

ICRP Oral History Project: An Excerpt of an Interview with Bo Lindell

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H: This is the beginning of today's interview session, which is the second session of our interview. I'm Toshirhiro Higuchi, and I'm with Dr. Bo Lindell. Today is May 26th, 2012. The time is around 2:30 pm. We are at Dr. Lindell's house again. Thank you very much for joining us.

H: During our yesterday's talk, we talked about your experience as a scientific secretary at ICRP during the time from 1957 to 1962. Around that time, same time, you were one of the scientific secretaries for UNSCEAR. In 1960, you published an article, which is about radioactive fallout, but in this article, you basically pointed to the new concept of radiation protection, which is the dose commitment. Could you describe why you wrote this article, what motivated you?

L: Well, UNSCEAR had to collect data through which you could calculate radiation protection quantities. I wanted to go through the whole concept of dose commitment to see what were the significant quantities that we needed to assess in order to estimate human risks. This paper that I had in '56 was really a calculation of something that was not really possible to calculate, but I wanted to show that if you try to calculate radiation risks, then these are the quantities that you have to assess. But of course it ended up always automatically with a dose commitment. I wanted to find out what we needed to calculate, and assess.

H: So did you come up with this idea? Or someone also helped you develop this idea?

L: Well, what was helpful at that time was my close contact with Dr. Beninson. We had a lot of discussions that influenced both of us.

H: How were the reactions of other ICRP members and UNSCEAR members to your article and the concept of dose commitment?

L: Some were proud [thrilled?], understanding what we had in mind and then you had other people, one of my best friends in addition to Beninson, was John Dunster. But we were not in agreement, but we could discuss things. Dunster was an also extremely honest person. He didn't like to push his own views and he had to be convinced that they were the best views. He was really one of the ... He was honest by heart. Dan Beninson was honest by mind

H: I see difference.

L: So Dunster and Beninson were really the ones who helped me to have my views accepted by the Commission. Then there were some other people who accepted my view because they agreed with the logic, Dr. Tajima for example, also one of the very few people who understood it entirely. Then this was enough support to have the rest of the Commission accepting it.

H: What were main objections to this concept as you remember now?

L: I think the main objection really came from John Dunster. As I said, he was an extremely honest person, so he, like Beninson, could accept other people's views as a logical consequence of their assumptions. Other people could not accept the views if the views differed from their own indoctrination. And then the difficult thing was to convince people that they might have been wrong. And that's not an easy thing to do. It needs honest people and also clever people to adjust their mind. It's not so common that you change your own mind.

H: Sure. And because of your idea of dose commitment, now we know that some long-lived isotopes like carbon-14 should be carefully watched out for. Because back then in the 1950s, the ultimate health hazards from this isotope for example C-14, was not entirely well noticed.

L: Yes. So definitely your concept of dose commitment changed the way how we pay attention to certain radioisotopes, long-term radioisotopes in the environment.

L: Yes, but there comes the ethical point of view because you can say, "I don't care about future generations." That's nothing to say that it is wrong to say that. It's a different view. There are some papers in ethics. This, for example [showing]. I think in ... also very helpful.

L: "Ethical analysis..."

H: It's published in 1986

L: That's the one who told us what we were doing. I said we didn't really realize what we were doing. But what we were doing was right [laughter]. That is ... a very difficult lady ...

L: Oh it was the very last one, "Risk and Ethics."

H: This is, "Risk and Ethics," written by Professor Kristin Shrader-Frechette [philosopher of science, Univ. of Notre Dame, Indiana, USA]. This is published in the proceedings of some ... "International Conference on Radiation and Society" hosted by IAEA in 1994.

L: Yes, she has published quite a lot of papers, but she was the one who really pointed out, all we dealt with ethics, which we really hadn't realized ourselves. I mean, we [have] no expertise in ethics. But she said that we were right, and this is what you have done, what you don't realize it. There are two major ethical concepts: one is [finding words]

H: So her paper was a revelation for you and other ICRP members. She basically articulated ethical things that you practiced but not realized.

L: Yes, that was earlier ... this paper is not ... her first ...

H: Do you remember when you encountered her argument? You mentioned earlier than 1994.

L: Yes, earlier than that ...

H: Risk and Rationality (1991) ...

L: It was before ...

H: So you came be concerned with moral perspectives before the 1990 recommendations came out.

L: Yes

H: and there are some lines that imply their concerns

L: Yes

H: No problem. But do you remember that you became more aware of moral implications as time went on toward the 1990 recommendations?

L: Yes, she was the lady who brought our attention to the ethical problems, told us what we were actually doing. We didn't realize that we worked in such a way that we, one side, we had ...

H: There are two moral positions, then on the one hand you practice one moral position and on the other side you have to strike a balance between them.

L: No ...

H: It might be a little difficult to find spontaneously so we can definitely come back to this later I think. I'm gonna definitely send you a follow-up so that we can properly cite the exact words for the moral positions. So when you conceived the concept of dose commitment, basically you, without knowing it, tried to incorporate the future into risk analysis.

L: There are two competing things. One is to keep the individual risk low, and the other is to keep the collective risk low. ICRP has been unusual by introducing both of these things. Because the normal thing would have been to work only individual risks or work only on [H: social and demographic risks alone regardless of individual] ... the collective.

H: So more concerned with optimization alone, not necessarily the distribution of risks to the individual.

L: Yeah.

