed. And to have a building big enough for that we had to use the site's motion picture theater, and there you had to have your white badge cleared to get in on that. But around outside the tech area you were all careful of what you said because there were all people. But, of course, you have to realize almost all the scientists were very motivated and they didn't want to breech security, so they were very careful I think. And you had a number of people who were, well, the foreign refugees, the Jewish ones particularly, who were very concerned about that. I don't think, for the average scientist on the hill, there was any problem on dealing with that. Actually, most of the wives didn't know very much either. My own wife, of course, was cleared and worked as secretary of the metallurgy division so she knew, but she didn't know much physics so --

Mark: It's hard to explain.

Hugh: Yeah. So --

Mark: I'll attest to that.

Hugh: -- that means that security is easier in that sense that there aren't, well, people in Santa Fe certainly speculated about what was going on up there and there were all sorts of stories. But, in fact, when we got married we went to Episcopal minister there and he sort of tried to prod what we were doing, but he sort of speculated mining or something but of course he never got anything, response on any of that.

Mark: Now, as you talked among your colleagues, I mean, I assume you talked a lot about the technical aspects of physics, but, I mean, did you discuss the use of the bomb? And on whom it might be used? Because as you go over the historical debate it's, "Would we have dropped the bomb on Germany, etc., etc." I'm just wondering what you thought about --

Hugh: We were under such stress at Los Alamos to get our work done and meet deadlines and so forth that we had almost no time to speculate about anything and so there was very little of that. At the Met Lab in Chicago on the other hand, their work finished up early and they essentially had nothing to do and they had a lot of time to speculate on it. And also we had no idea whether the thing would actually work, and so your first--it's idle speculation when you don't know whether it will work or how well it will work. And so until the tests on Trinity, July 16, 1945, and of course we were under terrific pressure and stress on that test to not make any mistakes and to get the data and so forth, that our worry and discussion of these aspects was post-July 16, 1945.

Mark: Of course by this time Germany had been out of the war.

Hugh: Oh, yes, yes. And there were some people who thought, well, especially some of the European refugees, that they were in it for Hitler and Hitler was done. They didn't really care. But I didn't see any great difference on that. And there are pros and cons on everything and you can't do a controlled experiment, so there isn't any answer as to what was right or wrong. But subsequent history, I think, has, we have witnessed a period of, since World War II, of 50 years with no other world war, and that's unheard for Europe and the world, so I think in some sense, one thing we didn't worry whether, well, we speculated whether this would indeed make world war an obsolete method of settling national disputes. And I think to a large extent that seems to have occurred because it's suicidal now if you try to settle things that way. But of course it hasn't eliminated smaller wars.

Mark: Right. I'd like to discuss the Trinity test but I want to go back and cover a couple of other things. One of them is, is the Army and your relationship to it—as I read the memoir they seem to be just sort of, not terrible, oppressive.

Hugh: They were not intrusive at Los Alamos. There were military police on the perimeter and at the gate post and there were a group of special engineering detachment soldiers who had been drafted who had technical skills and so forth that were useful, and they were in barracks and helped on many projects and were cleared and so forth. In fact, I had a WAC working for me full-time measuring photographic emulsions, so there were military around. But they weren't obtrusive and occasionally you'd see General Groves at the Army mess but there was not, it wasn't obtrusive.

Mark: I see. They provided security and maintained the facilities I assume?

Hugh: Well, no. I think the Zea (sp??) Corporation did most of that and there were Spanish-Americans mainly on that. The janitors at the tech area were Spanish-American and there were Indians from the neighboring Pueblo _____ and so forth. We had one of those working for us. No, the military weren't particularly in evidence. No.

Mark: That's interesting.

Hugh: Well, there were some around but, and the special engineering detachment but, no, it was primarily a civilian setup.

Mark: I see. So, the first test on July 16, perhaps you could explain a little bit about where you were and what you were doing and, just for anecdotal purposes and nothing else, describe the explosion to me.

