Chris Busby vs Jack Valentin, 22 April 2009

Full transcript of the video posted by Ditta Rietuma (BSRRW) with the debate in Stockholm between Chris Busby (ECRR) and Jack Valentin (ICRP), arranged by MILKAS, 22 April 2009.

The main reason for this transcript is to scrutinize the misuse by Chris Busby of some of the statements by Jack Valentin.
The transcript of a certain part can be found on several of Busby's web sites, for instance on the ECRR site: http://www.euradcom.org/2009/lesvostranscript.htm

The debate is spread over 2 videos posted on Vimeo:
Video 1: http://vimeo.com/15382750
Video 2: http://vimeo.com/15398081

The transcript on the NPYP forum is divided into 3 parts:
Part 1 (Video 1): Chris Busby's presentation, followed by Jack Valentin's presentation
Part 2 (Video 1 and 2): The debate/interview between Chris Busby and Jack Valentin
Part 3 (Video 2): Questions from the audience

Any errors in the transcript are mine.
/Mattias Lantz – Nuclear Power Yes Please

MG: Miles Goldstick (MILKAS)
CB: Chris Busby (ECRR)
JV: Jack Valentin (ICRP)
RvM: Roland von Malmborg (FmKK)
RR: Roland Reinholdsson (SERO)
AW: Andrzej Wojcik (SU)
BC: Björn Cedervall
JS: Johan Swahn (MKG)
JK: John? Kristiansen
EL: Eva Linderoth (MILKAS)
XX: Unknown persons

Part 1: Chris Busby's presentation, followed by Jack Valentin's presentation

MG (Miles Goldstick): ...because cancer is a terrible disease. No matter what side of the nuclear issue you are, most people understand that cancer is a terrible disease and we have to try to deal with it. We have with us two eminent scientists, Dr Chris Busby and Dr Jack Valentin.

Dr Busby has been the scientific secretary for the European Commission on Radiation Risk, ECRR, which was set up to deal with issues related to the International Commission on Radiological Protection. Dr Jack Valentin has been the scientific secretary for many years, he is now emeritus, just as of some short time ago.

I though I'd leave it at that, The format for today is that Chris Busby will give a presentation for half an

hour, followed by Jack Valentin for about the same period. Then there will be a 15 minute break, with coffee and pastry outside and then there will be an interaction between the two, and questions from the audience.

So please Chris.

[Request of translation into Swedish from somebody]

1:30
CB (Chris Busby): This is a historic occasion in my opinion, because we have here the scientific secretary of the International Commission on Radiological Protection, an institution that has been underpinning the basis of all the risk models of radiation and cancer since 1952. It is the model of the ICRP that permits nuclear power stations to operate, that permits the American military and the British military to use depleted uranium.

It is this risk model which I am now calling into question. We've called it into question for quite a long time. But it was in 1997 at a meeting of the European Parliament, STOA group, where I first met Dr Valentin. It was a meeting that was to address criticisms of the ICRP risk model that were being brought forward by a number of people; myself, Alice Stewart, Rosalie Bertell, Jean Francois Viel, a number of eminent scientists and who were arguing that there are problems with this model and that it should no longer be employed for accurately predicting the effects of radioactivity.

At that time we set up the new committee called the European Committee of Radiation Risk and I'll talk a little bit about this and those developments. The model of the ECRR was developed and it was published in 2003. We will have a meeting at Lesvos in Greece in three weeks time, to which anyone can come, where a number of eminent members of the ECRR will be discussing this issue and try to take it forward.

3:20
I have to be quite rapid in this presentation because I need to get through quite a lot in a limited space of time so I will blast my way through. Many of you people will already know all of this stuff, so forgive me, some of you may not.

First of all I just need to say that there are various types of radiation and the three main types that we need to discuss or consider at the moment are gamma rays, which are electromagnetic radiation-like light, and then energetic electrons, beta particles, and also alpha particles, which are rather like Battlestar Galactica in terms of their damaging power relative to Luke Skywalker's... little... quite... aeroplane things.

4:10
Now, the electromagnetic radiation, the external radiation, the gamma rays, they produce, on interaction with matter, with living tissue, they produce fast electrons. And as these fast electrons which cause the damage they interact with tissue they produce ionization, and that can damage the DNA, which is now known to be the target for these effects. It is the DNA that establishes if the cells can go out of control ultimately. But the effects of these are not just cancer effects, there are also a whole range of effects on human health and in fact you can probably argue that nearly every type of human health condition can be effected or harmed by radiation.

4:50

Now, ionizing radiation, whatever its source, external or internal whatever, it's absorbed and produces these electron tracks, and it is the electron tracks that will cause the problem when they react with DNA and they cause mutations, cancer and of course genetic defects which can be passed across the generations

Now, the important thing here to remember is that the absorption of gamma radiation is proportional to the 4^{th} power of the atomic number. Those of you who are chemists will know that all the elements have an atomic number which is basically the number of electrons in the orbits around the nucleus. The atomic number goes from one for hydrogen which is the lightest element right away up to 92, which is the heaviest element, it's uranium. Of course we've got heavier elements now that we've produced in nuclear reactors, but on Earth those are the numbers, they go right up. But most of the elements have quite low atomic numbers, and in fact there is a reason for that.

5:50
Now, radiation exposure and health has been modeled since 1952 on the basis of the cancer yield in the survivors of the Hiroshima bomb, the Japanese A-bomb studies. And this model is essentially the model of the ICRP, the ICRP model, the model that I'm attacking today, and have been attacking for a considerable part of my life. And the reason that this model is false is because it is based on the assumption that all cells in the body receive the same number of radiation tracks. If you're going to model cancer and radiation or if you're going to model health and radiation, you have to have some sort of...unit that you can measure the radiation in, in order to say "this number of units of radiation can be related to that amount of cancer following the exposure of a person."

6:41
And the unit that was developed, was a unit based on physics, which is energy per unit mass, and it's called Absorbed dose. And so all energy per unit mass, all absorbed doses are related to the numbers of cancers that are produced following that exposure. It is not however a valid assumption for internal radiation and this is where the problem is because the people who in Hiroshima and Nagasaki were outside in the open, and there was a gigantic flash and their bodies where bathed in gamma rays and the energy from these gamma rays caused equivalent ionization in every one of the cells in the body. And so it was quite reasonable to take that as a measure of exposure of harm, because all of the cells had the same amount of harm.

But this is not true for internal radiation, because with internal radiation you are exposed to fission products, these substances which never existed on Earth prior 1945, substances which get inside the body and attach to cells and they have biomedical properties at the molecular level, and some of them have high affinity to the DNA, Sr-90 is a good example, but there are others. Uranium is also a good example.

So the external exposure model is modeled by physics, this is the original ICRP phantom. It's like a bag of water. And so it's exposed to external radiation and the doses are assumed to be the same for most tissues. But for internal radioactive exposure, particularly also for particles you can get this kind of effect here where you can see that, these are plutonium particle in a rat lung. You can see what's called an alpha star, so this is like sitting in front of a fire and heating yourself, warming yourself up in front of the fire. You get an equivalent dose of radiation, in this case infrared radiation, through all of your body. And the equivalent would be to reach into the fire and take out a hot coal and eat it.

8:39
So we're in the position now, that there is an **anpass** between two separate risk models. A risk model

developed by the ICRP in 1952, at that time probably quite reasonably I guess, since they had to do something quickly. And now a set of models that the ECRR has developed in order to account for a number of anomalous discoveries. We have nuclear site leukemias, we have childhood leukemias near nearly all of the atomic plants that where epidemiologists have looked. There is a sea coast effect on the Irish sea due to material from Sellafield. There is an increase in infant leukemia in children who were in the womb at the time of Chernobyl, and a whole range of other things, part some of which I will look at.

9:28
So the ICRP radiation risk model is now manifestly proved wrong, in fact it is quite embarrassingly wrong. And this matters because it's resulted in the deaths of a very large number of people. The ECRR calculation of the cancer yield of the nuclear project, if you'd like to call it that, most of the radiation released in the environment this century is in the region of millions of people, 61 million people have died as a result of cancer produced by the radionuclides released during weapons fallout mainly.

10:00
And we have all epidemiological discoveries, the whole range of them here, and all of them have to be explained and cannot be explained on the basis of the ICRP model. And you have a whole list of theoretical falsifications of the ICRP model, or the basis of the ICRP model. The ICRP model is now bankrupt and needs to be tipped in the bin.

So as I said there are now two committees and two models for the health effects. The ECRR model you can get from Euradcom, you can order it from the ECRR or through Milkas, who have some copies. The ECRR, I just put up a some of the people in the ECRR. So we are not talking about people who, like me, are perhaps not so important, but some extremely eminent scientists here, we are talking about, this woman here, who's the head of a seminar institute of radiation biology in Moscow, member of the Russian Academy of Sciences, now she is a deputy director of the institute of biochemical physics. There's a whole range of people here, Rosa Goncharova who is a geneticist in Belarus, has found all sorts of effects following Chernobyl.

These are people who are coming to this meeting in Lesvos on the 5th of May and as I said anybody else can come and Dr Valentin has been invited, and I think maybe someone might come from the ICRP, but I am not holding my breath.

11:24
Atmospheric nuclear testing killed babies. It caused increases in leukemia in areas of high rainfall in the UK, these are all from publications in peer reviewed literature. This is an increase in childhood leukemia in Denmark over the period of weapons fallout in the 1960's. It is the result from the deconvolution of a disgracefully biased and almost dishonest report by a number of eminent epidemiologists working in collaboration with the British Nuclear Radiological Protection Board. This is the standardized incidence ratio of all cancers in Wales, which you can see follows very closely the increase in Sr-90 twenty years before. One of these graphs is from the cancer registry, the red one, and the green one there is previous exposure to Sr-90, all taken from government documents.