H: So, Definitely as you pointed out, ICRP is unique, paying attention to both moral positions and risk perspectives.

L: Yes.

H: And one of the key concepts to discuss the collective part of the risk analysis is the collective dose.

L: One, of course, is considering ...

H: We can definitely come back here again.

L: Yes but it is an extremely important point. It is the key area ...

H: So individual vs. collective, and morally speaking, individual means deontological, more like a duty, and collective in terms of optimization, utilitarian perspective.

L: Collective ... the important thing about the collective is not ... the collective that you look for. The collective is only a tool. The important thing is that you look at it from a point of view of society, not from the individual. The other is you look at it from a point of view of individual. He mustn't run too high a risk. And combining these two concepts was unusual. And that is what ICRP did.

H: Exactly. So first ICRP came up with the collective dose to compute and quantify the collective risk. Do you remember when ICRP started speaking of the collective dose? Do you remember?

L: I think it is misleading to talk too much about the collective dose. What is important is ... just see things from the point of view of

H: society?

L: Not society ... the practices. So look at it from the point of view of the practice. And then you have to find out what was the consequence of what you do. And find out whether this is acceptable or not, from other points of view, benefits and risks. But when you do this, you could end up in the situation where you accept something which is good for society but it happens to be very bad for some individuals. And you have to look at that problem as well. So one problem is the collective, the other problem is the individual. I am not very good at mentioning this...

H: Also regarding risk analysis you also introduced the method of PQR, probabilistic-quantitative-risk assessment in your article in 1970. What motivated you to write this article, and why you became interested in this PQR approach to radiation protection?

L: I don't think I can answer that ... I'm blank at present [laughter].

H: No problem. Any recollection about ... how did people react to your proposal to use PQR as a risk analysis perspective to radiation? How other people reacted to your suggestion?

L: I don't recognize the problem at present ...

H: So basically other ICRP members and other people basically accepted it as a sound approach, like everybody basically thought that it was a very useful approach to radiation protection.

L: I don't ...

H: If you don't remember, it's fine.

L: I don't see the point.

H: Seems like you wrote the article to advocate the introduction and uses of PQR to assess radiation risk. Like Sir Edward Pochin

L: Yes,

H: he also advocated the PQR approach, quantifying both hazards and benefits. That's his main argument. I'm interested in this movement, quantifying both sides, biological effects and also benefits, to optimize outcome of radiation protection in the 1970s, and you were one of the pioneers in this new movement. So just I'm curious if you remember anything about the time when you advocated this approach.

L: When was it?

H: 1970. When you were a main commission member, not yet chairman

[Pause]

H: If you don't particularly remember this episode, it's of course fine. But it makes me wonder about your relationship with Sir Pochin. Do you remember him?

L: Oh yes. Yes.

H: Could you describe him for me?

L: That's not so easy. You know, he had a very hot temper. His skin could change color from normal up to red or violet or so forth.

H: So you can immediately tell that he was irritated or angered.

L: Yes. It could explode really at the end. But he had no warning signs. But it was a very complicated thing for Pochin. I mean, Pochin was very well-educated, so his parents had told him that one must accept other people's view, and it can be very difficult to him because he was somebody who had a very silly opinion but who am I to say that it is silly? It's wouldn't be polite to say that ... on the other hand it is silly. He came into conflict with himself. This fellow I have to accept as a nice and competent well, but at the same time he is a damn fool. I shouldn't say that, but he is a fool [laughter]. He made it very difficult for him[self].

H: Do you remember any episode about him making a problem, difficulty for you and other ICRP members?

L: Yes, not for me ... For some reason he seemed to accept what I said. Not for Dan Beninson. Not ... for most other people he would come into situations where he was dissatisfied with himself because he felt that that fellow was wrong, and that was not polite for him to feel that somebody is wrong.

H: So he had a struggle inside him.

L: Yes, a struggle inside. Beninson and I were very lucky to get away with what he said, not causing problems with Pochin.

H: I see, but his basic concept of quantifying both benefits and hazards ... how his idea was seen by other ICRP members and UNSCEAR members maybe?

L: No ... I don't think there was any great problem with that. Really ...

H: So it was a very common sense.

L: Yes. That was not a difficult part.

H: So a difficult part is something else

L: Yes.

H: Do you remember any particular problem, concept?

[Pause]

L: Well, it would be even people ... all estimated very importance [?] and my competence ... but mostly this was not a big problem in the Commission really, because most people were quite reasonable.

H: So he, Sir Pochin, made a little irritation sometimes now and then but mostly the main commission went smooth.

[L: Pardon?]

H: Mostly the Main Commission came to consensus without much problem.

L: Yes, Yes. Mainly because the people who were influential on the Commission were also reasonable and didn't cause Pochin to explode. If they had been unreasonable, then it would have been a problem ...

H: Do you remember what kind of issues were ... was Sir Pochin very sensitive and delicate about to explode? Like, what kind of issue? Or just time to time according to his personal mood? Or was there anything that he held dear to himself, like any issue or subject, or more like time to time depends on his mood.

L: I don't think there was any conflict with his view.

H: So more like a personality issue.