Hugh: Well, see I was part of the research group originally. We were determining the parameters necessary for understanding fission and calculating what would happen when you did such and such and we had determined these satisfactorily by, well, to, you never have it a clear satisfactory, so the pressure was off on most of the measurements, at least by the end of 1944. And so in 1945 most of the people in the research division were reassigned to the Trinity division, test division, and my boss in the research division, Professor [John] Williams, who was in charge of the Minnesota work originally and the accelerators, electrostatic accelerators at Los Alamos, was in charge of all the services at Trinity. And one member of the Wisconsin group, Bill McKibben who built one of the accelerators, was in charge of all the timing and signals at Trinity. I was in charge of the neutron measurements at a group on that. We measured, well, one was a special distribution of the neutrons afterwards and some of the people were involved on that. The one I was involved in most was the time sequence of the neutrons and for that purpose we devised what we called a camera where we had a little motor pull a sheet of cellophane tape rapidly between two sheets of uranium 235 plates and the neutrons would produce fission in the U235, and the range of a fission fragment is 2 centimeters of air, and so if you, the ones at the surface of the plate, the fission fragments come out and the if the cellophane tape is going by in front of it, those fragments then would be caught on the tape and those fragments are radio-active so if you pull the tape too quickly and then look at the radio-activity on the tape as a function of position you have a time distribution of the neutrons. So that was what we were doing. The main purpose of this, of course, was to be diagnostic. In case things didn't work you wanted to know why they didn't work and what were the situations. In fact, for that reason we had three stations on this. One at 300 meters out and one at 600 meters out and the ground station in a little aluminum dog house and then we had one up on a balloon about 300 meters out so to get away from the ground effects and make our interpretation easier and the explosion was such a success that the nearby ones were completely destroyed and we didn't get any record from those at all. The one at 600 meters, the dog house protected it enough so that we could retrieve that and we did get a record there which you could see the effects of the shock wave and things like that, but it wasn't really crucial of course 'cause it worked. That was the main thing. But I was located at the base camp which was 9.7 miles from ground zero where most of the scientists were involved in things up closer were, and we'd been issued dark welder's goggles and instructed to lie down away from the blast, ground zero. And we had done that and we heard the countdown over the loudspeaker—9, 7, 6 and so forth—and as time zero came my first reaction was that someone had sort of slapped me on the face and it was heat radiation, an accident (??) reflected from the atmosphere and the mountains around that came, of course, very quickly. Of course you didn't hear anything. At 9.7 miles it takes about a minute for the shock wave sound to get there. But then we could stand up and turn around and look through the welder's goggles at the blast, the mushroom cloud, and it indeed was impressive, and as it lessened we could take off the goggles and look at it directly. So it was indeed very impressive and very sobering experience.

Mark: Yeah, I was going to ask you if you recall your thoughts at the time.

Hugh: Well --

Mark: I mean, did you say "Wow" or something like that?

Hugh: It was, of course, euphoria that it had worked. We'd spent years of effort on it and none of us was more than 60 or 80 percent odds that it would work probably because there's so many things that you don't know and things can go wrong, so that we were quite euphoric at the time. But of course it was after that that you started discussions about the future and what—there were some people who worried then about whether it should be used but most of us, I think, felt that in war, well, the air bombing of Tokyo killed as many people in one raid as Hiroshima, so I don't think the differences are as much as some people would like to -- and the Dresden bombing and things like that. And in fact, there's an interesting question which I don't think people have really thought about; why should military people be discriminated against in a war and civilians discriminated in favor of? It's total war and I think in fact my own personal opinion is that these codes on military behavior not injuring civilians and so forth was a strategy designed to make tolerable, a nice organized thing, so that war could be a means of settling disputes. But I think once you let that go and include the civilians as part of the war then that is what makes the difference, that war becomes a not acceptable means of settling disputes because it's too suicidal. And so I think in that respect the inclusion of civilians I think is probably in the long run a good thing rather than a bad thing so I take a view quite different than the popular politically correct one that you shouldn't attack civilians.

Mark: Yeah.

Hugh: Civilians are, it's total war and I see no reason to discriminate in favor of civilians.

Mark: As I listen to your experience at Trinity --

Hugh: Yeah.

Mark: -- what strikes me is that there seems to have been a little concern about radiation, which of course is what many people associate with nuclear weapons in the first place. What did you know about radiation? I mean obviously you knew that there was going to be some sort of effects.

Hugh: Oh, yes.