So what we're saying here with this is that the cancer epidemic that everybody knows exist has been caused by the exposure to these same fission products, these substances like Sr, Cs, Pu and U of course, which were generated during the weapons fallout. What all of these substances I mentioned have in common is that the doses, remember what we called absorbed doses as calculated by the ICRP are far too low to account for these cancers on the basis of their model. And the level of error is this in these

different cases. These are all clear situations where we have increases in childhood leukemia near nuclear plants.

13:02
In all of these, just take the dose and calculate how many childhood leukemias you'd expect to find on the basis of ICRP model, you are out by these factors. You notice that one of the factors is 300 the minimum factor, that is an interesting number, because it comes up again and again, and some of you will know that there's been a recently, a very large study done by the German cancer registries, the childhood cancer registry which shows the effect...

RvM (Roland von Malmborg): Could you in other words explain Barsebäck for example, I do not understand what's standing there. [referring to a table on the powerpoint slide]

CB: What's standing there are the... Forget about this, this just came in somewhere else. This is a study that I've been doing in Wales which I'll come on to of Sellafield pollution, but anyway... What you have here is... In 1983 they discovered an increase in childhood leukemia near the Sellafield nuclear plant. They looked to see what the doses were to children and they had a dose of so many Sv, it was a dose of about 400 microSv was the dose from the releases. Now, on the basis of the relationship between radiation and cancer, and leukemia, using the ICRP model, they have a risk factor which you can directly translate to doses into the number of cancers that you'd expect to find.

And what you do you work out the number of cancers that the ICRP will say would occur on the basis of that dose, and you divide it into the actual number of cancers that you see, and the number that you get is that and you can call it like an error if you like, a mistake factor or something like that. That number comes up again and again. I've studied the Irish Sea coast, this is a very highly polluted area. Substances are pumped out of the Sellafield plant historically lots of plutonium, uranium and strontium and all that stuff. It ends up on the beaches, and the beaches are like this, they are muddy beaches, this a beach in Northern Ireland in a place called Carlingford. And this is a map of Carlingford. And we went and knocked on doors and we asked all of the houses in this whole area how many cancers there were, you can see that the cancers are all next to the coast.

The rate of cancer by the distance from the coast is given by this. So as you go further away from the coast you get a rapid falloff of cancer. We also found this in the Irish Sea studies in, here we are, in Wales. So this is childhood cancer by distance from the coast in Wales, and this is adult cancer for all these different things, all cancers, leukemia, breast cancer, lung cancer, colon cancer, all by distance from the sea. So there is a sea coast effect associated with polluted coast where there are fine sediments.

15:45
XX: Question here? There has been that you have more people may live by the sea compared with...

CB: No this is all factored in. And the age of people, and social class, and everything you can imagine is factored in. I have to go fast here you know.

XX: No, but I just want to...

CB: This is a hot particle from Sellafield that has turned up in an edible mussel. So that is just to show you that that stuff is there. Ok, now this is another nuclear site at Bradwell in Essex. This is representing breast cancer risk, and this is also a very muddy estuary, this is the sea here. So this is the

muddy estuary here, this is the nuclear power station, and you can see that the risks are much higher close to the radioactive mud.

We kind of know what the reason is, because the sea influence of the waves causes a resuspension of particles in the fine sediment, and then they blow ashore, and they drop out over a period of approximately the same distance that you see that the effect of they exist, and it is about 1 km.
So people living within about 1 km of the coast inhale fine levels of plutonium and in fact we find them in autopsy specimen so we know that they are there. You can cut up animals and you can cut up human beings, in fact the National Radiological Protection Board did just that, and showed that there was plutonium inside the tracheal bronchite lymph nodes on people living near the coast.

We set up a committee, I managed to get the British government to set up a committee, but effectively the minister who set it up was sacked by Tony Blair, and the final report was altered and constrained. So just to show you that people know about this. How much time have we got?

Allright, we can go back to this then. Well, anyone who wants to know about this CERRIE process, will find a lot on the internet. The disgraceful way in which the, this attempt to bring these issues to the attention of the government was controlled and altered by legal threats and all sorts of shenanigans. But we made the minority report, which is called the CERRIE minority report, and that's available and you can buy that it gives the whole story. And also my book “Wolves of water” were I talk a lot about this stuff too.

18:10
Now, there is an unequivocal proof in the error in the ICRP model. This was published in the year 2000, but it has never been cited by any of the radiological risk people, in any of their publications, they just completely ignored it. This looks at leukemia in infants, not only in Wales and Scotland, because this is Wales and Scotland that I talked about, but it was first brought attention to in scientific and medical public, in peer review literature, that there was an increase of infant leukemia in Scotland just after the Chernobyl accident, and then also in Greece, and then also in Germany and then also in America and then I came in with my Wales and Scottish studies.

So we've got five different studies that all show that there was a sharp increase in infant leukemia, that is leukemia in children in the age group nought to one, who were in the womb at the time of the Chernobyl accident. Now you will probably not know but the Chernobyl accident in terms of absorbed dose produced very little absorbed dose.

So the maximum absorbed dose into a foetus, into a child in the womb, was in the region in the Chernobyl affected territories was about 2 mSv, just think of that as a number. That's about the same as the natural background radiation range that you will get in a whole year, 2 mSv. It's approximately the same, so if we're talking about dose this dose is not very big. So any person at any time will get a dose of 2 mSv. But there was an extra dose of from the Chernobyl accident in the Chernobyl affected territories of 2 mSv according to the radiation risk people.

19:45
And by the time you get to a place like Scotland, the dose was about 100 microSv, that's 0.1 of a Sv, allright... 0.1 of a mSv, so that's about one twentieth of the natural background average dose in a year. So these are tiny tiny doses as absorbed doses. Of course they are not absorbed doses in that sense becasue they are not external radiation, they have to do with internal radiation from these isotopes that were released from Chernobyl, Cs-137, Te-132, I-131, and Plutonium came to Wales too.

So there were internal doses to these infants, and we looked only at those infants who were exposed in the womb at the time, over the period of the Chernobyl accident. And here's the numbers for Wales and Scotland combined, and you can see, you don't have to be epidemiologists, to see, I mean they are small numbers, but you can see that just after Chernobyl, the rate went up. You see? It went up by a factor of about four.

We also know that in Greece it went up by a factor of about three I think, in Germany by a factor of two and interestingly in America by a factor 1.5, and in Belarus, which is nearly the only place where anyone published, it went up by quite a small amount, about 1.4, about 40%. So the effect was not dose related, but the effect was certainly there. And so using that we can see what the ICRP model predicted on the basis of the doses, we can divide it into the number of children who were actually diagnosed with leukemia in that year, in that cohort and what we got was a factor of about 300. So we're back to that number of 300. So there seems to be some error in the ICRP risk model regarding internal radionuclides of the order of 300 to maybe a thousand.

21:40
Of course the radiation risk community said that there was no problem after Chernobyl. This is Alberto Gonzalez talking in 2000 at a conference in Kiev. And there's an interesting DVD if anyone wants to see this, it's from a film that was made by Swiss television called “Atomic Lies” about the way in which that conference resulted in all sorts of bias and dishonesty and coverup and general skullduggery by people like Gonzales. These people are crooks, they should go to jail, no question. I would maybe say worse... Maybe they should just be sent to a deserted island somewhere, with a lot of nuclear waste.

22:30
And this is Alexey Yablokov who is a member of the Russian academy of sciences and he is at the same conference saying that members of the Soviet statistical ministry were arrested for falsifying health records. It was so bad that they actually reduced the number of leukemias in the Chernobyl cleanup workers to the extent that people ended up more healthy than the general public.

So nobody was allowed to record leukemia after Chernobyl you see. And of course, when somebody did start calling attention to problems, like professor Yurij Bandashevsky, also a member of the ECRR, and coming to this conference in Greece, he was locked up by the government for eight years of hard labour. And that is also in this DVD. So we're talking about some very heavy people here, some very big dodds. And I'm so glad to have their representative here, Dr Valentin, because I should be asking him some serious questions about this.

23:20
Now if you want to know what happens about Chernobyl there is a book that we have just re-published. We published it in 2006 and now there's a new edition of it, 2009. And what is happening in the Chernobyl affected territories, it's disastrous, it's terrible. People are dying like flies. The average life span has come down by 10 years, the birth rate has fallen catastrophically. In 5 children only one of them is healthy, 4 children are unhealthy, it is just appalling. If you listen to Bandazhevsky talking about this, I know there are other people from there.

And all this information was published in Russian language peer reviewed literature, some of it in the west, and none of it has been considered by any of western radiological risk agencies. The ICRP report in 2007, which was the latest one, barely mentions Chernobyl.

24:10
Now I will finish by talking about depleted uranium, or what I call uranium weapons. This is the latest tragedy in the pollution of the environment, and many of you will know that uranium is a by-product of the nuclear industry that has been re-used in the last 20 years or 18 years as a weapon in order to destroy tanks and it causes a whole range of effects in people living in the countries where it has been used, and also in veterans who've been firing it and have been exposed to it generally.

I've been to Iraq and I've been to Kosovo, I measured the stuff, it sticks around a long time and flies all over the place. There I am in Kosovo in a nuclear biological kit on Nippon television. We brought back depleted uranium, one year after it had been used it was still there.

25:00
So this is my final theoretical falsification of the ICRP model, it has to do with the uranium and its ability to absorb gamma rays which I talked about earlier. I have been drawing attention to this since 2002, but more recently it has become more important because we managed to get the story into a number of journals.

Uranium has this high atomic number, it absorbs about 200 000 times more radiation gamma rays than background radiation. This is a 4^{th} power relationship between the atomic number of uranium and the effective atomic number of water. We say that the effective atomic number on water is one, we just ratio it all after that.