L: Yeah, and he could accept that people had a different view. And he could feel that this was very stupid. But what leads to a problem most is that feeling was not so polite, and he wanted to be polite. So he was mainly angry at himself. No ... the problem was what comesto him and to Beninson and to some other people that somebody ... overestimated their importance then that could annoy people. Beninson was not annoyed easily. Rather, feeling that this was interesting, an interesting psychological phenomenon and an

example of peculiar behavior of people who were not clever enough. So that was not a problem [for him]. Pochin it was a problem. He could annoy him[self] quite a lot. See if somebody was talking about himself in terms that didn't correspond to that person's quality.

H: You mentioned ... as we talked about Sir Pochin, you mentioned Dan Beninson. I understand both him and you were best friends

L: Yes.

H: Could you describe Dr. Beninson for me?

[Leafing through the book]

L: The one who has done it?

H: Oh you wrote some ...

L: Professor Ilyin's book about problems with handling the Chernobyl accident. He's criticizing the Soviet Union experts quite a lot. And even ...

[Pause]

L: Here is the guy, Beninson

H: Page 24 of the book published by Professor Ilyin, Chernobyl: Myth and Reality, published in 1995. Here is the description of Dr. Beninson. Do you have agree with this description? [L: Yes] So you recall him as Professor Ilyin describes here.

L: Yep.

H: You mentioned in the earlier interview that you became friends with him through UNSCEAR.

L: Yes. I met him before UNSCEAR. When he was at UNSCEAR, I was in Stockholm with Sievert. And Beninson made the trip around to UNSCEAR member states.

H: What was your first impression of him.

L: He was a very clever man. So we met in Stockholm. When I came to the UNCEAR office, Beninson was just leaving, so we were together at the Secretariat rather for a short time. But we worked very well together. He accepted me and I accepted him.

H: So both of you developed friendship very fast

L: Yes

H: Within a short period of time.

L: Yes, I did.

H: So what part of him you really like most?

L: Oh, that's very difficult [smile]

H: you can pick up any aspect of him

L: Many, many parts of him. Most parts. Yes.

H: Did you share any common interest, hobby, or pastime? Did both of you share the same interest in something, like writing or literature or any other thing other than radiation protection. Any personal interests?

L: And ICRP

H: ICRP. That's professional. So you didn't spend much time with him other than ICRP? Or you spent time with him in other occasions?

L: Well, we spent time in many things. People considered us out of our minds. We thought that this was rather ridiculous so each time we passed by the shop, we went to the biggest window, and then we paid our respects to [laughter] the big porcelain. People would have probably thought that we were completely nuts [laughter].

H: But both of you got the fun out of it.

L: Yes.

H: I can see that both of you were very humorous

L: Yea, big birds.

H: So Dr. Beninson must have been a very cheerful person.

L: Yes, he was. I miss him.

H: Yes you clearly remember a good time with him. Let me go back to the time when you became a chairman. How did you become chairman?

L: I was vice-chairman.

H: Under whom? Who was chairman when you were vice-chairman?

L: I think it was Gordon Stewart

H: So you were vice-chairman then. How did you become chairman? Was it more automatic from vice-chairman to the chairman?

L: It was fairly automatic, yes. As it has been in UNSCEAR, there have been exceptions, but it would have been remarkable and embarrassing if people who had been vice-chairman and expected to become chairman and when they didn't become chairman, and then ... I would have not been very happy.

H: In your case, you became chairman, and the Main Commission members supported your promotion to chairman.

L: Yes, since they had supported me becoming vice-chairman.

H: How did you feel when you were nominated for vice-chairman first?

L: I don't remember either.

H: No problem. So when did you become chairman? In 197 ...

[Leafing through book]

H: Oh so from 1977 to 1985

L: Yes

H: So in 1977 when you became chairman, the 1977 Recommendations were just published. So after that, around that time, the radon underground house problem.

L: Oh yes.

H: I think around the time when you were chairman, this problem became very prominent. Do you remember how this problem came to your attention?

L: Oh the problem came ... [laughter]

H: It was a big event right?

L: It was an enormous problem in Sweden. The problem more in Sweden than any other country. I was the head of the Swedish Radiation Protection Institute (SSI) ...

H: So you were the director when this problem came to attention.

L: Yes. And it took a long time. We knew about the problem of course from Sievert's days. Sievert had been very interested, and so forth.

H: Yes, natural radioactivity. I mean, background. He was interested in variations in background.

L: Yes, but of course it was the problem of how to deal with it, if we should use an effective dose, or the Gray for example. We wanted to intervene in some way because we had radioactive building materials. It was very radioactive. But we couldn't intervene because we didn't have the power to intervene. At that time Sievert's Institute worked according to a law which dealt with the protection of patients and the protection of people working at hospitals, but we had no way of intervening and stopping the use of radioactive building materials.

H: Like in a home

L: Yeah, at home, or school, or so forth. And then we wanted to intervene, [but] we couldn't intervene. And we waited for ICRP and WHO, IAEA and other international bodies to come up with some recommendation but they didn't ...

H: Why?

L: Well, they would come in a very hot position. Everyone would accuse them of having waited too long, and it would be a lot of problems. So then we [researched] on houses, living quarters. And we found one series of houses that were built actually on uranium waste. So they were very radioactive with radium. We felt that we couldn't ... we had to do something quickly. We couldn't act as an authority. You would have acted on the basis of information. We issued ... things like this.

H: This is a pamphlet made by SSI about possible radiation exposure at home.