Mark: As far as radiation sickness and those kinds of things, there apparently seems to have been a little concern. You had some goggles and --

Hugh: Well, that was for the eyes --

Mark: Yeah.

Hugh: -- to take out the ultraviolet light. At that distance we didn't worry about the radiation, neutron radiation or other. We got there. We knew it wouldn't be, and in fact I am a bit amused about the popular concern about radiation problems because actually the experimental evidence is that probably some radiation is good for you. It's called the hormesis effect and if you take rats for example and expose them to radiation, and a control group not to radiation, the ones exposed to radiation live longer and have fewer problems than the ones that don't. It's called the hormesis effect. But you never see this in the paper.

Mark: I've never heard of it.

Hugh: Yeah. And, well, in fact, one of our students, Professor Cameron, who founded the medical physics department here at the university, was part of a team to evaluate nuclear shipyard workers compared to non-nuclear shipyard workers, and they found out that the nuclear shipyard workers were healthier, had fewer cancers and so forth than the non-nuclear shipyard workers. The other members of the committee wanted to say, "Oh, that's just a healthy worker syndrome. You recruit healthier for it" or something like that and they weren't going to publish it. He had to fight for several years to get them to publish the results even. And, of course, if it had been the other way around, every paper in the country would have headlined it. Of course, the way it is you never hear anything about it. Of course it is true on the rats if you give them too much radiation, you can kill them. It's just like on sunlight, you need some for vitamin D, too much you get skin cancer. And it's not surprising I think, from evolutionary point of view, that the radiation level on which life developed was much higher than it is now because radioactivities have been dying off with time and so it isn't surprising to me that what developed was adapted to a higher radiation level. Well, for example, to pick up our catcher cameras the health people there allowed us to take a year's dose which was 5 frankens (??) at that time, units they used at that time, and we went in and we had meters and picked up our equipment and came out and got less than a year's dose but close to it. But it's nothing that we worried about. I'm certainly, I've been exposed to radiation, of course, all the time from accelerators and so forth. I think the studies by the doctors and geneticists of the survivors of Hiroshima and Nagasaki, I've heard talks by them, Kelly Clifton and others, and it's very interesting there has not been all the things that were predicted about genetic effects and so forth and those who survived have not had undue cancers and other things. If you get a high enough level to really produce radiation sickness and so forth, then of course you're sick.

Mark: Right. And that did occur.

Hugh: Oh, sure.

Mark: What you're saying is it's a matter of degree.

Hugh: Yeah, that's right. And the popular press and a lot of scientists even believe a linear extrapolation, even a small amount is bad, but there's no real evidence for that. In fact, the evidence is to the contrary. In fact, for example --**[END OF TAPE, SIDE A]**

Hugh: -- believe a linear extrapolation, even a small amount is bad, but there's no real evidence for that. In fact the evidence is to the contrary. In fact, for example the natural radiation from uranium and _____ in the rocks and cosmic rays is such that people living in Denver, of course, have a much higher radiation level than people at sea level and you fly a jet airplane or a plane and go up 30,000 feet, you get a lot of cosmic rays. In fact, you get more dose there than nuclear workers are allowed to take or something. People don't worry about it and it's, in fact, the nuclear radiation from coal-burning fossil plants is more in most plants per kilowatt hour of electricity generated than in a nuclear plant but people don't worry about that either. Uranium contains, I mean coal, most coal contains lots of uranium and these long-lived products, takes a lot of coal to produce one kilowatt hour, and the stuff is spewed out all over the landscape and that's part of life.

Mark: Yeah. So, after the tests --

Hugh: Yeah.

Mark: -- it was about two, three, about three weeks then until the bombs were actually used. If you'd describe what happened at Los Alamos, and to you and your wife personally, during that time. And when the bombs went off you were visiting relatives. I was just wondering --

Hugh: Oh, the bomb went off, yes, yes, yeah. Well--

Mark: In combat I mean.

Hugh: Immediately after the Trinity test our job was, of course, to get our records and write up the stuff and --

Mark: Close up shop?

