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Human Radiation Studies: Remembering the Early Years

Oral History of
Doctor of Veterinary Medicine
Leo Bustad

Conducted November 13, 1995

Prepared for
the U.S. Department of Energy
Contract DE-AC06-76RLO 1830

Pacific Northwest National Laboratory
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Pacific Northwest National Laboratory
Richland, Washington 99352

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ORAL HISTORY OF DOCTOR OF VETERINARY MEDICINE LEO BUSTAD

The interview was conducted on November 13, 1995, at Leo's home in Pullman, Washington, by Frank Hungate from Pacific Northwest National Laboratory.

Leo Bustad was selected for the oral history project because of his early and prolonged involvement in animal studies at Hanford. He also interacted with many people, both professionally and in his community activities.

Short Biography

Dr. Bustad was born January 10, 1920, in Stanwood, Washington. He received a B.S. in 1941, an M.S. in 1948, and DVM in 1949 from Washington State University. Dr. Bustad earned his Ph.D. in 1960 from the University of Washington School of Medicine. Dr. Bustad joined the General Electric Health Instrument division in 1949. The division later became the Hanford Laboratories.

Early Employment

HUNGATE: Leo, could you please summarize your pre-Hanford history pointing out features and individuals you consider relevant to choosing Hanford as a place to work.

BUSTAD: My first introduction to the area was as a student in the Irrigation Practices at Washington State University in their Ag [Agriculture] Engineering Department. They had a course I thought would be useful to know since we depend a lot on irrigated land for our whole being in this state. We were on a trip to review the various irrigation projects. We went to Prosser and the Yakima Valley and came back on a road that went by Hanford and White Bluffs. One of the cars in our entourage was having trouble so we stopped—it was in June, as I recall, or late May and it was one of those very hot days and I wasn't used to living in a hot climate—and I said I'd have a hard time working in this kind of atmosphere. It was out in the desert too, without any experience in the desert at that time. It turns out that [starting] in 1949, I spent about 15 years within a mile from where I said these words in 1938. So, that's my introduction to Hanford; how it first came about.

[At that time] I was a student in the DVM program at WSU and was working on a masters degree in Animal Nutrition in the department directed by M. E. Ensminger, who later became one of the best known animal scientists in the world, having published more books in more languages in Animal Science than any person in history. The General Electric Company or the Atomic Energy Commission engaged him as a consultant on any animal problems. They had a complaint from some horse owners living west of the project (200 Area). They said it's probably that smoke that came out of the 200 Areas. Dr. Ensminger came to visit me about the complaints. In those days, of course, everything was classified. But, arrangements were made so that I could examine some of the samples from the problem area. We already had interest in and some information on radiation effects. I had reviewed much of the pertinent literature. We

examined thyroids from dead animals who were grazing in the area. It was a hard winter and they were out there trying to make a go of it. The thyroids looked normal. If there was radiation from radioiodine (which some thought was involved); but if there is damage to the thyroid gland, it stays there forever. Damaged thyroid cells are replaced by fibrous tissue (which we later defined in several species). So that was the nature of my introduction to the Hanford project.

Dr. Harry Kornberg was engaged to start the Biology unit out in the 200 Areas. But in order to bleed the sheep, I had to go through about three security gates since we were in a production area. They were having trouble bleeding sheep. Karl Herde was the one who gave me an orientation—I probably had a more intense orientation to the Hanford works than anyone. Because they hadn't built our facilities yet, Karl Herde had time to introduce me to all areas and activities and he had experience and knowledge about who was doing what. The plans for the experimental animal farm were made available to us. We closely observed the construction and made design changes. The point I was going to make was that I had an unusually good review of the whole plant because Herde had been there in production, so he knew all the production phenomena and the development of the testing methods of the radiation effects. That was going to be high on their priority list since we were going to address many of the environmental issues. We interviewed critical people in the production facilities and what the plans were for new methodologies and helped add people to address problem areas. That's one reason that Frank Hungate was recruited. So, we built an excellent research laboratory. I say I had this unusually good introduction because Karl took off the time to tell me everything he knew about what was going on, and he had probably a better comprehension of the whole production activity than most people.