L: In this, of course we said that we informed about the levels we have found in homes. And then we said that if there is a radon concentration of 1 picocurie per liter, we may expect ... No, we informed ... we formulated differently. We said that for each reduction of the mean radon concentration (with 1 picocurie per liter), you could perhaps count with an annual [... searching for the word]. No, if we, for each picocurie per liter we could count on an annual [benefit] of 20 missing cases of lung cancer per million of population. We sent that to all the ... committees for the welfare, buildings and general health [Ministry] and we sent it

to them, we also sent it to the Swedish TV, radio. We were informed by people from TV and radio that said, "What do you mean by sending us this? What are we supposed to do?" We said, "Inform people." I mean ... [laughter] "You always want to inform people." And they said, "Well we can't do that. They were very scared. And I said, "Yes I know. That's why I am sending it to you." So we had difficulty to get the information out.

H: It was because they had strong concern about a possible panic because of this information?

L: Yes. Yes. No governmental organization would like to be the one that scares people. And we felt that we had sent out this, and we have said that if you reduce the radon concentration by 1 picocurie per liter, you will [eliminate] 20 cases of lung cancer. So we had informed. But others should use that information ... That was very difficult and we had great problems in having other governmental offices who actually were the ones who decided on building material and so forth. I mean, we, at that time, had no power at all. Only to inform.

H: Right. The only thing you could do is to send information, but no other than that.

L: Yes. But there were others who [?] on building material and so forth. They could have stopped [this practice] right.

H: So what was your strategy to get the message across? Because you mentioned that it was very difficult to persuade the other government agencies to follow. So how did you approach this problem?

L: We found a number of houses which were extremely radioactive. They were built on uranium waste. They had very high radium concentrations. We had to inform the local building committees. We have local building committees where there are laypeople also included. We had to inform them. We felt that we couldn't inform people living in the houses before we had informed local committees because the local committees would have to deal with the problem. So we had to inform them first. But then we called the meeting [with] the local committee for the purpose of informing them. And that meeting came to the knowledge of the biggest newspaper in Sweden. And they went out with information in the newspaper, that's news. That caused an enormous upset. We received about a thousand telephone calls a day

H: At SSI

L: Yes. And people were weeping in the telephone. Some people said "I'm going to commit a suicide." It was an enormous problem. Of course we were criticized for having kept it secret. Which we hadn't ... in the first hand we had sent out this. It was not secret. But we also intended to go out and inform people once we had informed this committee. But we couldn't do it, without first informing the committee. So that caused the problem. And then of course the government said that we would set up a committee to investigate this to see what can be done. And they appointed an important law expert to chair this committee. And he called me to get information, and he said, "This is ridiculous." I mean [laughter], "You said that it could be dangerous at home, to live in a house? This is non-sense. You can't come and say that "it is dangerous to live in your house, your building." But after he had learned a little more about the problem, he changed his mind. Then we got laws on building material.

H: But always like when we see some risk, there is an argument that this risk is there, but relatively small compared to other risks, for example, this case, living in the house, which is fairly radioactive, but still was there any argument that it's still OK because it's still relatively not that high, for example, compared to smoking risk? Why did you, and your organization SSI, focus on attacking this risk at this moment, not letting it be?

L: Because it was the dominating risk. Smoking was not a risk by itself. Smoking was a risk because of radon. So smokers who got lung cancer ... There was nothing else we could point at. . That was more dangerous.

H: Definitely it was consensus right after the information became available that this is something really we need to take care of at SSR.

L: Oh yes, sure. The government introduced laws and gave us power to deal with the problem.

H: How did this experience influence ICRP's understanding of radon problem? Because ICRP also started attacking this problem, right?

L: Well, it was rather unfortunate that we had started with radioactive building material. That was known, that was a problem. That was known internationally because we talked about it at various meetings. Then people in other countries had a picture of Sweden with a very peculiar building material. And of course it's not a problem for us because we don't have that building material. And we said that if you wait and measure, you'll find that you guys have the same problem. Which of course became obvious after a while, but it took some time.

H: So it took time before ICRP as an organization really took this problem serious, as an international problem.

L: Yes. Yes. Should have taken action [earlier].

H: Do you remember when or roughly how this problem finally came to attention, to ICRP? Through you, or other people? Who really lobbied for this matter?

L: Well, it was of course known by ICRP but not as a problem but .. even Sievert mentioned this.

H: They didn't really think that this is a problem to be addressed by ICRP ...

L: No, it wasn't at that time. At Sievert's time, there was no risk indicator. There was no limit or action level.

H: It was more scientific information, just curiosity

L: Yes, Yes.

H: But ICRP started noticing this other problem, regulation problem

L: Yes

H: After Sweden became interested.

L: Yes, not after Sweden ... they did at the same time. Sweden was the easiest thing to study at that time. Some Canadian cases. But still it was a feeling behind it that this was a local problem, not a general problem.

H: Did you also feel that way? Or you thought that this is an international problem so that ICRP should take a lead. How did you think?

L: Well we knew it was a Scandinavian problem. We wouldn't know if it was

H: also other part of the world ...

L: because Professor Maynord had published radon, high radon levels in the United Kingdom. But it took some time ...

H: Do you remember who took the leadership in bringing radon problem to ICRP?

L: We had the radon problem in ICRP ...

H: Yeah, right. But what really pushed the problem through to the stage when ICRP started considering giving recommendations?

L: That was ... general development.

H: General development. So everybody realized at some point that we need to really address this issue.