Hugh: Not close up shop but to write up the stuff, reports, and we did some other tests to corroborate some things, so we're busy on that. Then we were allowed to visit our, I had a sister on a cattle ranch in Colorada near Wilsonberg (sp??), and security was quite relaxed about our going there. Of course, it was all done essentially. And we were at this ranch on August 6 for the Hiroshima and Nagasaki things and my mother was coming and my elder sister, too, so we had a sort of family reunion there and it was just as my mother was coming on the train that the announcement, she heard it on the train before she got there, and I'd had my sister keep the radio on at Wilsonberg (sp??) so that she had heard it too. I didn't know the exact time but I knew it was certainly a possibility in this time.

Mark: And so what were people's reactions? There's been much debate about the bomb in this 50th anniversary year. I'm interested in people's immediate reactions at the time.

Hugh: I, of course, don't know for sure what people's reactions were but my own and I think a large fraction of the people's reaction, was relief that the war would soon be over. That was my reaction, that here's the end of the war. And, in fact, I was surprised that it took until the 14th for it to be over. And I think if there'd only been one, they would have worried whether it was in fact the only one we had. In fact, it was the only uranium one we had. If there hadn't been the plutonium ones, that would have been it because the separation of U235 was just enough for one bomb. So it isn't, it's easy to be a Monday morning quarterback and say you should have done this and you should have done this but no one knows what should have been done, and I think the odds are fairly high that a reasonable, rational course was followed. And what, in our conversations among my co-workers and so forth at Los Alamos, the main concern was over the future. Almost all of us believed there should be international --

[TAPE WAS INTERRUPTED]

Mark: Okay, I'm sure we're back.

Hugh: -- we formed an association called the Association of Los Alamos Scientists—the acronym, A-L-A-S, ALAS—and we thought that our biggest contribution would be to try to inform people more accurately about what the problems and possibilities were and the need for international control of weapons.

Mark: This was in August or September of '45? It was very soon after.

Hugh: Yes, yes. Well, in fact we had started talking, of course, in the lab after July 16 and one of my co-workers and I, Debbie Frisch (sp??), talked a lot and I thought it meant that in the long run we had to sort of have world government to prevent it from happening, and he argued to the contrary that civil wars are the most bloody, and cited our own civil war, and of course he was correct. I don't know the answer to the problem, but we were not successful in getting international control of atomic weapons, nuclear weapons. After the war my wife took our baby and went to Washington to visit her family and I went then later there too, and it's the first time I'd seen her relatives, of course, and I took the time while I was in Washington to lobby congressmen about the importance of international control.

Mark: Was this on your own? I mean you just walked up to congressmen and introduced yourself.

Hugh: Yeah, yeah. So I did quite a bit of that. And also we felt strongly at Los Alamos, and I lobbied on this, that there should be civilian control of nuclear energy, not military. That was one thing we were worried, feared that the military would take control of it. And we did succeed in getting essentially a civilian commission, Atomic Energy Commission, which I think was a good thing but we were not successful in any international control.

Mark: Now --

Hugh: Oh, this Los Alamos group then later merged with other scientist groups. There was the Chicago scientists had a group, too, and formed an organization, Federation of American Atomic Scientists, originally, and that has changed now to Federation of American Scientists which is still a group lobbying for and educating the populous for elimination of nuclear weapons or control of them. Yeah.

Mark: Yeah, I was just about to ask how long your activities in this, and how long your lobbying activities and other sort of activities, lasted. Did you continue to do this into the '40s and into the '50s?

Hugh: Yes. I came in '46 to the University of Wisconsin here and we had a group here at Wisconsin that did some of that too. In fact, I think I made one trip from Madison to Washington on my own on things.

Mark: What sort of reception did you get from political persons? You've intimated some of this already. If you could comment a little bit more.

Hugh: Well, congressmen, of course, were interested in hearing anything about it. And, of course, there was wisdom in publishing the Smyth Report (??) which put on record most of what could be released at that time although I think probably more could have been, but it at least gave a basis for talking about things in a rational manner. My reception was always quite good but the votes didn't necessarily follow.

Mark: I'm interested because the late '40s, now the '50s of course this was a period of Red baiting, anti-Communist agitation, and I'm wondering if perhaps some may have thrown you into that camp and if you experienced some sort of hostility in that regard?

Hugh: No, I never did. No. I was opposed to the McCarthy thing and everyone I knew was.