HUNGATE: Karl was extremely well versed.

BUSTAD: He really was. But, he wasn't fully appreciated.

HUNGATE: I believe that's right. Was the animal farm still going at that time—the one across the river? Excuse me, I said the animal farm [I meant] the farm, the crop farm.

BUSTAD: At that time, right across from where we were located in the 100 F was a farm producing hay and also fruit of various kinds, as I recall. You and your associates, Jack Cline, and also Archie Selders, were very much involved. We have pictures and slides of them out there farming. My involvement over on that side of the river—across from us—was with the wildlife people to look at what kind of wildlife was there, including some cormorants. The people at the fisheries and aquatic biology were interested in collecting samples and it was hard to obtain fish and other organisms. It was very tedious, so the biologists decided to get some young cormorants and train them to catch fish as they do in Japan. That experiment didn't work out. But, we did examine to see if they would catch fish. We had them at Dr. Dick Foster's facilities, in Aquatic Biology. They had some ponds there. They tried to see if they would catch any fish—they didn't seem to. But, they went out on an evening requisition and got a few small trout and released them in the cormorant pen and it didn't take them long to exhaust the

supply. So, we knew that they could catch fish. Some staff members felt that it wasn't a good use of cormorants to catch the fish and not get to eat them.

HUNGATE: I hadn't heard of that before.

BUSTAD: It really happened. Wayne Hanson was involved in it. They also set up a system for orientation into the whole radiation field. By the time I came to Hanford, I'd read much of the material available on radiation effects and the nature of radiation. Herde went over all that with me, how he had approached it. Then, the first International Radiation Congress was held in Oberlin, Ohio, in 1950. It was an outstanding meeting because they brought in just about everybody that had anything to do with radiation effects up to that point. It was an outstanding experience for me.

HUNGATE: Were you at that meeting?

BUSTAD: Yes

HUNGATE: So was I.

BUSTAD: Were you really?

HUNGATE: Yes, my brother was teaching at Oberlin and I went to the meeting while I was at Reed College before I joined Hanford. That's interesting. Yes, that brought together an outstanding group.

BUSTAD: It is important to meet the leaders. That proved very valuable to me. Kornberg contacted Shields Warren (a world authority on radiation pathology) and said we got a guy here that has been interested in radiation effects and wondered if he could spend some time in your lab. So, in the fall of 1950 I worked in his laboratory in the Deaconess Hospital—a Harvard teaching hospital.

I graduated in June 1949 and went straight [to Hanford]. It was another hot day in June when I got here. I wasn't too sure it was the right choice.

In 1953, I went to the International Congress of Veterinary Medicine in Sweden. I took my wife along, saved up money for the trip so I could visit Norwegian relatives. It was an unusually good experience because I was able to visit a lot of radiation groups not only in Norway, where I gave a speech—part of it in Norwegian, in fact. I'll never do that again. It was their National Meeting after the International Meeting in Sweden and they were going to have a program and a big banquet. It was in a very nice resort. They invited me to speak to them. I gave the first half of the speech in Norwegian, and then finished off the last part in English. Of course, after my talk, they all told me what a good job I did. But, by about eleven o'clock, when they had drunk quite a bit of aquavit they told me all the things I mispronounced. I was at a disadvantage because as they stated in the leading newspaper in Oslo that this guy from the U.S. had never been to Norway but his folks immigrated from Norway, and gave this dissertation in a

fresh Gudbrandsdalen dialect which in this country was like saying he gave a scientific paper in a fresh Ozark twang! It was an interesting experience too, for I was introduced to the research there.