L: Yes, Yes

H: So it's not specifically a Swedish initiative or anything but more like a general development that led everybody realize that ...

L: No.

H: Other development during the time when you were chairman was ... some of the first nuclear reactor accidents like ... of course there was an accident in 1957 at Windscale but now in 1979 at Three Mile Island incident. Do you remember the TMI incident?

L: Yes. I was in the Swedish committee to study it. I was at TMI.

H: How was it? So you visited the site?

L: Yes

H: Did you have any meeting with US health officials and radiation protection experts over this TMI?

L: Yes

H: Was the meeting useful for you? How was the meeting?

L: People who I met were people who worked in the authority ...

H: NRC? Nuclear Regulatory Commission?

L: Yes ... And the point that called our attention really was an extremely short time that people had worked at ... NRC. Because we met with them in Washington. So we met everyone there. And they had been working with NRC like a week or a month or ...

H: So everyone was new at the job

L: Yes

H: So you found the situation a little chaotic.

L: Yes, it was all we felt that very few people had worked] for a long time.

H: Did you find them well aware of radiological problems? Or were they more concerned about reactor safety itself?

L: No of course they had ... an organizational problem ... the top governed and then deputy director and deputy etc etc etc. [at NRC] Yes. That was a problem within the organization. I was together with Dr. Beninson and two other people ... I was in the first ... probably getting old here

H: You were at the first meeting with ...

L: IAEA started with a set of committees which were sent around the world to look at the use of radiation. And that was called ...

[Taking the book and looking for the name of the committee]

L: LAPAT.

H: It was created to study the problem of radiation there.

L: Yes.

H: So you were one of the members.

L: It was set up, one committee at a time, ... one task ... and then a new task and a new task and a different committee. So I and Dr. Beninson participated in the first LAPAT that IAEA set up. At this time, it was also ECA, because they were the ones who were responsible at the IAEA to set up this committee. So he set up the committee and called Beninson and me, and one more person ... I don't remember really ... And this very first one was sent to China, and we went around China, looked at how they dealt with radiation protection.

H: How was it?

L: It was ... there were no contacts at the lower levels. You have contact; you have to go up and down. It was not very effective. Then they were extremely proud of treating radiation harm ... somebody had worked ... exposed, and got radiation burn and so forth. And they set up a group of experts to treat that person and they were extremely good at treating. They showed us a nice picture on how the person had looked with radiation injury and how well he had been treated. And we said that "Don't you think it could have been more effective if you hadn't caused that injury?"

H: How did they respond?

L: I don't know. I mean, this is all in our report to the government.

H: And obviously the Chinese effort to cure some of the acute radiation injury wouldn't really prevent long-term, of course, hazards.

L: It didn't.

H: So the Chinese effort focused on curing immediate radiation burns for example, this measure, treatment, doesn't really address the long-term, cancer risk problem, of course.

L: No, no.

H: So they were not quite aware of this potential problem?

L: Oh yes, yes.

H: They were not?

L: They were quite very aware

H: Quite well known [to them]. But then they didn't really give priority to this potential long-term risk.

L: You have a different goal. A different authority. That's [?] problem because they didn't cooperate at the working level.

H: So those who used radiation tended to focus on this aspect, while radiation protection experts didn't really communicate ...

L: No, no, no. They didn't know about the other.

H: That was definitely a problem that you detected.

L: Yes, we reported on that ... I think our report was very well received.

[Interruption]

L: Development. Who was an Italian lady, [NAME Failla], who came to read the report, saying that ICRP was developing the optimization of protection based on quantitative assumptions on how much to pay to save a life. And she interpreted that as putting a numerical value on life. So that shocked her a lot. And she went to the Chancellor of the Pope's Scientific Academy and complained.

H: Do you think that she read the 1977 Recommendations?

L: Pardon?

H: What kind of report do you think she read? I think the 1977 Recommendations? Because this Symposium happened before the 1990 Recommendations, right?

L: Yes, right.

H: So I guess she must have read the 1977 Recommendations or something like that.

L: I don't remember what it was.

H: So she complained and ...

L: She contacted the Vatican's representative at the meeting on this matter and complained. She said, "ICRP is putting value on human life." That went up, high up I think in the Vatican, so the Pope created a scientific group to look into this problem. He had people on the group.

H: This is a report and this is a member [roster]. So I notice ... many ICRP members including yourself, but also Dr. Sowby;

L: Dr. Beninson

H: And other people too ... So how did you feel when this problem or this concern came to you ... So Professor Failla had concern about ICRP's approach, and then it came attention to you and ICRP, and you were invited by the Pope to discuss this problem. How did the discussion go between you and other people, including Dr. Failla?

L: The problem was solved quite easily by the Vatican itself because they sent an expert ... I should find the names ... They sent in an expert from the Vatican, and an expert on ethics, who said that this was not a problem. This was a misunderstanding.

H: This expert attended the meeting, and he or she explained the moral aspect of it, and this expert said that ICRP's approach was not a problem.

L: Yes, the group discussed it and came to the conclusion that when you do as ICRP recommends, and then you reduce the risk, and that can never be a problem. And an ethical problem ... But it is interesting to see that laypeople, in this case, the Vatican group, can misunderstand things like the optimization of protection.

H: So the concept of optimization is subject to a possible misunderstanding

L: Yes.

H: This principle of optimization was first explicitly stated in the 1977 Recommendations, right?