Mark: International control seems to some people would be --

Hugh: Well, the real problem with international control was the Russians. They wouldn't cooperate on this and they wanted to go ahead and get their own, and they did, and it's been a standoff but it would have been much better I think to have had an international control.

Mark: I thought of something I wanted to ask you about before, but it can lead into some questions in this area, too. I was going to ask you about some of your colleagues at Los Alamos. What sort of backgrounds they came from. Where there a lot of young guys like you? I mean, you weren't even 30 years old yet.

Hugh: No, no.

Mark: And so were there a lot of young --

Hugh: Well, the thing that was characteristic about Los Alamos was the young average age of people. In fact, that was, my wife said the strange thing coming back afterwards, you saw older people. At Los Alamos there was hardly anyone above 30 or 40. In fact, I think the oldest person I knew at Los Alamos was Joe Hirshfelder's mother who, he was a chemist from Wisconsin, a bachelor, and they let him bring his mother down and she was, I don't know, 60 maybe, or something, but 50 or 60 anyway, and that was the oldest person around. So it was quite a different, it was a young environment.

Mark: And after the war then, as the scientist movement started as you described, there were some of your colleagues who disagreed about international control and those kinds of things.

Hugh: Oh, I'm sure.

Mark: Like, if I'm not mistaken, [Edward] Teller.

Hugh: Teller's a peculiar person.

Mark: You make a mention to his conservative beliefs early.

Hugh: Yeah, and he's unpredictable. He thought most of the secrecy was nonsense. He wasn't one for lots of secrecy and that stuff so he's quite unpredictable. He'll take on anything. I wouldn't want to say I don't agree with him on lots of things and he's, I think the best illustration is the one I gave in the book, that he complained about, when he was here in Madison after the war, that all the things that physicists had done in the war, or tried, it worked out and he thought that was terrible. He said, "Ten percent return on an investment is good investment"--we weren't being adventuresome enough--"but 90 percent of what we try should fail." And I think that, of course, he goes on star wars and all the things like that. He's an interesting character.

Mark: So after the war then--as I mentioned you're the first non-military veteran I've interviewed, and at this point I often ask how did your war experiences affect the rest of your life? One of the problems veterans sometimes had is that being drafted hinders their professional well-being. This is a, I'm wondering how your involvement in Los Alamos affected your professional career. I can only imagine it must have been a big boost to it.

Hugh: That's hard to say. Of course, I had hoped to get a National Assurance Council fellowship from Rice and go that way, and that was foreclosed by the war. On the other hand, my job at Wisconsin was certainly facilitated by my contacts with Wisconsin people at Los Alamos, although the only faculty member from the physics department who was there was Julian Mack and it probably overall, I don't know, you can't predict what --

Mark: No, I guess not.

Hugh: I had chances to go other places than Wisconsin and I don't know whether I'd been better off going to Princeton or Illinois or what, but you can only just speculate.

Mark: It didn't hinder your career by any means.

Hugh: I don't think so, although as I say if I had gotten a National Assurance Council fellowship and done well on that I might have had a better career. I don't know.

Mark: That's interesting. Because it seems like a pretty remarkable item to put on your CV, Los Alamos project.

Hugh: Yeah.

Mark: I mean, that's interesting.

Hugh: Well, National Assurance Council fellowship would have been nice, too.

Mark: So after the war you taught, you did research at the university. I want to get to the 1960s and as we mentioned, touch briefly on the Sterling Hall incident. If you just briefly describe some of your --

Hugh: Post war.

Mark: -- post war work and leading up to the '60s and then I suppose up to your retirement.

Hugh: Well, I thought that for the future the most important thing for the scientist to do would be to train other scientists, and we had a very talented group of graduate students coming to Wisconsin, and so my first priority was training other graduate students. And I handled lots of graduate students. One of the accelerators from Los Alamos was brought back to Wisconsin, I brought it back and reinstalled it, and Professor Herb built another one on his own, so we had good facilities and we had good staff and good students and our students have turned out very well. They're in responsible positions and academic places all over the country. I, myself, had almost 50 Ph.D. theses and, of course, that is such that if everyone did, the world would soon be populated with physicists. I found it very rewarding to work with these graduate students. In fact, my wife is always amazed that many of my students were my same age or some even older. In fact one was visiting us this summer and he's only a year younger than I was. He's, yeah, yeah.