I also stopped in Holland and in England; places where great work was being done. I tried out plans for our experiments, and got a lot of the estimates of what kind of levels we should use. So, that too was very helpful to me. I also went to the National Institutes of Health and the Naval research group. They were very much involved during the war. They also were a help to me. I went to Yale and one of the students at Yale was involved in the Atomic Bomb Casualty Commission early and was one of the first people on site in Japan. I had read their various reports so it was fun meeting them. After about four years, I knew most everybody involved in radiological work at the major health centers of the world.

HUNGATE: Oh, it certainly would. Let's see, you joined shortly after the so-called Green Run. Do you have any recollection of any aftermath of that relevant to your work? That was I think in 1949.

BUSTAD: The only thing the Green Run did, it raised background radiation temporarily in our control animals. We had some of them at the Prosser experiment station. There was a slight rise in the background radiation in the hay that was there (on the top of the hay). And, in counting the sheep, even though we always did this to see that the controls got counted the same way when we measured it; it was up slightly, but lower than in our lowest I-131 levels. The other interesting thing about it, they fired what they called the atomic gun down on the test site in Nevada. It was a cannon, an artillery piece.

HUNGATE: I don't recall that.

BUSTAD: Well they tried it out. Some of the fallout of radioactivity fell on the Tri-Cities area. Two kinds of interesting incidents occurred. The local newspaper interviewed some people that found some dead sparrows in the Pasco area. We were called in on that too. I called a friend in the extension and asked him if they had put out any poison recently and he reported some strychnine had been placed in the area. The dead birds (house sparrows) brought to us had strychnine in their bodies. That, we concluded, was what killed the birds, it wasn't the radioactive fallout.

HUNGATE: One of my earlier remembrances was within a year or so after I joined we had that rain out of one of the tests where we walked into the labs and somebody discovered their shoes were hot.

BUSTAD: That's the same thing.

HUNGATE: That's the same one?

BUSTAD: Yes, I believe so.

HUNGATE: We had to protect the lab against radiation, not the reverse.

BUSTAD: Another part of it was they were on the radio scaring everybody. One guy called home and asked them how things were and they said fine. And they asked, what shall we do? He said, oh, build yourself a tent in your living room. He got home and they had a tent in their living room. So that was that.

We now shift to addressing our main sheep study with radioiodine. Sheep were picked out as the appropriate animal for the study because they were grazers, in fact, they were the chief grazing animal in the environs. There were some large feed lots, so that was an important consideration. So we went out and the first thing I did was to hire somebody who knew more about sheep than I did, and that was pretty easy. I like sheep and goats. I once had a pet goat. But, it turned out that the fellow I picked was a Scotsman, named Malcom Kerr, who had been with sheep all his life. He was highly recommended by all kinds of people. He worked for Coffin Sheep Company, which was the biggest Suffolk [sheep] breeder in the area. We hired him and went through Coffin's whole flock and Malcom picked out the best ones; tried to get uniformity. So, they hauled those in and got them used to their new quarters. All of the design features didn't work very well because these were yearling ewes we were going to breed and study their offspring too. What they [the architects] had done to control any contamination, on the cement, they put in solid rubber matting in all of runs for the sheep, which worked all right to an extent. But, it was very compromising to the bucks when they brought the rams in to breed the sheep; unless they had the recklessness of a second lieutenant, the old ones weren't about to mount a ewe and slip and fall off, which was happening. So we had to get some "young tigers" that were really courageous or fool-hardy. We also put sawdust down on the floor to improve their footing so we could have every ewe pregnant.

Before we got the sheep, of course, we couldn't go out and buy a thyroid counter for sheep. They weren't on the market. We had outstanding cooperation with Hoyt Whipple and his group and the other people in Health Instruments. We developed thyroid counters (various kinds). So we thereby determined how much was in the thyroid. The thyroid concentrates iodine in a remarkable way. It was fun to develop the system, get the people trained, to have them uniformly trained to handle the sheep, so they'd be handling them with care. To be sure of this, I would periodically visit the various shifts, because we had continual coverage at night and day. We always had somebody on shift and they would rotate through swing, days, and graveyard shifts. Now and then, I'd show up. I think, now and then they'd like to call me when they thought they had a problem at three in the morning. So, I'd drive out 40 miles and duck the deer that were crossing the area highways in the middle of the night.