L: I don't remember.

H: Do you remember why ICRP decided to put this principle explicit into its recommendations, rather than letting radiation protection experts figure out by themselves about principles? What really pushed ICRP to clearly state that optimization ... sorry, justification, optimization, and dose limit, and these three are the principles of radiation protection? Because initially ICRP didn't state out the principles.

L: It is an understandable development. This other lady [Kristin] pointed out, and ICRP was using ethical concepts without realizing that they did so.

H: So ethical principles naturally came, and later you discovered that you were practicing ethical principles.

L: Mhm

L: I think you should contact a man at the Institute of Technology, Svenova Hanson in Stockholm. He is interested in risk and protection but not necessarily radiation risk. He has a number of papers where he has said that ...

[Leafing the proceedings]

H: Definitely I will contact him about his take on risk analysis and ...

L: He's saying that the kind of ethics that radiation protection uses is fairly new and this is not so that there is a group of experts in ethics that ICRP should have consulted, it's rather so that experts in ethics have certain things to learn from ICRP for radiation protection.

H: Interesting proposal.

L: That's an interesting point of view. I think it is relevant to your task.

H: Actually this is a great lead to the next question that I have, which is the membership of ICRP. ICRP became a professional organization made of experts, scientific experts in fields like health physics and others. But the nature of risk is such that there is always a consideration of value judgment, so always there is a question if ICRP should include non-scientific members like stakeholders, or ICRP limits its role to technical assessment. Do you remember how ICRP has been addressing this aspect of risk analysis?

L: That's a long story. It has been discussed for a long time. The first time I participated in such discussion was an ICRP meeting in Munich in '59.

H: How did you feel when this matter was discussed? What was your position regarding this matter? Whether or not ICRP should invite representatives like from labor and other stakeholders.

L: In '59 I had no position [laughter].

H: How was your opinion if you recall? Because I remember that Professor Sievert liked to keep the organization scientific instead of inviting non-scientific members. Was it pretty much your position back then?

L: No, I think that Sievert's view was quite reasonable at that time. But the time has moved.

H: Lauriston Taylor also opposed including non-scientific members around the time of 1960, saying that including non-scientific members and making the committee big would really delay the decision-making process, and obviously non-scientific members do not really have competence in judging technical facts. So of course this is one position and this is the argument that prevailed back then. But obviously this matter of including non-scientific members always came up time to time. Do you remember what was your position regarding this matter when you were chairman? Or even when you were a member of the Commission?

L: I remember that I felt it was a difficult problem. Sievert's view was quite reasonable.

H: You just mentioned that time has changed, time has moved

L: Yes.

H: Could you explain to me what you mean by, "time has changed"?

L: We have another example. That is risk ... ICRP for a long time used radiation risk as synonymous to the expectation of death, or premature death. But then you are looking into it, it becomes more and more complicated because you have to know what the quantities are that you should use, and how to use them. That's more difficult than you can think at the beginning. I think that risk is ... for example, we used risk as synonymous to the expectation of death, or premature death. And that sounds alright. But when you try to put numbers into it, you have to make assumptions, and those assumptions are fairly arbitrary, and it became more and more obvious that ... I mean, when you talk about premature death and try to put a number on it, then a number of questions will arise. Death of whom? Death of male, or female? Any weighting for age. Then the more you look into it, the more complicated it gets. It's not so easy. When we talked about risk and death, more and more questions will arise. I mean, you have to make assumptions, and often those assumptions are not spelled out, so they are made often really without the person making the assessment realizing that he has made the assumptions. Becomes more and more complicated the more you look into it. That is the case with many things.

H: Did this experience convince you that ICRP needs some input from not just experts—of course experts are very important—but also some other non-scientific experts and other people.

L: Well, it is difficult to draw a borderline.

H: So far ICRP's membership is limited to those in science. Was there any way of getting inputs, information, from non-scientific part of the public other than the membership, because the membership was limited to science ...

L: Yeah, but as you are looking into it, a number of questions will arise. What is science? What do we define as science? It's not so easy as you may think at the beginning.

H: Beginning, you mean at the time when radiation protection started.

L: Right. Because at the time when radiation protection started ...

[Pause]

L: Yeah

H: Now, as time moved on, you realized that the problem, issue is much more complicated than just a pure technical assessment of the number of deaths

L: Yes

H: So you think that risk analysis should be based on a broader context

L: Yeah.

H: Did you realize this complex problem during your chairmanship ?

L: Yes

H: Do you recall any episode that really reminded you of this complicated problem?

L: I wrote a chapter myself of the Recommendations.

H: So you also wrote a chapter about this in the Recommendations.

L: Yes, in Publication 60. Yes.

H: Because you felt strongly about this complex problem.

L: No.

H: Or you happened to follow your shoulder.

L: One has to realize the problems that arise. And those problems are ... very quickly realized if you try to ... to assess the probability of death, what do you mean by that? ... And then since everyone does die, the probability of death is one ... so you have to make some specifications, and then you count to the probability of premature death. But what is then premature death? When you look in it, more and more.

H: Around that time you delivered a Lauriston Taylor lecture in 1986 or 7, and in the lecture you tried to quantify a possible additional risk as added to the normal curve of premature death. So it really represents one of your efforts to devise a more meaningful risk analysis method. You gave a lecture because of your strong concern about this aspect.

L: Yeah. That's ... I think I have.