Uranium will absorb 585 000 times more gamma rays. Where does that energy go to? Well it goes into the tissue where the uranium is. Now where is that tissue? We find that the tissue is the DNA, because uranium binds very strongly to the DNA. The affinity constant for uranium in DNA has been measured by an American called Nielsen, and it's extremely high. So it means that very low concentration of uranium, we can't be certain about this because this is all done in a test tube, we don't know about people, so experiments need to be done. But we certainly know that uranium is likely to be on the DNA, so if you're reckless on the DNA and its absorbing all this radiation.

Where does the energy go? Well it goes into these fast electrons that I was talking to you about, but in this case the electrons are called photoelectrons and they whiz out of the uranium which is stuck on the DNA. And they whiz into the DNA. This is a coil of the DNA, corrupted.

And this is what it looks like when you take a cross section of it, and this is a uranium ion, uranyl, uranyl 2++, on the same scale as the cross section as the DNA. So you can see, having uranium on the DNA standing in natural background is not very good for the health. Now, we have actually done a study of this, using a FLUKA model, which is developed by CERN in Geneva to look at particle physics. My colleague Andreas has done this study, and he sends a beam into a 10 nanometer diameter hypothetical uranium particle in a vacuum.

27:06
And he compares the absorption of this with the absorption of water and gold particles of the same diameter. I'm asking you to look at the top of this now. In this one he puts in 100 000 photons, so we got 4 electron tracks out of the little particle of water if you put in 100 000 photons of natural background radiation.

You see what this experiment is, it's having a hypothetical water or tissue particle, and it's bathing in natural background radiation and it's looking to see how much, how many fast electrons come out. And

you can see 4 fast electrons come out for 100 000 photons. For gold, which has an atomic number of 72 or something, 79 I forget, anyway, that sort of order. So it's got quite a high atomic number though, you get a lot more. This is only 1000 photons and you got all of these tracks, and of course uranium 1000 photons you got a lot of tracks.

And this is not hypothetical, because a man in America called Heinfeld has done this experiment with mice and he's put gold nano-particles into tumours in mice and irradiated with X-rays and he's destroyed the tumours. So he's actually using this, he has patented the method to destroy tumours. So therefore it works. So this falsifies the ICRP model theoretically due to the uranium exposure, and the ICRP model underpins all the military arguments that uranium weapons are safe. So I think at that point, I have to say check mate.

This is a uranium bomb in Lebanon.

29:00
CB: What?
[explanation of the meaning of the word "underpin"]

So this is my uranium thing. These are the conclusions, I'll finish with this.
* The increases in childhood leukemia and other childhood cancers are primarily caused by exposure to internal man-made radionuclides.
* The ICRP model which is used to underpin the operation nuclear power and discharges of radiation in the environment are just nonsense, they are embarrassingly wrong. These people should just... They should put on sack cloth and ashes and check into a monastery for the rest of their lives, just sit down and kneal in a penitentiary and prayer.

This is arguable in terms of theory, and it's clear epidemiological studies, specifically in the Chernobyl infants. The current cancer epidemic in adults has the same cause, and therefore it's time to reassess the risks of radiation. And here's the yield. You see, 61 million cancer deaths. 1,600,000 infant deaths. This is the whole of the nuclear releases since 1945 to 1995, I think up to 1992 I've got here.

There's a loss of quality of life. And the blame for this can be squarely placed at the door of those scientists and administrators who developed and supported the scientific risk model. And I say that this is a war crime. This is a crime. And it has far greater in magnitude than any that has occurred in recorded human history. This is serious, serious stuff. And if I make jokes sometimes, it's because I have to deal with the extraordinary awkwardness of it. And you can learn more about it from these web sites. Thank you.

[Applause]

31:30
MG: I'd like to ask the audience to try to please keep the questions to later, at the break.

JV (Jack Valentin): Thanks Miles, thanks Chris for your presentation, it was quite interesting. And thanks also for being here. I'm thinking it is fairly difficult to get into your line of thinking. We haven't seen your earlier published material in peer reviewed press. That has changed, certainly, I admit that. But, it may signify, I believe, some sort of a change in attitude that you've actually invited us to participate at your conference in Greece. I am not the right person to go, in fact back at the time of *** I knew a little bit of genetics, now I know quite a lot about how to shuffle papers.

We have about 20 people currently this very week at a meeting in the US discussing the details of internal emitters and problems with dose calculations, problems of uncertainties, all of that stuff. In May there will be a large international meeting where I've seen that a lot of the people from ICRP will participate. I didn't see any of names from the ECRR, but maybe you are there, maybe it's just that I don't know the names.

33:06
So what I'm trying to say is there seems to have been a little bit, your culture and it's an advantage if perhaps we can get slightly closer and talk to each other and of course I am happy if we can avoid throwing rotten eggs at each other, perhaps discuss what might be the technical differences between our ***.

33:30
So what I'm trying to say here is first of all: What is ICRP? And what are our roles of those organizations. And what is the development where we started out with the intention of protection of medical staff and our hope is that we're protecting man and the environment. Then a little bit about radiation risks and the scope of radiological protection and effects, and something about where we seem to agree more or less, and something about the areas where we certainly don't agree.

It all began as you all know in 1895, this nice picture shows Röntgen demonstrating his X-rays in Wurzburg. This is interesting, because the X-ray tube is actually completely unshielded, so all of these people are exposed to radiation, and wouldn't *** to happen.

Radiation which quickly was found to be dangerous only after one year and an American named Emil Grubbé described dermatitis due to exposure. He was a person with vivid imagination, so much of what he later said turned out to be completely false. But certainly he was one of the very first victims of radiation. And another American, Wolfgang Fuchs, published some advice on protection of hands at that time which actually summarizes the roots of radiological protection already after one year: Reduce the time that you are exposed, keep a distance to the source and shield yourself if you can't do these other things.

And at the same time was one of my favourites, Madame Curie was working in Paris. Not to easy to be a single mother there at the university which hated women and thought they couldn't understand mathematics and she made lots of interesting and important discoveries and then unfortunately she died of leukemia which almost certainly depended on her own exposure to radiation.

35:41
During the early 20th century concerns about radiation and safety escalated, because more and more doctors had most terrible wounds, many of them actually died. This was the beginning of ICRP which was formed in 1928 under a different name, the International X ray and Radium Protection Committee. And as it happened that was here in Stockholm and the first chairman was Rolf Sievert, known because of the name of the unit. Most Swedes have no idea that we had a famous scientist here who is instrumental in making sure that radiological protection exist.

We're a registered charity in the UK, we're established to advance the public benefit of radiological protection by providing recommendations and guidance on ionizing radiation. And the structures is such that there's a main commission, this is currently lead by the chief medical officer of this country, the head of the Swedish national health services, Socialstyrelsens generaldirektör Lars-Erik Holm. And

then we have five different committees dealing with various aspects of protection.

37:00
I have just retired, so for the next period a Canadian called Chris Clement is taking over my job. He was head of radiological protection at the Canadian licensing authority until he took the job. And this summer a radiologist in the UK, Claire Cousins, will take over as chair person. And of course this structure is now 500 years ago. We can see the chair person, over here I'm talking to my wife.

However, as you've already heard, not just Chris but I think Chris had the nuclear industry seem to agree on one thing, that this might be a representation of ICRP, because you need to recall that while Chris is talking about us underestimating risks something horrid, there are large other groups of scientists, which I find equally strange, who are claiming that we're over-estimating the risks. That the risks are not at all the size we say.

38:10
A few words about what we are and what we're not. Because the three organizations that Chris represents, Green Audit, the Low Level Radiation Campaign, and the European Committee on Radiation Risks, they all have information on their web sites which is patently false and misleading about ourselves. We were created by radiologists, not as it says by the LLRC, by the nuclear industry, also we were not created by ourselves.

We are independent, we are self-elected to remain independent. I might add that Greenpeace, an organization quite negative to nuclear is also self-elected. The French academy of sciences, is very positive to nuclear power, is also self-elected. We do not have a position on nuclear power, it's not our remit to say that nuclear power is good or bad.

We're financed by grants from governments and by sales of reports. We do not get one red cent from the nuclear industry. We are primarily biologists and medical doctors, quite a lot of physicist, but there are more biologists and medical doctors. We have public health experts and many other kinds of people, mostly from universities and expert bodies, and a lot of people from regulating authorities. We're not from, by not supported by or checked by anything from the nuclear industry.

39:45
In the cosmic scheme the United Nations has a scientific committee on effects of atomic radiation (UNSCEAR) where they publish huge reports in which, I fail to say, much about Chris work, which may be because they are all so stupid. The committee is very large and it looks quite a lot of people who are working since many many years with radiation.

This series is published on direct orders of the General Assembly. And that remit is to say here is how much radiation there is, and this is how dangerous it is. We use their material to express: Because there is much radiation, and because it's supposed to be this dangerous we think that you should “Blah blah blah”.

In order to be practically useful that in turn has to be translated into legal *** which are both by the UN, this is the most thing for the world at large, and by the European Union which is perhaps more important in a country like Sweden or the UK. They translate our recommendations into regulations which are of the sort: Thou shalt.

The early recommendations from the ICRP were only concerned with occupational exposures in

medicine and had very high dose limits. Then we realized that perhaps other people than just people in medicine work with radiation. And at the time of course radiation was basically good for you, there were safe thresholds, people thought, there would be no alignment of concern. What we see here is face powder which is radioactive to make your irradiant, this is a radioactive compress, this is a headoscope to check the size of your shoes, in case you *** just the feeling.

Then things changed with advent of accelerators, reactors, fallout, the tragic event with the Japanese fishing boat, “The Lucky Dragon” which was exposed from Bikini. We were renamed ICRP because we realized that there were so many more things than just X-rays and radon. Excess leukemias were observed among the survivors in Japan, and radiation had become a concern for the public.