HUNGATE: Was your work on sheep primarily dictated as a study of mechanism or was it primarily dictated by the fact that there were so many sheep grazing in the area?

BUSTAD: Well, the latter was very important, but also they were more economical to purchase and maintain than larger grazing animals. We wanted a good grazing animal, which was representative of the area. But we were also looking at how

much radioiodine does it take to damage the thyroid, and what happens after it's damaged. We had various groups of animals and specified levels of radioiodine fed daily. We developed some pellets that were attractive to them. And, in fact, some people were amazed, I think, that Herde and I were checking out what kind of pellets we should use for the sheep. We had various kinds. We were chewing and biting into them to see how they tasted, and to see what their qualities were. If someone came into our office, I'm sure they'd wonder what was going on. We developed new methods and quality control. We also trained the sheep to come into stanchions, each take their pellet, and leave. We had little trouble, even at high levels of radioiodine. The sheep seemed to like the routine. We, of course, monitored them frequently.

HUNGATE: So, really, it had the combination of pragmatism relevant to the large numbers that were there, and also the modeling for damage to any animal. That's great.

BUSTAD: We obtained a lot of data and the studies were carefully done, very conscientiously, I think. I mentioned that they all treat the animals well. One of the pre-war (World War II) residents of the Hanford and White Bluffs area was Matt Fecketa. He had worked with pigs and other animals and he had a real compassionate care and concern for them. I found out that he asked if it was all right to have a little garden in our area. He was on shift work. At harvest time for the vegetable garden, cantaloupes and some vegetables showed up in one of my control pens. I became suspicious, because I had worked with the shift people that were on days. In one case when Matt Fecketa was with us on day shift, the sheep came running to the door. They wanted to get into the cage where we examined them. So, I had to have a talk with Matt about that. We had to maintain control. No damage yet. But, we got to treat them all the same—of course, he would have liked to give vegetables to all of the animals. In another case, the animals were very suspicious and would hesitate to come into the run when this particular person was working. Something was going on during the night (he was probably rough with them). We couldn't have that, so we had to have another talk and we straightened out the animals' handling and feeding. This was very important and we really took seriously our responsibilities for these animals. There was a big investment in them and they had to be treated well and we had to examine them frequently. What helped our program greatly was visiting scientists working with us. We had a long-time program for two veterinarians from the Air Force, who were selected for this program for 1 to 3 years. They were a big help to us, and they conducted studies on the radioiodine as to various routes of ingestion, or injection, and blockage with stable iodine. Many studies were done by these officers. I'm still in contact with many of them after all these years.

HUNGATE: Yes, they brought in a lot of good ideas.

BUSTAD: There was a great interest in wildlife. When the geese were flightless, the wildlife specialists caught them and put bands on their legs, so they could determine their migration pattern. That was quite an effort. They also ran into a deer problem. Some of these people were more interested in making pets out of deer or wild animals than in attending to their own business.

****Start of Side 2****

HUNGATE: Maybe I'll keep my eye better on that red button. Well, we ran out of tape there, but let's resume. We wanted to identify some of the other studies that were done at the animal farm, like with the alligators and...

BUSTAD: We didn't have much to do with that...

HUNGATE: miniature swine...

BUSTAD: Yeah, developing... that was a real plus in establishing dose effect relationship with radioiodine. Then as we referred to some of those studies that appeared in our annual reports, in our own words there, and the other thing is we talked about... well, you remember more of the stories of the deer than I do...