H: [The title is] "How safe is enough?" How did you come up with this particular analytical method? I mean, the meaning of additional risk.

L: Well it comes very naturally when you are looking into it.

H: So naturally came to your mind when you prepared this material. Did anyone help forming your concept here? Did anyone ... did you discuss this matter with anyone at ICRP?

L: Yes, surely.

H: How were their reactions?

L: Their reaction was quite positive. I mean, when you looked at the curve for Sweden, for example, over the years, this has been a very drastic change here in the survival course. If you are going to use some reference for example, how do you select it without.

H: So basically you base your estimate of what's considered as negligible risk on surviving curve, right? Curve is changing all the time.

L: Yeah.

H: And you mentioned that reactions from other members were quite positive.

L: Yes.

H: So it means that all members at ICRP and radiation protection community in general were trying to figure out what was the best approach to this complicated problem.

L: Yes.

H: And do you think that we are improving our understanding of risk and approach to risk?

L: When you have a curve like this, and when you find anomalies appears, for example. How do you deal with that?

H: Right. This outlier causes ... questions, how to deal with the problem.

L: Yeah.

H: Thank you. I would like to ask a little bit of small question before concluding our interviews. During the time when you were a chairman, how was the funding situation? Did you find the task of finding funds very difficult and challenging?

L: Yes, particularly since I succeeded Rolf Sievert who was extremely thorough in finding money. He approached all the big American foundations for help. I inherited the whole problem. Professor Takahashi helped me to get money from Japan. I don't remember the name and month ... He was the person with not the best reputation I guess ... I don't think that the man who gave us money didn't have the best reputation. Because if you are in a position so that you can give money away, you cannot have a good reputation [laughter].

H: How do you manage to get money? In the first place

L: Yes. So this was the man in charge of the Japanese ship building industry...

H: Sasagawa?

L: Yes.

H: So Professor Takahashi helped ICRP receiving some funds from the Sasagawa Foundation.

L: He helped us by inviting me to Japan because he found scientific matters that I could attend in Japan. Then he helped me to find the people who then could find Sasagawa for us. I mean, Professor Takahashi didn't have any contact with Sasagawa. It was also an embarrassing problem in that Sasagawa's reputation was not necessarily the best one, and that was not so easy for somebody in Stockholm to evaluate [laughter]. But Professor Takahashi helped me to find a number of people who could assist me in finding some entrance to Sasagawa. At the beginning it looked very difficult, of course, and I got questions, "So why ICRP would need money? Why would ICRP need Japanese money? If ICRP is so important, why shouldn't countries pay ... all countries pay?" Of course [laughter] people have said that, don't realize how difficult it is to get one country to have interest ... to have all countries have interest, so not easy ... Then we ...

L: The man who was direct to Sasagawa. [Some exchanges] businessman.

H: Is his name listed in the book?

L: Yes

L: Then definitely we can reference that in your last volume.

H: We tried moving to approach Sasagawa.

H: So many steppingstones to clear.

L: Yes. And then the nearest we came was this man, who must have been director-general of the Sasagawa Foundation.

H: So the financial assistance from Sasagawa Foundation really helped ICRP going in the 1970s and 80s when you were a chairman.

L: Yes. After this meeting around to try to approach Sasagawa, the closest became was this director. He had arranged for Takahashi and me to come see him and said he had something like, "6 or 7 minutes." But then when we found him and began to speak to him, he got more interested, and it was not much minutes, it was rather hours. Professor Takahashi looked more and more happy because the conversation was in Japanese, right? I could find out the size of the mouths [laughter] of people. This director came with a rather natural question, I mean, "Why should we even need this?" And then if ICRP is so important, why doesn't every country contribute? And so forth. I explained, and those few minutes became hours. At the end, it ended up as something. It was very fortunate.

H: But still funding was very tough

L: Yeah.

H: So you needed to constantly find possible financial sponsors.

L: Yes.

H: One of the reasons why funding is difficult is the nature of ICRP as an independent, non-governmental organization

L: Yeah

H: So this is a kind of status ICRP tried to protect

L: Yes

H: But it comes with the cost in terms of need to find some financial sponsors. How do you think about the value of being independent and non-governmental, and professional? As opposed to, for example, coming into someone's umbrella, like UNSCEAR or Health Physics Society, or some other, International Radiological Protection Association?

L: Of course that is quite dangerous. If it can be avoided, it should be avoided.

H: Could you elaborate ...

L: Sure. I mean, if you are not independent, you are dependent. That's of course a great risk.

H: ICRP was born as a committee of International Congress of Radiology. ICRP eventually became independent of this Congress, although still affiliated, but as an organization it's now independent. Do you remember why ICRP decided to become independent of the Congress and stand on its own?

L: In the first hand, depending on the Congress made it extremely difficult to get money that was needed. Money that you could get from the Congress was very, very, very small. And second, every now and then,

the Congress groups that run the things repeatedly came back with proposals of changing ICRP or moving ICRP to other interests and so ... it would have not have been easy to maintain ICRP. And then of course ICRP's interest changed a lot. And the Congress couldn't expect to continue to have interest in ICRP as ICRP was moving toward nuclear power protection and many other peculiar things. It was ... at the end a very peculiar thing to have ICRP linked to the Congress of Radiology.

H: So that's why ICRP went independent.

L: Yeah.