42:14
So then we published further reports where we realized that it was important not just to avoid burning holes in your cells, which is what we had worked with before, but also to minimize genetic damage and cancers, this is what is called the stochastic model. And we realized that because, as we agree with Chris, any dose of radiation confers some level of risk. There's no safe dose. And because of that we felt that a dose limit is not really an important thing, the really important thing is to reduce doses below whatever limit there are. This popularization, the requirements from that has increased more and more, and at the same time developments where risks appear to be higher on the spikes in Japan than what we had thought first caused us to reduce the dose limits as well. And we developed this system of protection where any use of radiation has to be justified, i.e., more good than harm.

Protection has to be optimized, doses has to be as low as reasonable achievable. Why not technically achievable? Well, if you go to the dentist you put plasterboards, gipsskivor, in the wall to avoid radiation to the public. You can have five meters of plaster boards and you'd still be able to detect some radiation outside that. There comes a time when you feel enough is enough.

44:00
Right, I'm in the final stage with the applications of dose limits. One of the seminal people here was Karl Morgan, a friend of Alice Stewart's and Rosalie Bertell's, who was the person who organized for us to know how to determine internal emitters. And together with a report on external radiation these reports [ICRP Report 2 and 3] that were published around the end of the fifties established ICRP as what was universally decided the leading international radiation protection authority.

Now, one of the problems of course is that we have uneven distributions of radiation, and this was addressed in 1977. We thought at that time that we knew how to weight a whole body dose of uneven distributions. And Wolfgang Jacobi devised the effective dose equivalent which permits combinations of exposures from different sources at different times from external and internal exposures and permits comparisons of different exposures.

And all of this of course is very practically important in protection. The documents up to 1990 happen to be more logical than readable I must confess. Incidentally for the Swedish participants I can just confirm that yes, my cartoons are made by the single mother, “Ensamma mamman”, known to most Swedes of our age.

45:40
The 2007 ICRP recommendations that Chris mentioned, they cover all exposures, including those to other species than man. We still have a lot of work to do before we have a fully functional system but at least we claim that is how it ***. And we have introduced details about something we call dose

constraints, levels of individual dose below the limits in order to focus more on the individual's rights, with updated designs that the overall risk estimates remain much the same as it were in 1990.

During this process, which included a ten year period with two completely public consultations, we got comments, not the least from... not from Chris as far as I can remember but from your friends in LLRC, which compared me and my friends to Hitler, which was interesting. Because not just our documents but also the comments that are put from the public on our documents on our documents, are on this website, so you can see that there is at least one of Chris' colleagues who regards me as Hitler, something I find somewhat revoking with my Jewish heritage.

47:13
The report in 2007 updated tissue weighting factors. I am not going to go through the details, it's just to indicate the amount of science that we produce. Radiation weighting factors were updated. We have new computational phantoms, Chris showed you an older phantom which we used in the past, we now have a much more realistic phantom, based on real fetus, and real human beings, with.... Recall of course that accidents must not happen, which is a human failure problem.

We state that the effective dose that we use is there just for protection purposes. It is not something that is supposed to be used for exact calculations of individual risks. It's there for prospective planning of protection. If you have an individual person exposed then you need to do something else. Likewise the collective effective dose is for protection purposes, for optimization, for comparing options, but not for risk assessment, and particularly not for predicting the number of cancer deaths due to trivial exposures to large populations.

48:30
If you multiply a very small number, i.e., the risk to an individual after most types of exposure, with a very large number, i.e., a large population all of whom are exposed, you get huge uncertainties. So with “our” methodology, some people would stand up and say, the risk from Chernobyl would be 40,000 deaths, while some others would say, no it's 400,000. And we wouldn't be able to say which one is right, that's the sort of error you get. And therefore, we would say it's much more important to focus on the fact that Chernobyl was a tragic accident, it must not happen again. This is a completely different take on the problem.

So basically also we have the problem with collective dose that it's logical in a sense that it equates many small doses to a few large doses. But is it right? No, not necessarily. Think of road traffic accidents where about 500 people die every year in a country like this. And people don't give a shit. But if an aeroplane falls down and 500 people die at one time, well then it is a big problem. So we're not logical in other aspects, and therefore need not be logical in radiation.

The ethics we're basing all of this on is utilitarian at the outset. A utilitarian feels that an action is good if the consequences cause net benefits to the whole of society. And justification and optimization are exactly that.

Chris was using Star Wars, so let me briefly go to, oh goodness, what was the name of Spock and Kirk... yes, Star Trek, thank you. The picture is from a scene where their battleship is somewhere in a problem and some thing's gone arise, somebody needs to be into a radiation area and press red button and die, and this saves the ship. And Spock says, I'll do it. Then Kirk says, no you can't, you'll die. And Spock says the needs of the many outweighs the needs of the few. And this is basically the philosophy underlining the justification of optimization.

However, we also have some duty ethics where we say some actions are right or wrong irrespective of their consequences. Of course dose limits in radiological protection are an example of that. You must not exceed the dose limit no matter what. Likewise these new dose constraints put more emphasis on duty ethics and more emphasis on protecting the individual.

51:33
And actually in the next part of Star Trek, suddenly Kirk said, we need to find the corpse of Spock because if we just pick up the corpse somewhere in this eternal space, then we'll surely make him live again. And people in the ship doubted that. But then Kirk said: the needs of the one outweigh the needs of the many. Or in this case perhaps the many were the viewers of Star Trek who needed Spock to be alive again. I put *** mother there, because we all need to protect our mothers, don't we?

So hopefully you would find the recommendations interesting if you've read them. Now, to finalize, radiation risk, well, what are the doses? We know that Chris doesn't like doses but let's at least know what they are. The natural background dose is 2.4 mSv earthly, half of which roughly comes from radon. The dose from other types of exposure, from man made exposures, is entirely dominated by medical diagnosis.

55:52
Nuclear power has increased over the years of course, the global average dose is 0.0002 mSv but if you live near a plant the dose would be 0.02 mSv. Some of these huge amounts of medical is of course justified, it save lives. I have been irradiated and happy because of it and you too. But there is a 600% increase in the US over the last 25 years. The collected dose due to medical radiation in the US is now just as much as the natural background, and more amazingly, the doses from the use of computer tomography are of the same order of magnitude as the total integrated dose for all time from Chernobyl. Another comparison of course, atmospheric weapons testing much much more than either of these, 20 million manSv.

Of course this comparison is unfair because medical radiation is used basically for good purposes. But imagine that 1% of it could be taken away as unnecessary. And we all know that more than 1% is a waste. That would be the same as removing all occupational exposures, this gives you something to think about.

54:20
And of course lots of doctors perhaps they will not send you to a CT examination just for a common cold. But here's a web site where you can buy a gift certificate to give to your friends so they go through some more radiation

Here is another example, publicity material from a computer tomography machine producer who says, if only you maximize the number of patients, you can take ten patients a day, and then you earn two million dollars in five years. Not the sort of message we would like to send around. But then on the other hand of course you don't want to go to a dentist who is more happy to pull you teeth rather than take an X-ray of them.

You might say that I put too much emphasis on medicine, it is not to say that Chernobyl is a small matter, it is to say that we have many different problems and I think medical misuse of radiation is also a big problem.

The effects of radiation as we heard are basically in the DNA. DNA can be repaired such that there is no effect, this happens most of the time, all the time. I'm radioactive, you're radioactive, 5000 disintegrations every second in my body. Most of them repaired, of course. The cell could die, and if many cells die you get a hole in your body. And basically this can kill you if it is a nasty hole. And then, the worst part is if the cell survives but is mutated, which case of course you can get a cancer or genetic effect.

56:00
Our basic assumptions are that high doses are needed to get these deterministic effects but that all forms of dose can give you cancer or hereditary effects, and we believe that a linear no threshold model is suitable to talk about the possible effects. If you look at the whole of the dose range, obviously, if you have high doses you can get more than linear effects. If you have this area, we extrapolate a linear no threshold model. Chris doesn't like that because he feels that in this area there are higher risks. And I think, if I understand you right, that you wouldn't like me even to use the term dose because of the other type of effects you talked about.

Some other people talk about thresholds which make this area completely safe, and some people are even talking about hormesis where they claim that it's good for you to be irradiated with low doses. So there are all sorts of people...

XX: [Question about deterministic vs stochastic effects]

JV: Deterministic is when you get a burn, when you get a hole in. because cells die. Stochastic that's when you randomly occurring cancer or genetic damage.

The health effects we're talking about, well, if you have a high dose, then certainly you can see both radiation sickness of this kind, and cancer, and you can determine at these stages that there is a direct relationship between the individual person's death and radiation.

And this is what Abel was talking about, what ICRP, and Abel Gonzales and of course also think is that we're absolutely sure that there are many many cancer cases where you can prove that there are cancer cases, that there is an excess, but you cannot prove for a specific individual that this person got cancer simply because of radiation. And to claim that Abel would not accept this is falsification, you can't say this kind of thing, people won't listen to you. I believe honestly that you have important thing to say. Don't waste time on such silly comments when you can talk about the technicalities, well perhaps you could convince us that some of our ideas are wrong.

Then we have a really low area where we still believe because of biological reasoning that there is cancer due to radiation but where we cannot even prove the existence of these cancers. It's just because of logical thinking.

So the probability coefficients that we are working with are at this moment in time 5.7% for the whole population, and a little less for adults, as children are more sensitive. It used to be slightly higher but we state very clearly that of course there is uncertainty, so when you're using these numbers for protection purposes the overall risk coefficient of 5.7% is appropriate.

So are we underestimating the risks? Well, that depends whose eyes you're looking with. It pleases me that at least I'm not at the end of a scale.

59:51
So where do we agree? Well, I don't think that we have any discrepancy when it's about deterministic effects of high doses. When we talk about low doses from external sources there are differences but not huge ones, like interpretations of epidemiology, assumptions about repair, non-targeted effects, modeling for genetic risk, whereas, as pensioner I can say that I personally believe that ICRP has overdone it a bit, that the risk is a bit higher there because of certain assumptions that I think were wrong.