HUNGATE: Yeah, well, with the deer I was always so amused because I don't remember whether I saw or heard about the patrol picking up the deer and hauling him up into the Blue Mountains in the back seat of their four-door sedan.

BUSTAD: I think they did take some of them up into the Blues.

HUNGATE: And, as you say, if they just took them out to an island or something, why that's fatuous. They're great swimmers.

BUSTAD: I can't recall what I was going to tell you. It was an interesting thing. Having to do with the guards. They decided to get rid of a partly tamed deer. They took the deer in a boat to an island in the Columbia River but the deer beat them back to their security station.

HUNGATE: Well, the guards I had mentioned that, like your reference to the deer, and causing trouble when they became over-tame, then we were called in when the raccoons were being fed, then suddenly all hell broke loose because the raccoons tried to climb up poles and shorted out one of the reactors. So they had a scrambled reactor, and that changed the hue and cry about animals.

BUSTAD: I recall the stories about the deer on the premises that seemed to like people better than deer. And, what they did, they took this recalcitrant deer that loved people and found the main pack, the main group of deer and they introduced him to them. He was with them for a while, but he knew he wasn't a deer in a way, but they were grazing and there was a crew working on the railroad tracks. And this group of deer was running along the track and this one saw people, so he took off; goodbye you guys, I'm going back. So he came running down to where they were fixing the track. So that was one of the early failures. I think we mentioned the Air Force Officers and all before that deer.

HUNGATE: No, that would have been after. Yes, you referred to the help the Air Force personnel had given in developing your program. Let's see, who were those? Do you remember their names?

BUSTAD: I'd have to look them up. Charlie Barnes, of course, Joe West, Persing, Dale Smith, and a couple I can't come up with, but in our annual reports...

HUNGATE: Was Ron Walters in one of those?

BUSTAD: I don't think so. He might of been in the...

HUNGATE: He came in some capacity.

BUSTAD: ...he was working here for awhile, I think. It was part of his training at a program at the University of Washington.

HUNGATE: Don't remember. I just remember his being there and of course, he's now there as the head. I've had very few dealings with him since I retired.

One of my memorable recollections of you was as you'd be traveling by car between Hanford and Richland, whichever way, you often had an orange which you peeled with the skin totally intact. That was basically a trademark of yours.

BUSTAD: And then I'd put the peeling in various places; in his car, briefcase, office, desk and it about drove Kornberg crazy. It was the bane of his existence.

HUNGATE: What started you on that? That game?

BUSTAD: Oh, I don't know. I didn't like to drive and I needed some refreshment about that time of the day.

HUNGATE: Well, anybody who drove with Kornberg needed something to take their mind off his driving.

BUSTAD: Wild... Wildman driver, but the remarkable thing about it, I don't think he ever had an accident.

HUNGATE: All these strange things. Do you remember the time, there was some kind of party going to be had later and he had a short time schedule. Anyhow, he got to the guard gate and opened the trunk, then suddenly realized he had two cases of beer that he had gotten for a party that night. And of course that was totally contraband. I guess in that case, they recognized his good behavior and let him off and simply confiscated it and gave it to him when he left.

BUSTAD: Real character on the premises.

HUNGATE: You were very heavily involved in community activities. Were you aware of criticism? Personally I don't remember very much. Was there much criticism of Hanford's activities during that period? The fifties, sixties?

BUSTAD: Not much.

HUNGATE: There was very little, as I recall.

BUSTAD: And I gave talks to all kinds of groups and they were enthusiastic about what was happening in the atomic age.

HUNGATE: That's right.

BUSTAD: And all the potentials. Just in biology alone, the quantum jump with isotope development and all the techniques and the technical support that they developed as a result of this modern biology is now leading the world in developing therapy methodology for our most difficult and challenging health problems.