H: Then the membership of ICRP is based on scientific expertise but the Main Commission usually nominates members. There is a principle that anyone should be elected on his or her scientific merit, not nationality. If we pursue this, sometimes we end up having one country or a few countries happen to dominate the membership at that time. So there is always a dilemma, how to strike a balance. Did you encounter such a problem?

L: While I was chairman, I cut it as chairman ... to limit on the number of persons from the same country.

H: Why did you propose that?

L: Well, a bad experience, I mean, we had an American time, and British time, and even when we met in Canada, whenever that was.

H: But there is an argument that, since the members are elected based on their scientific merits, the nationality wouldn't really matter, even if American happened to dominate it. There is an argument like that. But how do you think about the merit of having broader representation as opposed to just purely scientific merits? What is advantage and disadvantage of this practice?

L: When I introduced the limit to the number of persons from the same country, then it was after a meeting in Canada where British and Canadians, Australians, met together before the meeting of the Commission. That was not really according to the rule that we should be really independent of countries. So even though the principle is that countries shouldn't count, countries themselves made them count.

H: So that's why you decided to take a formal action

L: Yes

H: To make sure that it wouldn't happen

L: Yeah.

H: Finally let me ask a question or two about your association with the Nordic Society for Radiological Protection. When did you join the Society?

L: I wasn't in the Society.

H: So you were not affiliated

L: Pardon?

H: You were not affiliated with the Society.

L: What do you mean?

H: Were you a member of the Nordic Society for Radiological Protection?

L: Yes, everyone in the field was.

H: Also as the director of SSI, you contacted the Nordic Society in various occasions.

L: Yeah, that was sort of complicated. It was the directors of radiation protection authorities that had means to make it possible for them to meet. They could travel. Hospital physicists, for example, cannot easily travel. It came natural that people like Perry Grand in Denmark, Christian in Norway, and I in Sweden, we had problems with the Finns. But of course, the Finns were very important because they were probably the most competent, rather more competent than members from Denmark and Norway and so forth.

H: So the Nordic Society became a forum, where radiation protection leaders like you met.

L: Yes

H: And then exchanged opinions. Also you were at ... the director of SSI. Did you find the Nordic Society very useful and helpful for your job as the head of SSI? And also in other capacities like ICRP.

L: That's difficult to answer ... We have this red book ... which is a series of publications with Nordic flags. The first volume, a thick one, ... and that was something that I took initiative for because we had new ICRP recommendations coming.

H: Which recommendation, in 1990 or 1979?

L: I don't have a direct answer.

H: No problem.

L: New recommendations were coming, and I could appreciate time like before they were out, but in fact we had all the necessary information, and at the Nordic meeting, at my proposal, it was decided that we should create a book corresponding to the forthcoming ICRP recommendations. But we would amend the ICRP recommendations while we find it necessary from our point of view. And that came as a book, which I have here.

H: The first volume

L: Looks nice. This thick.

H: When the Nordic Society adopted the ICRP recommendations and published books like this, obviously ICRP recommendations were taken according to the situation unique to the Nordic Society.

L: Yes, we would point at that book to say, "After the ICRP recommendations are out, this is how we would interpret them in the Nordic countries." So we had the opportunity to look into ones, whether we could possibly agree on everything. Either agree on the ICRP texts or agree on the amendments to the ICRP texts. But we tried to avoid [having] a different text in each country.

H: Why it's better avoiding different texts for each different Nordic country?

L: Well, it is a great help to have the same text. And as I said, we will either take the ICRP texts or our own version of the ICRP texts. And that was very helpful. So we got that in print at the same time as the ICRP recommendations came. Then we know that we have no problem with the ICRP recommendations.

H: So the Nordic Society became like a lubricant, implementing ... helping the Nordic countries implement the ICRP recommendations smoothly and effectively

L: Yes.

H: To conclude our interview, I would like to ask you to reflect on your long, long service to ICRP. And what is the most memorable moment when you were associated with ICRP? What did you take from your experience with ICRP.

L: Well that's almost an impossible question to answer. The only way to make it possible to answer a question like that would be, if something happened, so very different from other things, so very much more important. That's not the case, I mean ... Many, many things are equal, of equal importance ... To speak personally, I think the thing that I value most is my cooperation with Dan Beninson because we created a rather forceful subgroup in ICRP. And then we had help from John Dunster even though he didn't think he was, but he was a very honest man.

H: What did ICRP mean to you? Was it an organization? Was it part of your life schedule? What did ICRP mean to you?

L: ICRP meant a lot, of course, I mean, what I am trying to figure out ... that was ... some people of ICRP or if it was the organization?

H: Anything, organization or people or anything.

L: I mean, the international cooperation between John Dunster and Dan Beninson, we, and some Americans, shifting over the years, and France.

[Interruption]

H: So you think what ICRP means to you is you were in this international cooperation in driving radiological protection forward.

L: Yeah. I wouldn't call it "international cooperation." It was a close personal cooperation among people in a number of countries. Professor Takahashi said to me that he appreciated that I took account of his language problems, and so did Dr. Beninson as well. And he said, "Yes, that's true." So that is ... if I had close cooperation with Beninson, Dunster, some Americans would differ a little. Both Beninson and I were very much aware of the problem that people in other countries with less knowledge of English ... the problem that they would have ... we were quite aware of that. We tried to be fair, and we got that cooperation.

H: Thank you very much. This concludes our interview.