The exposures from intakes are more complicated, we agree about that. There's variable duration, there's heterogeneity, there's uncertainties of a lot of things, including the photoelectric effect that Chris has been talking about here. But there are also some areas where we disagree.

First of all the concept of dose where we feel that the model we're using is actually useful for radiological protection purposes. You calculate the intake, you add by kinetic and dosimetric models which I believe Chris would agree with. You get the absorbed dose, you weight that with radiation and tissue weighting factors to get an effective dose, i.e., the dose that would apply to the whole body. And our position is that no better alternative exists, and the averaging implicit in dose is acceptable for protection purposes.

Chris some years ago suggested what he calls the second event theory that binding of Strontium in DNA causes a type of overburdening of the repair system. It was a brilliant idea but it is as far as I've been told by people who understand that better than me mathematically incorrect. The photoelectric excess effect we talked about. It exists but the experts that I've been talking to are assuring me that it is nowhere near as big as proposed by Chris.

We feel that epidemiology supports the use of dose for internal emitters if we look at the nuclear workers. If we look at radon, which is consistent from miners and residential ***, and where you get similar doses both from epidemiology and dosimetry.

If we look at thorotrast, a radioactive contrast medium that was used many years ago, if we look at plutonium. So we think that there is a burden on our back but we can still perhaps do this correctly. Thank you.

[Applause]

1:02:40
MG: We will take a 15 maximum minute break and get back for an interaction and questions. Thank you. Oh, by the way, we will bring on some music, that music has been made by Chris.

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Part 2: The debate/interview between Chris Busby and Jack Valentin

MG: …more questions from the public. If the two speakers would like to ask each other questions for a few minutes. Any hands up from either of you?

CB: Oh yes, there is a whole list of questions that I would like to ask Dr. Jack, Dr Valentin, Jack, I want to talk to you about. It is very rare, I have never had the chance to sit face to face with such a key person of an organization that I have been consistently attacking for 15 years. So in the kindest way

possible, and without any hostility, I really do want to try to get to the bottom of where you're coming from, and how you deal with this mess, with this question of radiation risk.

Because I did notice in your exposition, and a lot of that I disagree with, but I don't mean to go there. But I have some concerns. The first thing I notice in there was the, you said that the ICRP themselves take the evidence from the UN, is that true or do you take your evidence from all over?

JV: Yes, to both of these, because I could say the most important single source is the UNSCEAR. However that is basically a Reader's Digest of radiation biology and radiation physics, so it comprises a lot of different summaries. In addition to that we look at other organizations like BEIR in the US, and of course a lot of national institutes like RPP, HPA now which you don't like, the IRSN that you perhaps don't dislike quite as much if I understand you correctly, and several other such organizations. We try to look at the information from many sources.

1:05:02
CB: Right, because this leads me to the question why you do not look at any of the sources that we address, and the sources that we regularly quote. So there has been, like you say, an iron curtain if you like, between the ECRR, or what used to people who now become ECRR, and the ICRP. And there's a very large amount of evidence in the peer review literature and of course outside of the peer reviewed literature, what we call gray literature, and indeed the the European Commission. The European Union have said in many documents that, and WHO too although they probably do not believe it although they say it, that one should look at all sources of information, and as scientists you should look at all sources of information, you can give them different weightings. But the fact is that you have never cited any one of the articles which falsify or argue that your levels of risk are out by an enormous amount. Why?

JV: This puts me in a slightly difficult position, of course, because I tend to agree with you that we should have quoted some of your stuff, and of course since we do not believe in a lot of the things that you're saying we should have said why we don't believe in that, but I tend to agree that ICRP should have done a better job in reacting as it were to some of your stuff. And of course, I'm not a civil servant. If you got the scientific secretary of ICRP, you press a button on its back then and it says what it's supposed to say. Now I am retired and can say, yes I think so.

But by and large I don't think that there are too many people who are greatly impressed by the evidence you're giving. I think it would have been much wiser in that situation to state more clearly why we are not impressed as it were, and thus also giving you a chance to come back again and say this is why I think you are wrong and so forth. Because that is of course the way forward to make sure that we, well if we do not agree with each other, but at least I agree with you that we should at least understand why we do not agree with each other.

CB: For example this book here was published in 2006, and prior to that the CERRIE Minority Report was published in 2004. And both of those documents, and this one certainly, has hundreds of references from the Russian language literature which show extraordinarily enormous effects from radioactivity on genetic damage in plants, so it can't be radio-phobia, in fish, which can't be radio-phobia either, an enormous document here with evidence which has been entirely ignored, and it's not mentioned in any of the UN or the ICRP or the BEIR documents which you must surely concede people would think are driven by biased scientists who want to sustain the idea that radiation is what you say.

1:08:15

JV: I have already agreed that it would have made more sense for us to quote more of your stuff. With us I do mean the mainstream community, not just the ICRP, not UNSCEAR, BEIR and such like. I don't know what more I can say. We're not talking here about individual results, because for most of them I believe some of my colleagues will come up with various technical comments. But the philosophical idea that we ought to comment more about your work I tend to agree.

CB: Ok, well here's another question. Why do you think there are childhood cancer clusters near nuclear sites, does this not in itself falsify the model?

JV: I am sure you are aware of that there are also studies that can show that there are clusters of leukemia around nuclear power plant sites where they never built a nuclear power plant.

01:09:10
CB: Yes, but I'm sure if you've read any of our information, you know that those data are confounded by the fact that the places where they are going to build the nuclear plants are on coastal areas which are contaminated by radioactivity or levels of high rainfall.

JV: Well I, if we're talking confounders that is the main types of criticisms that we have with all of your epidemiological studies. You don't have sufficient controls of the various biases which can be very large in some of these cases. ICRP does not have an official position on this, of course since we have commented specifically on this I can only talk as a person involved in the ICRP, but I know that people within the ICRP say in their discussions. But in principle people do not agree with your epidemiology. We can show numerous examples of other epidemiological studies where you get quite contradicting results of lower cancer risks, but the most famous one is of course Bernard Cohen and radon, you must be aware of that he shows very clearly, and falsely of course, a health effect of radiation.

CB: Yes, I do not need to go to Cohen and all that stuff, we would be here forever. But these arguments about confounding disappear in the case of the infant leukemias after Chernobyl. This is surely something that you cannot possibly support in any argument whatever, as these children were in the womb at the time of the Chernobyl accident. They were reported by five different groups in different countries in peer review literature papers. And taken together they must show that the levels of exposure that existed, microSv exposure, you have a statistically significant excess of infant leukemias in those children, now how can you possibly explain that?

01:11:20
JV: I can't but on the other hand I do not think you have enough explanations either. I honestly don't think that you can convince me that you are right. But we return to technical arguments where we would have had to sit with the papers in front of ourselves, send each other emails, send each other reports, go through the arguments, slowly but surely. And wouldn't that be a clever way of continuing our discussion between the ICRP and the ECRR.

CB: Well yes and no, but I can tell you one thing, we wouldn't be here tonight if I hadn't been throwing rotten eggs at you for 15 years. I mean it's only a result of bringing pressure on you people by chaining myself to nuclear power stations, writing in the literature, playing songs on the banjo, and using every possible method available to draw to the attention of the public the fact that your risk model is bankrupt. Otherwise we wouldn't be here.

01:12:18
JV: Are you sure that you wouldn't have had more success if you just come up friendly-like and talk to

the people at HPA?

CB: Come on, I've been in the CERRIE committee, I've been the depleted uranium oversight board, I never had these people work. You know, the skullduggery and the kind of shenanigans that went on in those government committees just are all written about. And maybe you have read them, or maybe you haven't, but they're in all the books that I've written, and probably they're all on the internet as well, and those things happened. I mean, one of the secretariat of the CERRIE committee actually resigned, this is a nuclear industry woman, Marion Hill, resigned with a letter arguing that the CERRIE committee chairman and secretary were biased.

JV: I know that Marion retired, I know that you are very unhappy with Ian Fairlie, who of course was "in your camp" the other secretary member. I have heard many stories from CERRIE too, not all of them very favourable for you. But somehow, it's the wrong thing to work about who did the wrong thing at that time. Can't we look forward, and how can we be more constructive instead?

CB: Yes. I agree. I have been asked to ask you this, and I think you have already given the answer but I would like to give it again. Can the ICRP model be used by governments to predict the consequences of a nuclear accident in terms of cancer yield?

JV: I think basically no, because the uncertainties are too large. Now I think the uncertainties we are talking about would be in the order of an order magnitude, I think you talk about two orders of magnitude, and therefore we have a difference. But I think the order of magnitude that I'm talking about is enough to say that it's not useful for that sort of prognosis.

CB: Well what's the point of it then?

JV: You get an upper limit of course. You think that your worst likely number of cases would be X, that ten times X can be excluded.

1:14:45
CB: Ok, ok, ok. But then that means that it is useful, assuming that you've got this range of, I mean I'm talking now formally, would the government be formally reasonable in employing the risk model of the ICRP to calculate the risks, the cancer yield from some hypothetical explosion at Barsebäck say for example. Even if they could then say, well you know, on the basis that it might be ten times though, is that possible? Formally?

JV: I think that it would automatically be misused by both camps, and that therefore it is not... You don't do it like that, you look at individual doses, the highest individual doses and calculate which is the sort of area where people should not live, the sort of area where you would special need of quick evacuation in the case of an emergency and so forth. But these number exercises, I think it's just silly. It serves no good purpose whether you're in your camp, or in a pronuclear camp or an ICRP camp.

CB: Well in this case I am in a political camp, because as you may know I was science policy leader for the policy information network for the EU. And these are questions that the politicians want to know the answer to. When you decide to build new nuclear power stations or repair old ones or you have any policy relating to nuclear. One of the questions you need to ask yourself is what would happen if something went wrong, and therefore they need to know, they need to have some sort of model. And at the moment they are using your model. Now, are you saying that they should be or that they shouldn't be, I think you are saying that they shouldn't be using your model, they should be using no model at all,

it's guess work or what?

