T R A N S C R I P T

LEGISLATIVE COUNCIL ENVIRONMENT AND PLANNING COMMITTEE

Inquiry into Nuclear Prohibition

Melbourne—Friday, 28 August 2020

(via videoconference)

MEMBERS

Mr Cesar Melhem—Chair
Mr Clifford Hayes—Deputy Chair
Dr Matthew Bach
Ms Melina Bath
Mr Jeff Bourman
Mr David Limbrick
Mr Andy Meddick
Dr Samantha Ratnam
Ms Nina Taylor
Ms Sonja Terpstra

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Ms Georgie Crozier
Dr Catherine Cumming
Mr David Davis
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WITNESS

Dr Helen Caldicott.

The CHAIR: I declare open the Environment and Planning Committee public hearing for the Inquiry into Nuclear Prohibition. Please ensure that mobile phones have been switched to silent and background noise is minimised. I would like to welcome any members of the public watching via the live broadcast. I would also like to acknowledge my colleagues here today: Dr Bach; Mr Hayes, the Deputy Chair; Mr Limbrick; Ms Bath; Mr Meddick; Ms Terpstra; Mrs McArthur; and Ms Taylor.

A special welcome to our first witness, Dr Helen Caldicott. Thank you very much for making yourself available. Unfortunately we have not been able to see you in the flesh. I know your preference was to actually address the committee in person, but due to the recent events with COVID-19 that was not possible. We were looking forward to seeing you in person, but unfortunately we are not able to. But I am sure we will enjoy your session via Zoom.

All evidence taken at this hearing is protected by parliamentary privilege as provided by the *Constitution Act 1975* and is further subject to the provisions of the Legislative Council standing orders. Therefore the information you provide during the hearing is protected by law. However, any comments repeated outside the hearing may not be protected. Any deliberately false evidence or misleading of the committee may be considered a contempt of Parliament. All evidence is being recorded, and you will be provided with a proof copy or version of the transcript following the hearing, and the transcript will ultimately be made public on the committee's website.

We have allocated 5 minutes or so, or 10 minutes—we are in your hands, Dr Caldicott—in relation to your giving us a bit of an overview. Members have received your submissions and various articles and recent correspondence, and I am sure members have read them. So it is over to you to give us a bit of an overview, and then we will go to questions. As you said, there is a significant number of members on this committee and all are in attendance, so we will try to sort of allow about 5 minutes each to ask questions and have answers. So, Doctor, over to you, and welcome again.

Dr CALDICOTT: Thank you very much, and thank you for inviting me to testify before this committee, a very important committee. I am not actually sure why Victoria is investigating nuclear power and uranium. I checked up, and there are no uranium deposits in Victoria. There are some thorium deposits. Anyway, I am a physician. I am a paediatrician. I am a member of the Royal Australasian College of Physicians, and I speak about this issue from a medical perspective. I said it was imperative that every member of the committee read the two papers that I submitted, one from the Australian Medical Students Association journal about radiation and what radiation does to cells and to the human body. No radiation is safe. Every dose you get adds to the risk of developing cancer or leukaemia and the like. Uranium is all about radiation. When it is mined, it is enriched from 0.7 per cent to 3 per cent for use in nuclear reactors. It is then put in reactors and fissioned. The first slide I want to show, if you could put it up for me, please—

Visual presentation.

Dr CALDICOTT: This is from Canada, but I want to show you this because it shows you that when you put uranium in a nuclear reactor and you fission it and break apart the atoms you release a huge amount of energy: $E=MC^2$, which was first enunciated by Einstein. The energy released by fissioning of the atom equals the mass of the atom times the speed of light squared.

Now what I want to show you in the slide, if I could move it down: these are the radioactive elements that are made in a reactor when you fission uranium. There are over 200 of them. They have half-lives. For instance, radioactive iodine-131 has a half-life of eight days, so in eight days the radiation has reduced to half, and you multiply a half-life by 10 or 20 to get its total radioactive life. As you see, as we go down here, there are huge numbers of radioactive elements that are created when you fission uranium, and this is never talked about by the nuclear industry. Some of these elements last for seconds and some last for millions of years. The ones that last so long are actually radioactive waste, which needs to be isolated from the ecosphere for 1 million years, according to the EPA in America.

As we go down and look at more and more of these, the most dangerous are these elements here: polonium, which is an alpha emitter; radon, which is emitted from uranium in the ore and is very, very carcinogenic; radium, which killed Madame Curie. When she died her bones were absolutely full of radium. She was so radioactive they had to bury her in a place isolated from the environment. She died of aplastic anaemia because the radium killed all the blood-forming cells in her bones. Thorium, which they want to use for reactors, is an alpha emitter as well. So are uranium, neptunium. Coming down now, plutonium is the one that you make nuclear weapons from. Plutonium-239 has a half-life of 25 000 years and lasts for half a million years. You only need 5 kilos to make nuclear weapons, and it is indeed the stuff, or the fuel, for most nuclear weapons.