Mark: Is he working in the field, by some chance?

Hugh: Yeah. He's retired now. He taught in Michigan, at a college in Michigan. He's doing work on, it's high school science teachers now since he's retired, trying to upgrade them. No, it's been, and I have another, one of the more recent students and his family coming in August. They're going to stay with us. So it's been very nice.

Mark: It's a rewarding experience.

Hugh: Oh, it's, I couldn't think of a nicer way to, and I've liked the teaching. I taught generally the course for the science majors' physics plus some graduate courses, but I've enjoyed it.

Mark: Now, as far as the Sterling Hall incident, there was military research on campus. Were you involved in this sort of thing?

Hugh: No, no, no. In fact, we were quite, well, when the AC gave the first tandem-type accelerator to Wisconsin based on some work that Professor Herb had done with the ion source for the tandem, we went to the Wellner-Fritz (??) Foundation and wanted a building to house it and they gave us money for it in an addition to Sterling, east wing. But then, unbeknown to us, they decided to move astronomy into this building and also Langer's Army Math Research Institute, and we were greatly opposed to this because we didn't want them foreclosing the space for our expansion. But that's the way it was and I was chairman of the building committee for the east wing, so we had to put up with the math research center being there.

Mark: Now, this was in the ‘50s if I’m not mistaken. That’s when that got there.

Hugh: Yes.

Mark: Or very early ‘60s perhaps.

Hugh: ‘58, ‘59, along that time, yeah, I think it was. Late ‘50s, yeah. And so the building that was built, physics had the basement and first floor. The Army Math Center, the second, third and fourth floor. And astronomy, the fifth and sixth. And our accelerator was underground between Sterling and Birch (??) hall. So that’s the way it ended up. And, indeed then, when the Vietnam War came along, the campus unrest, the Army Math Center was, and we were always unhappy about the Army Math Center because they keep their doors locked. You couldn’t go through there. We complained about them all the time. And we had no classified work at all. Ours was all open and everything.

Mark: Was there security concern?

Hugh: No, no.

Mark: I’m not sure if you’ve seen the film “War at Home.” It’s about the anti-war movement.

Hugh: I read the book “Rads” (??) but I haven’t seen it.

Mark: I’ve heard that, too. It’s the same. They mention again and again that the Army Center there was a lightning rod of --

Hugh: Oh, yeah, yeah. We were the two floors beneath it and so we saw it first hand. And in fact one of my colleagues who was a refugee from Germany was really just like the Nazis he says and he was the one that got us to install venetian blinds in the building because of the trashing of glass. He also made us get safes to put important things in so if there was a fire, it wouldn’t be burned and stuff. He was worried about the students on the campus. He said it was just like the Nazis.

Mark: And he was kind of alone in that I take it.

Hugh: Well, we didn’t like the trashing and the stuff that was going on.

Mark: So you got windows broken and those sorts of things prior to the bombing if I’m understanding you correctly.

Hugh: Uh, we didn't get windows broken but there were tear gassing and various things around. But the students were trashing elsewhere and my colleague was worried about the trashing. No, we never got that. In fact, my son at that time was a conscientious objector and worked in Milwaukee in a hospital to avoid Vietnam. The whole physics department was against the Vietnam War. It was, just faculty and students all together, and we would certainly have liked to thrown the Math Research Center out anyway because they kept their doors locked.

Mark: Yeah.

Hugh: They were just --

Mark: Not the best neighbors I guess.

Hugh: No, we didn't like them at all.

Mark: So, when the actual bomb went off, I speak to people who have lived in Madison for years, and even like a friend I work with here was about six years old at the time, remembers the explosion very clearly.

Hugh: Yeah, yeah.