JV: Well I certainly wouldn't say that they should use your model, because that would be...

CB: It would give the right answer.

JV: No, it would in my opinion give the wrong answer and at large expenditure which would not be sensible and which could have been used to save lives in other respects.

1:16:58
CB: Ok, here's one more question. The draft ICRP, you remember you said it was put up on the internet as a draft for people to make comments. Now that draft actually contained a statement which said that for some internal exposures, or for many internal exposures, the concept of absorbed dose concept was invalid, was not valid. We would agree with that of course, and maybe you would as well. But it disappeared in the final report, it is not in the final report. Why?

JV: Well, in fact in the annex, the biological annex, there's a whole section which talks about the difficulties. I don't know why this specific statement disappeared, but surely the person who reads these paragraphs in the biological annex will be able to see that there's a huge uncertainty.

CB: Well, I don't think we're talking about huge uncertainty, we're talking about the inability to use absorbed dose for internal radionuclides.

JV: As you have seen the ICRP position is that it is possible to use it although with large uncertainties.

1:18:14
CB: What do you call a large uncertainty?

JV: What do I call a large uncertainty? Well, certainly two orders of magnitude is a very large uncertainty.

CB: So it could be an error by two orders of magnitude for certain internal exposures. Then we agree?

JV: I would hate for you to go out and say: Jack agreed with me.

CB: Well, I need to have an answer.

JV: Then the answer is: I don't agree with you.

CB: But you just said two orders of magnitude?

JV: Yes, but I am sure you can find an exceptional case, a specific case where there would actually be that sort of and uncertainty. Remember it can also go in the other direction. And I'm sure that you can find in most cases uncertainties with are less than one order of magnitude which I would find normally. If we look at the existing evidence I don't think you've got enough evidence to prove your case.

CB: The existing evidence is 3 orders of magnitude. If we take the child leukemia clusters around nuclear sites, we're talking about 3 orders of magnitude.

JV: Well that's what you are claiming on the basis of a handful of cases.

1:19:30
CB: I'm claiming that on the basis of the German study, the Aldermaston study, the study at Sellafield, the study at Harwell and numerous other studies. The only answer which you've given to me is that they found minor excesses of leukemia in an extremely biased and rather stupid study done by Richard Doll, in which they were looking at particular studies along the south coast of England where there was already pollution as a later study by Alexander et al showed, associated with contamination of the sediments nearby.

JV: Just as an aside, let's not throw too much rotten tomatoes at Sir Richard. Sir Richard, just to let everybody know, was the person who took on the tobacco industry by proving that tobacco causes cancer. He was the person who proved that there is a radiation risk even after the lowest dose by looking at radiologists. He was the person who first told Alice Stewart that her early results didn't prove anything. And then said to her, which she never liked, that, he actually said to her very clearly "now that you've changed your analysis I agree with you." And he stood up in public to say that. He's the person that who has actually been awarded by the Swedish Academy of Sciences their gold medal for radiation protection. I think you can't really say that he would be biased by the nuclear industry.

CB: I am afraid I shocked up Sir Richard Doll to the Danish committee for scientific dishonesty in 2004. So I've already said that and I can back it up with numerous documentation too. Richard Doll might have been doing some interesting stuff in the 1950s but later on he became very much an advocate of the nuclear industry, and was one of the main people behind these population mixing stuff, and he never believed that the Sellafield leukemia was caused by radiation.

JV: And neither do I though surely for different reasons.

CB: Ok, well, we have to open this up to the audience at some point I think. I just want to say about your ethics. I think that anyone is interested in this, the ethical position of the ECRR is quite different from the ICRP. The ICRP ethical situation is a very outdated system called utilitarianism which was developed by Bentham and John Stuart Mill. And basically with the utilitarianism you can have a slave society because the advantages of the many outweigh the advantages to the few. We believe in human rights, and we believe that you have the absolute human right and the integrity of your body and the decision to refuse to allow it to be contaminated by radioactivity. And that's a fundamental human right, it is a UN human right.

01:22:09

[Continued on http://vimeo.com/15398081]

00:40
JV: It is indeed, however societies also have rights and you always have the problem of balancing the individual vs society, and as you see we also have a duty at these, which is expressed in the terms of dose limits and which we have strengthened with dose constraints. And you cannot escape some amount of utilitarianism.

CB: Ok. I think that I should now give a bit of time to the audience, and I've have thrown all the tomatoes that I intend to throw.

…

Part 3: Questions from the audience

XX: ...philosophy, but unfortunately one tried to repeat these experiment, we wrote about it, and I can say that I have tried to see what has happened since then. And they have not been able to repeat these experiments showing that heavy Auger electrons were much more harmful, but maybe there have been experimental faults in it but it was real experimental work on mice and very puzzling to me still why it has happened so that they are not able to really show that Auger electrons emitters are more harmful. They should be, they go into the DNA and they might be so but still no answer on it. I just tell you that there are things that has not been resolved in the radiation protection area.

02:28
CB: Well we talk about Auger emitters, yeah? Ok, well, we considered Augers emitters in CERRIE, and nothing ever came of it, because nothing much came of CERRIE but in the ECRR we put a weighting on Auger emitters, so they carry a weighting. This is what the ECRR does. The weighting factors that the ICRP use which are weighting factors of ionization density which they add to alpha particles, we also add to Auger emitters, and they will get a separate weighting if the Auger emitting element binds to DNA, because obviously if you have bound to DNA and Auger emission you will get twice the effect. So that is included in the ECRR along with a lot of other things that the ICRP model don't include.

JV: I am aware of that there are different studies pointing in different directions and I can just confirm that Auger electrons are on the table for discussion on almost every meeting.

CB: But nothing gets done?

JV: That was an unnecessary comment.

03:29
CB: Well it's nevertheless true, wasn't it Jack. You know, these people, I get irritated by this endless, endless sort of, you know, prorogation.

JV: As long as you get opposing results from different studies it is very hard to recommend something which makes a great difference in for instance nuclear medicine.

CB: Yeah, ok.

RR: Roland Reinholdsson, NGO organization SERO, Swedish renewable energy organization, and I will ask Miles to translate my question into English.
...
Efter Tjernobyl så har man fått väldigt små skördar, minskande skördar av frukt, och man har fått minskande antal insekter, bin och flugor och så vidare. Och samtidigt så ställer jag mig frågan, har det här någon betydelse när vi ser att ett av de stora utsläppen från våra svenska kärnkraftverk är radioaktiva gaser. Vi har haft väldigt mycket utsläpp av tritium, visserligen har de inte så stor påverkan, från läckage i turbinerna i Oskarshamn. Men vi har andra utsläpp av Krypton-81, Krypton-85, vi har utsläpp av Radon, Xenon, alla dessa radioaktiva ämnen med 14 nollor efter, utsläpp som varje år adderas i naturen. Kommer det att påverka våra insekter eftersom de har en väldigt kort livscykel?
[After Chernobyl there are very small harvests, decreased harvests of fruit, and there is a decrease in the number of insects, bees and flies and so on. And at the same time I am asking myself, does it have

any importance when we see that one of the large releases from our Swedish nuclear power plants are radioactive gases. We have had very large releases of tritium, though they do not have so much impact, from leaks in the turbines at Oskarshamn. But we have other releases of Kr-81, Kr-85, we have releases of Radon, Xenon, all these radioactive elements with 14 zeroes after, releases that every year is added in nature. Will this affect our insects due to their short life cycles?]

05:30
CB: Ok. There have been many many anecdotal reports similar to yours, and in this book here there is a lot of evidence that the radiation from Chernobyl affected the entire animal kingdom in the areas where the contamination was. So the answer is clearly that around nuclear sites there will be similar effects. There was a study done in Plymoth of the tritium released from the naval dockyard there, which showed that the developmental and larveal stages of a number of marine creatures, invertebrates, were affected by tiny doses of tritium, the effective doses were well below 1 mSv. And tritium of course is of concern because it is beta emitter with very short range, very low energy beta emitter, so for 1 mSv of radiation from tritium you have lots and lots of hits, lots and lots of tracks. And this may well be the reason, but of course it's just, you can't wait.

JV: Well, not just perhaps. Let me take another take on this because, it's known already since the 60's in experimental systems if you irradiate populations of fruit flies generation after generation, they actually produce more flies, more unit by mass per unit food put into the experimental system, which proves of course a fact which is not all that nice, it proves that radiation causes mutations and for a population, the population might actually be served in certain circumstances by a high mutation rate but of course it is at the cost of "suffering" for the individuals, because many of these mutations will be useless and harmful. So there's no question of course that radiation causes genetic mutations. These might be bad for individuals, they are not necessarily bad for the population. And if you now go to Chernobyl, of course there's quite a lot of wild life, there's quite a lot of plants and animals living there very happily. And one of the major disturbance factors has gone away, this is the people who lived there.

MG: We are all mutants.

08:10
AW: My name is Andrej Wojcik, I am from the Stockholm University, I am a radiation biologist since 25 years, I am the vice president of the European Radiation Society. I do not belong to any agency, I am not associated with either UNSCEAR or the ICRP or any other radiation protection authority, I'm a researcher.

It's more like a comment that I would like to give. I think I know the literature related to the problems of low dose exposure, because I have worked with effects of low dose exposure. For every publication that you've showed, for every evidence you that you showed, I could show two other papers, for example from the book of Don Luckey, about hormetic effects of low levels of radiation. As you mentioned we could throw at each other papers showing quite different effects, and nothing would come out of it. And you see, you have been talking a lot about childhood leukemia, the German study, this newest case control study which was published, the so called KiKK study. The problem there was that they found, there's no question, they found a cluster of leukemia around German nuclear power plants, but it was certainly not due to radiation. There are other factors that cause childhood leukemia, there has been a number of studies, not only in England, not only by Richard Doll, showing that there are clusters of leukemia around nuclear power plants that were built, also around other large industrial entities. With respect to nuclear power plants that were never run, that were never operated. And we

simply don't know why these clusters arise.