HUNGATE: That's right. Well, I've mentioned this before, but I think in my own mind one of the characteristics of that time was when the city put in this water treatment plant downriver, taking water downriver of seven or eight or whatever reactors there were that were putting radioactivity into the river upstream. And yes, there was discussion and very careful consideration of the impact. But, it was accepted communitywide, without more than each person evaluating and I really don't recall there was every any serious public disclaimer of that. Do you?

BUSTAD: Not during my time.

HUNGATE: It was an example of people in mass consciously taking on radioactivity.

BUSTAD: And studying it to see that it was done safely.

HUNGATE: That's right.

BUSTAD: And, I don't know, it was very well received. [If] we heard any reports, like on thyroids or something, we'd check up on it. The people, of course, were very well aware that this was a hazardous occupation, like we had some high-level stuff you had only a short length of time exposure to them. And they were very careful about this, as far as exceeding any levels of exposure. Then we had M. R. Woods who followed our work carefully so we were not exposed to above limits of radiation.

HUNGATE: Who's M. R.? I don't remember.

BUSTAD: M. R. Woods (we called him micro roentgen). He was with the Health Physics group people; checkout team on our operations... can't remember his name either.

HUNGATE: You had, in operating the animal farm, some problems of disposition of wastes and disposition of animals and so forth. How did you manage—I think I remember physically—but how did you develop protocols for taking care of those kinds of problems?

BUSTAD: Well, like on... radioiodine, it's a matter of holding for awhile under cold storage. But for the iodine, just go through seven half-lives or something.

HUNGATE: Ten half-lives or...

BUSTAD: Ten... so, iodine wasn't a serious problem.

HUNGATE: But, strontium-90 became a...

BUSTAD: Yeah, and that was, I think, that had to go in the special procedures, but the Health Physics people were firm on that.

HUNGATE: So, you worked with the Health Physics people to develop protocols, which would protect the environs and the workers and so forth.

BUSTAD: Yes, but I can't recall the names. There's a guy that worked his way up to a responsible position. He was working in biology from the Health Physics, and I wish I could remember his name. He's in higher supervision now. So we had good support from those people.

HUNGATE: Now, what did you do with the feces and so forth from the swine on strontium-90? Was that buried or was it put into...? I know for the animals, you used to have some kind of a metal container you—submarine, I think it was called...

BUSTAD: Yeah, submarine was the name for our whole body counter, wasn't it.

HUNGATE: No, well, I don't know. I guess I had heard that there was a big tank that they were dropped into.

BUSTAD: Hmmm...

HUNGATE: This may be incorrect, but that's what I had heard.

BUSTAD: The guy that would know is Horstman or whoever he suggests, because he was there.

HUNGATE: He was involved in that.

BUSTAD: Yes. He and Manny Karagianis. Does that ring a bell?

HUNGATE: Well, I don't think...

BUSTAD: No, no.

HUNGATE: I don't think Manny was...

BUSTAD: No, no. It's another guy that's just retiring now, in charge of Toxicology or other responsibility in Toxicology, such as Nathan Nidadar, I think.

HUNGATE: Can't bring it up?

BUSTAD: I've been here 22 years and not involved. It's surprising, in the last year or two, I've really lost a lot as far as recall goes.

HUNGATE: I'm afraid all of us suffer from that similar problem.

BUSTAD: One thing... mentioned is the strong interaction of helping one another in Biology. And we had picnics and we had canasta parties in various homes. There was a real spirit of cooperation. It was very valuable.

HUNGATE: I think that was very strong, throughout all of that early period which I call the GE [General Electric] period. It was in Biology and, really, across the plant because you could go to anybody and ask them for help, and if their time permitted, "yes" with no hesitation.

BUSTAD: ...But guys like Bill Roesch and really strong people gave us help.

HUNGATE: I think probably, as I look back on it, it was a direct result of having one large contract covering the whole thing so that people didn't have to worry about covering their expenses, their time. Because it was a blanket contract covering the whole thing. And that made for a very positive goal kind of attitude.

BUSTAD: And it cut the time to accomplish assignments and goals.