Mark: If you would just walk me through your experience with the --

Hugh: Okay. We live in University Heights which is a mile and a half or something here. I walk to work all the time. And our son from Milwaukee, the conscientious objector, I think was home at the, well, I'm not certain. I shouldn't, but at any rate, my wife woke me up and said she'd heard an explosion and I said, "Are you sure?" Then a few minutes later I got a call about it and I went over at the time and Professor [Henry] Barschall was there, too, and he was quite disturbed. One of his students was running on the accelerator then that night and he suffered broken ear drums and various things. And one of my colleagues, Professor Quin, was working there at night, too, on it and he was saved. The door to the police department office where he was was open; otherwise, the blast would have torn it off and probably hurt him a lot more, but he got out the window without major injury. And of course a non-nuclear student, Fassnacht, was killed in the basement level _____. Some of my students lost their work, thesis work. In my office I have burned copies of magazines and so forth that I'd loaned to students that were in the fire afterwards. All my things in my office, books and stuff, came down on the floor. The spare wheel of the van was in my office.

Mark: Yeah, you've got a picture of it in the --

Hugh: Yeah, yeah. So, it was indeed a frightening experience. Ed Young, who was chancellor at the time, was down and I know he was worried about Barschall because Barschall was so concerned about some of his students working in the accelerator and we tried to keep him from doing foolish things. And he didn't do any of it.

Mark: Young, you mean?

Hugh: No. Young tried to keep Barschall from --

Mark: Oh, I see.

Hugh: -- he was --

Mark: From overreacting or something?

Hugh: Yeah, yeah, yeah. So --

Mark: Did you lose research in that?

Hugh: Oh, sure, sure. My labs were destroyed and --

Mark: I mean, you personally.

Hugh: -- student thesis. Oh, yeah. It took us a year to rebuild anyway and some of course. And Barschall's lab which was underneath ours—our lab dropped down on top of his—he was so concerned that he essentially quit nuclear physics then and went, at the university, and took leave and went out to Livermore Laboratory and worked there for a couple of years and I finally got him to come back. But he hasn't really been active in nuclear physics since. He, well, he's been more active in nuclear engineering and the medical physics but he doesn't hold an office in our area, but in other areas. No, the costs were a great deal on students. Student's thesis material, they lost lots of time and effort.

Mark: And I assume it took a long time to get your office straightened away. You had to go somewhere else.

Hugh: Oh, yeah. In fact, I moved upstairs to the Math Research Center. 'Cause that wasn't hurt very much the next floor up. The Math Research Center had been moved out to the WARF or someplace. I was, the dean appointed me associate chairman in charge of the reconstruction at that time so I devoted full-time to getting things back in shape. We had great support from all over the country on equipment and rebuilding the building. We had everything in pretty good shape within a year.

Mark: I've just got two more things. One is a personal interest of mine. I did some research on the TA at one time.

Hugh: Yeah.

Mark: And the, I was going through the UW campus computer and one of the things mentioned in your oral history interview is the fact that you were part of this series of interviews. Were you involved with that strike that they had and those sorts of things?

Hugh: They've had several strikes.

Mark: I'm thinking of the big 1970 one. I was wondering if, I wanted to go and read your transcript but I just didn't have time to do that. You were on the negotiating committee or something?

Hugh: No, I was not on the negotiating committee. There were some physics TAs that were very active in it and I thought quite unreasonable in most of their demands.

Mark: It was more prevalent in the humanities I think than it was in the --

Hugh: Yes, yes. But there were some physics TAs involved and I thought their demands were quite unreasonable.

Mark: And the last thing I wanted to ask about was the 50th anniversary of the atomic bombing and your work and I'm wondering if you had any thoughts on that. It might be a nice place to, or an appropriate place anyway, to close our interview.

Hugh: Well, I certainly had thoughts but I think I've probably expressed them. I think nothing is black and white and you can't do a controlled experiment as to what the world would have been if something had been done differently, so I'm reluctant to say that such and such is right and the other thing is wrong. But I'm basically an optimist. I think things have turned out actually better than I expected. I was worried that without international control there would be a nuclear war in my lifetime and there hasn't been yet, and I hope I get through without nuclear war. I'm basically an optimist. I think we'll probably muddle through on it. I think the nuclear weapons build up was a terrible waste of resources, both ours and Russian, but on the other hand if it has mutually assured destruction prevented a world war, then it may be for the best. I don't know. There's no way to decide. But to say, I'm basically an optimist and think we'll muddle through somehow.

Mark: Is there anything you'd like to add? I've concluded my interrogation.

Hugh: Oh, I think we've gone on.

Mark: Well, I appreciate your coming in. I really thank you very much.

Hugh: Okay.

[End of Interview]