The situation in low doses of ionizing radiation is very similar to electromagnetic fields, to the question of healthy food or not healthy food, the effect of food on cancer, the effect of sunlight...well sunlight is clear, but, yes electromagnetic fields I think is a good example. The effect that you talk about of ionizing radiation in the range of up to a few mSv are so low, just like electromagnetic field, just like factors in the food. They are so low that you cannot repeat them up. And there are so many other confounders that influence the results of the study that it is basically impossible to say from at least the epidemiological evidence it is not there, and it will never be there, because the number of people affected are too low to give statistical power to these studies, you would never be able to show that radiation in the low dose region is harmful.

You have mentioned Chernobyl. Well, these studies that you talked about, about childhood leukemia after Chernobyl. There are quite a number of studies showing that this is not true. With respect to life expectancy, in Belarus, Ukraine and Russia, it has gone down by ten years, approximately, and this is due to the collapse of the Soviet Union, the collapse of the medical health care system.

CB: How do you know?

AW: Because I come from Poland, I know how it looks like.

CB: You cannot know these things.

AW: Oh, yes. There is a major report published by the WHO about the effects of Chernobyl, where all these factors are mentioned. I really don't see why WHO should be biased.

CB: You must know...

AW: No I must not know. I am a serious scientist.

12:10
CB: Well I find your remarks very interesting because I hear this a lot. Because you believe you know you are right, and your mind is closed to the evidence. You tell me, you say that the statistical power of studies, epidemiological studies, the statistical power is too low to determine whether or not there are low dose effects or not. But you can only say that if you already know what those effects are. Do you not see this, I mean, can you not see that the vast pit into which you have fallen there? Because in order to say that the statistical power should be something you have to have a risk factor to begin with, to know what the numbers of people that you are going to find will be. And therefore you are using the risk factor which we are attacking in order to generate the statistical power which you then say doesn't exist. It's just bad science I'm afraid.

Now what I'm saying you should do, and maybe you say you mustn't do anything, because obviously you know the answer, but what I would invite you to take that video, there's a DVD there, which you can have. You can play it on a DVD player, it is quite entertaining. And it shows a Swiss television documentary about a most important meeting in Kiev about the Chernobyl accident. And in that video you will see two people covering up the effects of the Chernobyl accident on camera, on camera. So I invite you to have a look at that. And when you wonder why I get irritated and why I say the things I do it's because I continuouly having to face people who believe that they are right on the basis that they are scientists and therefore they feel superior to everybody else.

14:00
AW: You see, research is not based on looking for truth, research is based on finding correlations between facts and for this we have certain mechanisms. There are statistical mechanisms to evaluate the power of studies, and the way how to perform studies. When I hear you say that you have been going around knocking on people's doors and asking if they got cancer, I'm sorry but this is not serious science.

CB: Why?

AW: Because it proves that you are from the very beginning biased.

CB: Why is it not serious? Are they going to say that they have cancer when they don't have cancer?

AW: No but because they...

CB: Why would they say that they don't have cancer when...

AW: It is exactly the same like when you look at the effect of mobile phones. You talk with people and you start to collect data based on what the people... They experience harm from using mobile phones because they have head aches and this is a proof for the dangerous effects of electromagnetic fields. I don't claim that people have no head ache. Of course they will have head ache, but this is not a reasonable way to approach the problem. It is not reasonable way to go to people and knock at the doors and ask whether they have cancer in the household, in the family. And even for the simple reason because you will no be able to get an appropriate control group by this approach.

CB: Well, you are wrong, we can talk about this afterwards but you can get an appropriate control group.

MG: I'd just like to say that we have to be out of this room by 4, so I think we will take a break at quarter to, and then...

15:47
BC: My name is Björn Cedervall, I am a medical radiation biologist, I have been in the field for about 35 years. And various independent institutions and so on. I have three points I'd like to comment. The first is about the risk factor, five percent fatal cancers per Sievert as Jack said, and this number comes from survivors of those who received doses at Hiroshima and Nagasaki. And that's a very unfortunate event of course in the history, but that's a major event of available information of what you can get from very high dose rate exposure.

So what else could you use when you discuss the statistical... If we take for instance the German study you would need of the order of ten million children in order to be able to see if low doses cause those cancers in order to detect an increase in cancer.

Now there's another way of looking at childhood leukemias, and that is, you said, Chris, at the end of your talk, this about population mixing stuff for example like that. I think this is very important, you should all listen to this very carefully, because if you look at the literature, what people are doing to understand why certain children get cancers and in particular from common *** one called ALL, Acute Lymphatic Leukemia. It turns out that there are a number of other associated factors, associated

economic factors, population mixing stuff, infections, there is a lot, it's been suspected for 250 years.

Now there is definite proof that some viruses, these are DNA sequence-specific so we know exactly what these viruses are doing. Some children obviously get these infections during pregnancy when the mothers are pregnant. And these cause specific transmutations which is rearranging the chromosomes and so on, we understand what happens.

Now, we're talking about so called relative risks, the German study, it tells about a factor of 1.4, 1.7 or something like that depending on how you interpret it, but also that is at one of the nuclear power plants in Germany, Krummel.

There are other correlations with higher risk factors, they are not 1.5 but rather 4 or 5. And the strongest correlation I have found in literature is for Californian children eating hot dogs, and those who get more than 12 hot dog meals per month have a 480% increase which is a relative risk of 5.8. Increase in ALL, yes. I am not saying that hot dogs are causing the ALL but they are probably pointing at averages of poor economy and all that. There are other things like living near waste dumps or near highways and so on.

So there is a complex world and if you want to understand it you must go into the literature and look at this. It was not only Richard Doll came up with population mixing, there was a number of other authors.

The last thing I want to say to put some perspective into this. Jack, you mentioned the fruit flies, that was published about 40 years ago. And that experiment, they gave fruit flies, bananflugor, the equivalent of 60 Gy, which you translate into gamma radiation to people would be like 60 Sv, an enormous dose. Many generations they gave this, they followed them for two years. They repeated the experiment three times and and got the same result each time. I am not saying that radiation is good for you and that you should improve every one by irradiating them, because there are other factors too which I can't go into. But it tells something about the proportions, these 60 Gray.

Now, how much do we get in Sweden from all the nuclear power put together? Radiation-wise, we talk about 10 manSv. That...computerized tomography in Sweden gives us today about 3500 manSv per year, those are some relations and perspective.

20:44
CB: I don't think you were listening to my talk about dose. All of you and the previous gentleman that was talking have been using dose as some meaningful concept. You ask what different experiment that could be done. You say that on the basis of the risk model of Hiroshima that even...

BC: It is not a model it is a fact.

CB: No it's not, it's a model I'm afraid. The model is associated with taking a risk to Japanese survivors and transfer everywhere...given an enormously large external dose of gamma rays and using that as a model to look at the effects of people who were given doses of internal radiation, from Sr-90. Now, that is not scientifically valid however you put it. There is no scientific philosophy that would enable you to extract the experiences of people who were exposed to a single large acute dose and to convert that into chronic internal dose to substances that bind to DNA.

BC: ***

CB: The reason that you can't do that is quite straightforward and absolutely rational, is because you are talking about ultimately the density of the ionization of the DNA. And that is not going to be the same as this Auger gentleman was mentioning earlier. This is not going to be the same for a substance bound to the DNA which is kicking electrons into the DNA

BC: I was not talking about that. ***

CB: You are, because you are talking about absorbed dose, external acute radiation. I'm sorry, the external acute radiation exposure of the Hiroshima survivors is the basis of the risk model that Dr Valentin and his bunch of people are using to predict the effects of internal radiation, and this is not scientifically valid.

Allright, I have one other point while I'm at it, and that's the other guy who was talking about mobile phone controversy. Ok, let's go there. Now, actually it is not about whether people think they might have had a headache once they phoned their friend on the mobile phone after somebody asked them in a questionnaire. No, it's about studies like studies by Olle Johansson at your Karolinska Institute who showed slides at the Royal Society when I was there last year, showing the damage to skin tissue from exposure to normal radiofrequency radiation from a mobile phone which was identical to the damage to skin tissue from fairly large doses of ionizing radiation.

Its also about acoustic neuroma studies which show that people who get brain tumours in their brains, following the use of mobile phones always get the brain tumour on the same side that they hold the mobile phones whether they are left handed or right handed.

So I am afraid there are ways that you can do studies that you may not feel are accurate or valid scientifically but which yet give the correct answer.

MG: We can give the gentleman a short response if you like.

23:55
BC: Ok, I just want to say one thing here, very clearly. I refer to external acute exposure. I have nothing against a separate scientific discussion about particle radioactivity and internal contamination and so on, but that's another discussion. But I don't like to get rotten tomatoes thrown at me about something that I did not say.

CB: Allright...

BC: I compared external gamma radiation *** with internal gamma radiation ***. And most of the radiation we talk about, for instance exposure at the nuclear power plants...

CB: No!

BC: ...it's not, but if we talk about at the nuclear power plant it's not about the internal emitters...

CB: It is. It is about internal contaminants, it's about...

BC: We have our dosimeters and they are sensitive to gamma exposure.

CB: The cause of the childhood leukemias near the nuclear plants it's the external and the internal radiation from the releases from the plants, that's what they are saying. But what I am saying is that all of these topics which I put up here are about internal are about internal radiation from releases from the plants. The Sellafield...the leukemia all along the coast of Sellafield and all along the Welsh coast and all of these discoveries which I made from the epidemiology. All of those are due to exposures from internal radionuclides. I agree with them about external radiation, I don't have a big argument about external radiation.