HUNGATE: Yes, solution of problems was the objective.

Now, you mentioned [name of local farmer] and [name of local farmer]. I always enjoyed [one of the farmers] because he chatted with me and, as you said, he was one of the early farmers in the Hanford area. And, he was a person who had a farm, former military person, who had gotten land there and homesteaded it and, as I recall, he said the first year that he had a crop and a good price, was the year after the land was confiscated by the government. He raised apricots.

BUSTAD: He also had pigs, he told me about that.

HUNGATE: Oh, did he?

BUSTAD: One time I think he had 20 little piglets from one sow. And of course, the sow couldn't handle it, so he divided them in half and then he'd take them to the sow and when they finished nursing, he'd give them some rest, then he'd take the other 10 in to the sow. He fed her well so he could really see how many he could raise. He was really keen about how many he could help survive to weaning.

HUNGATE: Man, that would be a strain.

BUSTAD: The interesting thing about it, I kept trying to make contact with [one of the local farmers]. I was gone, but I wanted to see him and help him since he was suffering from stomach cancer. When I returned to Richland he was still alive so I got to see him. I was saddened by his intense suffering. I considered it an honor and privilege to know and work with him. As a good will gesture to me, he gave a thousand dollars to the Richland Lutheran Church for the pipe organ fund.

BUSTAD: Yeah.

HUNGATE: It was a shame, he just retired and then... didn't enjoy it. When did Glenn Horstman join? I don't remember...

BUSTAD: 1955 as I recall.

HUNGATE: I knew it was after I came, but I didn't remember the circumstances.

BUSTAD: If you want to set up a big conference and get the cheapest Coca-Cola or have it for nothing...

HUNGATE: Get Glenn.

BUSTAD: Better get Glenn. Some other people said we'll leave Glenn out of it this time. And, when they got near the time of the conference and things weren't going very well, they had to call him in. And, he was an entrepreneur of the first order. Hard worker.

HUNGATE: Well, have we missed any topic areas that you'd like to comment on, Leo?

BUSTAD: I might think of them when you... I'll try to recall... But if you have time to page through the annual reports, it will give you a lot of stuff, I think. And then, the biology radioiodine and that conference we had on iodine; those, and the conference on pigs. Turned out in books, you know.

HUNGATE: Right.

BUSTAD: Still getting requests for it.

HUNGATE: Well, it certainly is interesting, the...

BUSTAD: It would be good to get all the Air Force officers names.

HUNGATE: I was glad that you mentioned Ensminger. Because Ensminger from here was a very important person, Lauren Donaldson from the University of Washington was a very important person in guiding activities, and Arthur Scott from Reed College who was a big factor in my coming, was a very fine person.

BUSTAD: He's dead now.

HUNGATE: Yes, yes. And then, in Atmospheric Sciences there was Phil Church from the University of Washington, who set up the water collecting system for the Cascades and was very important in establishing Meteorology work at Hanford. Hopefully I'll get that from Chuck Simpson.

BUSTAD: Yeah, Yeah. He'll give that to you.

HUNGATE: Well, do feel free to make any additions and comments and elaborate if we fail to get transcribed here this perception that you and I have that there was such a vast difference in attitudes toward things in the early days, as compared to now. And I think that's predicated not just on different backgrounds but there was a very strong need-to-know attitude then, and there's a very strong preservation of position now that changes things very drastically.

BUSTAD: Yeah.

HUNGATE: Well, thank you very much, Leo. And I'm just sorry that our recorder lost the middle of the conversation.

BUSTAD: There were many others who should also be recorded but some aren't still around. Dick Foster would be an excellent resource.

HUNGATE: Roy Thompson was one I would've liked to interview, but, of course, he died this past year. Dick was not on my list to talk to--possibly because he worked with fish.

BUSTAD: I heard Roy wrote sort of an autobiography of some sort.

HUNGATE: Oh did he? I'm not aware of that.