If external radiation was as dangerous as I am saying internal radiation is nobody would ever come out of a hospital after having an X-ray, they would have died long ago, they would have just fallen down dead as soon as they get from the X-ray.

I don't have a problem with external radiation. External radiation, there is a particular number of ionizations per cell. I mean, we can calculate what it is. You can take the number of MeVs, you can divide it into the number of ionization events and you can say the density of ionization events is so many events per cc. You can do that. But if you stick a piece of Uranium there or some piece of Plutonium or some other piece of crap that produces this radioactivity intrinsically, then you get much much higher doses. I mean, one alpha track across the cell will give half a Sievert, one alpha track, and will probably kill the cell.

Now what is happening when you put a particle in there, which is solid Plutonium, or solid Uranium, which is producing all these beta emissions from photoelectrons and so on, you get a very high local density of ionization. And that's the concern that I have that this external risk model doesn't represent a proper assessment of the risk from that kind of exposure.

MG: It's now quarter to two. I'd like to continue to two. If people need to leave, please, feel free to do so.

26:48
JS: My name is Johan Swahn, I work for this...nuclear waste issue for the MKG organization. I am a physicist to start with, but I have worked mostly on policy issues, in nuclear policy for a long time. I did somewhere...it wasn't working. But I've done some studies of radiation physics when I was at the university.

What I found is interesting is that exactly what you Chris were mentioning now, the difference between internal radiation and external radiation, and I understand the controversy. My thinking about this on an almost intuitive level, a scientific level, is that mankind has been exposed to natural radiation, Potassium-40 for example for a long time. And those particles have been a part of our evolution.

Now when we insert artificial radioactive particles, they might not end up in the body in the same way as natural radiation. Is this something that is being studied? I ask both of you actually about this, because maybe we are looking for some sort of understanding why it could be that internal radiation is perhaps more dangerous than what we thought about before. It can be likened perhaps with the chemical issues where we think that artificial chemical compounds are more dangerous than natural compounds. It's not necessarily true, but it can be. Sometime it is very true at least. Could it be that artificial radioactive particles or radioactive elements have a different function in our bodies compared to natural ones?

MG: Should we let Jack respond to that first?

28:59
JV: At the level of something happening within DNA I would say that there's no difference between artificial and other radionuclides, but of course, one thing is clear. This is pointing to the fact that some material binds to DNA and of course the doses become different in that case. We have been talking about alpha emitters where you get a completely different dose than if you have gamma rays. So, of course there are differences although not at the level of DNA once the ionization happens.

CB: What I would like is for the ICRP or for some government to point me to head of a committee of young clever mathematicians, physicists, physical chemists, biologists, to investigate this exactly because nobody has looked at this very closely, no. That's the answer.

The only book that I have found in existence is a Russian book, the Russians have been reasonably interested in this up to some point in time. And they produced a report in 1972 which began to look at the effects of internal radiation, but they said that there was a lot more to do and as far as I know nobody has done it. That is to say nobody has published anything about it. Now this is quite a different matter whether somebody has done it or whether they have published something about it. I mean there are a number of communities that do research, particularly the military community, and it could be that they have done the research and they just haven't published it because it would be too embarrassing to do so.

30:41
JC: Confusion? In case of nuclear accidents, confusion is one of the most important and most lethal and detrimental factors when the authorities are to master the consequences. I am John Kristiansen, consulting engineer.

After the Chernobyl accident or disaster, the Stockholm county council asked me to instruct them very quickly about radiation and what the consequences would be and what to do. And that's what I do as well as I could. And thus I became aware of the risk of confusion. And taking part in the conference for instance by IAEA on the consequences to society of radiation. This was confirmed very expressively by the reporting from Chernobyl, for instance by the doctor ***.

Confusion, and what is the main reason for the confusion? The units! The system of units used is a terrible system of units. It is contradictory to proper principles of systematic of units. And I shall take the liberty just to quote a phrase or two from the paper that I presented to the conference. “Poor argo and violation of epistemiological definitions and principles, pair comprehension and statements about ionizing radiation and abolishment of the Gray and Sievert is one of the suitable measures I find to be urgently needed.” I shan't go into detail but I take the pleasure to present this paper to Dr Busby this paper. Dr Valentin has already...

33:20
RvM: After this Chernobyl accident I got hold of a Geiger meter. It was only one place in Europe I found any for sale. They were all sold out, I phoned all around Europe, Italy, France and everything. I found five in England and two were bought for Sweden, one I went around with myself. And the alarm was set at 20 counts per second which was to get out of a German laboratory and have it sanitized, that was 20 that level.

Still one year after Chernobyl inside and outside in Stockholm the level was over 20, so the alarm always went on when I put it on. But what surprised me was that the numbers we got of the radiation in

Sweden was always measured one meter over the ground, all over Sweden. And I think that's because of this controversy. Because when I went down on the ground, if I had 20 in the air, it would be 600 or even under... in Stockholm under the pipe coming from the roof it was 3500. And I put it through the X-ray machine in Arlanda airport and then it only went up to 1500, so the radiation under the drain pipe from the roof was the double of this X-ray machine.

So the numbers which was presented to the people all around Sweden was taken at 1 m height and they were not looking at the ground. But when I went there the levels would go up because...and I would breath these things in, people would eat it and drink it. And I think this is controversial, in Sweden we were used to have the radiation in the rock, but people don't eat and breath very much rock. And this was completely new dimension and I think that this is the controversy which we have to...the reasoning probably was that a person is on average approximately 2 m high, so the radiation from the rock that reach a person can be measured from 1 m height. But this was nonsense measurements on the effects of Chernobyl and it seems that this controversy that you have is explaining now exactly the problem I was wondering, why the heck do they not tell us what's there on the ground? So is this? Does anyone of you know why they measured 1 m from the ground, was it the conception that you could compare the stuck radiation source of the rock with what we was breathing in?

33:24
JV: But you don't breathe the soil area, you don't eat the soil area. You breath air which is near your nose, as it were. And there are lots of reasons for why you do these measurements this way. I am not prepared to go into the details but it is not a way of trying to hide anything from anybody, it is a way to try to get comparable measurements to be able to calculate deposition in a sensible way. And of course there were other measurements which were presented to members of the public all the time, for instance the level of contamination in grass. And if you didn't see them I am sorry Sir, but there were measurements of the level of contamination in grass which were published all the time.
37:14
RvM: But there were also measurements which...from Swedish officials that were measured on Sergels Torg which were published by...Siemens had the results and Germany could read it, but in Sweden, when journalists went to the radio or television they got a pink paper that this was dangerous for the public to get nervous. And nervousness of the fear was more dangerous than radiation. so it was with... You would go to jail if you published the facts. This was the crisis in the Swedish...

CB: Ok, this is very interesting because what we have here is a scientific experiment. Now, the gentleman in the back would say that what you did was not scientific, so we can ignore it. Because it was not scientific, it was not published in a... You just went out with a Geiger counter, you had calibrated it, you...

RvM: I calibrated it with...

38:10
CB: I am sure that there'd be lots of explanations here but I could be wrong. But what I say here is that, what is interesting about this, because I know about this with radiation levels, I do a lot of court cases on this, and incidentally I win them all, all right, so watch it. Because what's gonna happen is that you people are going to be in court, again and again and again and again, and you are gonna to lose every time. Maybe not you but the nuclear industry who use your... and the environment people who use your model are going to lose, because they are loosing regularly.

What happened there was that you were measuring at 1 m gamma rays. And this is where they measure

gamma rays, at 1 m, because a person is about 2 m high and so it is considered to be the average gamma ray dose, and it is a convention that the gamma rays are measured with Geiger counters so that they can be compared around different parts of the country. Because obviously if somebody was measuring here and somebody was measuring there, it would not be comparable, so it's just a convention.

But the interesting thing is that with gamma rays, if it had just been the rocks and you had brought the Geiger counter down close to the ground you wouldn't have got a much of a bigger reading, you see. The reason you got a big reading was because your Geiger counter was responding to beta, beta particles which have a much shorter range. And this means that Sweden was contaminated with hot isotopes which were beta emitters, probably Te-132, which is a kind of forgotten isotope which came out of Chernobyl, and there was a lot of it because it is quite ***.

So this suggests to me that this was a quite high contamination in Sweden. And I'm interested in that because Martin Tondel did an epidemiological study that showed that increases of cancer in levels in parts of Sweden that had high contamination, or conventionally high contamination. And he was certainly attacked by everybody, who brought in the ICRP model and said "I'm sorry Martin, but you must be wrong, you know your science is incorrect, you haven't got the right sort of doses, it could not possibly have happened." and all this kind of toddle.

So, what I'm saying is that this for me, as a scientist, as a scientist, which I am, I listen to all the information. So if I knock on the door and somebody says "Yes, I have cancer", that is information. You don't have to read it in the International Journal of Radiation Biology before you believe something. Otherwise we never had survived as human race, because it did not exist at the time.

JV: I just want to add that, of course I was very much involved during the Chernobyl accident. All else is ok, but do not try to claim that any information was secret and there were any threats of punishing people. That simply was not true. It is so boring to meet people who come with these claims which they cannot substantiate. This is the one sort of thing that gets me angry when people accuse me and my colleagues of having been dishonest.

RvM: It was not you. It was the psychological defense, and Lars Vestman tried to published these and he was shown by the TV this pink paper from a psychological defense that it was forbidden with punishment of jail if certain facts were emitted.

MG: I regret very much that time is running on. Eva Linderoth is going to take the last word. And please bring your questions up afterwards.

EL: Yes, I am Eva Linderoth, I've been working with MILKAS, I am on the board of MILKAS, who arranged this meeting. And I am very happy to have been able to assist at this meeting and it turned out properly what the differences are, and I take it from there. I want to thank you very much for coming here, both of you. You have elucidated much. And as a thank you I give you each a cup, and that's all. Thank you.
42:44

THE END