It is an alpha emitter. It emits two protons and two neutrons, which only travel a very short distance and which can be blocked by the skin. But when it is in the body, it is highly carcinogenic. It mutates or changes genes and cells called the regulatory genes. When the regulatory genes are mutated, that can cause cancer, and the cells start dividing in a fashion that is not regulated. It only takes one-millionth of a gram of plutonium to induce cancer, and it lasts for half a million years and you need five kilos to make a bomb. So any uranium that is fissioned produces plutonium, and all bombs have been derived from the original uranium. All of these are highly carcinogenic—the alpha emitters.

Beta emitters are those like strontium-90, which causes bone cancer and leukaemia. Its half-life is 28 years and it lasts for a long time. And caesium-137 is a potassium analogue and gets into all cells of the body, and that is a beta emitter. A beta emitter omits one electron, and when the electron hits a regulatory gene in a cell, it will mutate or change that gene and induce cancer. So I think that most people on earth, let alone most people concerned about nuclear power, have no idea of the number of isotopes that are produced when you fission uranium.

The next slide I want to show, please, is this. Now, this comes from the New York Academy of Sciences publication called *Chernobyl*. Radioactive elements when they get into the developing embryo cause congenital defects like thalidomide did. Thalidomide blocks off arteries so when a developing fetus is developing an arm and the artery to that arm is blocked, the baby is born with no arms. Here is one. And that is so for all congenital abnormalities. Around Chernobyl there are many, many homes full of children who are grossly deformed like this. There are other areas near Chernobyl where there is a lot of caesium in the water, and that concentrates in the milk and the like, and the pregnant women eat mushrooms full of caesium et cetera. There is a very high incidence of anencephaly—babies born with no brains; I have delivered such a one—spinal deformities and neurological deformities where the spine does not fuse properly, and Siamese twins. And this has been reported in the literature widely.

Now, the next slide I want to show—spina bifida is the one I was talking about—these are lenses of birds around Chernobyl and also Fukushima. You can see they have got cataracts—that hazy sign there. Radiation causes cataracts, and there are huge numbers of people affected by the Chernobyl fallout who have developed cataracts. Indeed one of the major scientists working in the exclusion zones of Chernobyl and Fukushima—incidentally Fukushima was fuelled by Australian uranium—himself is developing cataracts.

Now, I could show you many more abnormalities and deformities, but in other words, radiation from the time uranium is mined—uranium emits radon, which is carcinogenic to the lung. Gamma radiation is emitted from uranium too. Now, gamma radiation is like X-rays, and many of these isotope elements emit gamma radiation. So miners are impacted by whole-body radiation, including to their testicles, which could mutate genes in their sperm. My speciality is cystic fibrosis, the most common, fatal genetic disease of childhood. But there are over 2000 genetic diseases now described, and radiation will increase the incidence of these diseases.

I could get into thorium—you can ask me about that; I do not really have time to cover that at the moment—or small modular reactors. You have got the papers on that.

I have lost my train of thought. Where was I going? Yes, gamma radiation and uranium miners and genetic abnormalities. Genetic abnormalities can occur in any species and any plants, and in fact we saw deformed plants around Three Mile Island and certainly around Fukushima and certainly around Chernobyl, so the genetic abnormalities can be induced in all species on earth.

The radioactive waste that is produced in nuclear power plants includes many of those elements that I showed you on that chart, which last for hundreds or thousands of years. In fact radioactive waste from nuclear power

must be stored isolated from the ecosphere for 1 million years, and that is an impossibility. Any container we have now lasts less than 100 years, and as the radioactive elements leak out of the containers—caesium, strontium, iodine-129, which has a half-life of 16 million years and iodine causes thyroid cancer—it gets into the water supply and then bio-concentrates by order of magnitude in the food chain.

For instance, at Fukushima 400 tonnes of highly radioactive water is emitted into the Pacific every day since the accident, and those elements—caesium, strontium, iodine; you name it—concentrate hundreds of times in the algae, hundreds or thousands more times in the crustaceans, then in the little fish, then the big fish and us, and we stand at the apex of the food chain. And so when you eat a fish which you catch here—because fish swim thousands of miles from Fukushima, for instance—you cannot taste the caesium in the fish, you cannot smell it and you cannot detect it. It is invisible. And the time to develop cancer when you have eaten some caesium which has lodged in your brain or your heart muscle or your pancreas or wherever. It takes 15 to 80 years to develop cancer once you have been subjected to radiation. For leukaemia it is only four years. We know that from the Hiroshima data, from looking at the hibakusha and when they developed their leukaemias and their cancers. So the latent period of leukaemia is four years. For cancer it is five to 80 years. And you do not know that you have inhaled or ingested some radioactive material. When the cancer develops it does not denote its origin. The only way we know about this is to do epidemiological studies to study a group of people who have not been subjected to radioactive elements and a group who have. And obviously the people around Chernobyl are a classic example. It is now estimated that over a million people have died in Europe as a result of Chernobyl, and 40 per cent of the European landmass is radioactive and will remain so for hundreds of thousands of years because there is a lot of plutonium that escaped and other elements, and if you want to read about it, you can read my book called *Nuclear Power is Not the Answer*, here. I do not eat European food, because I do not know what is radioactive and what is not. Turkey got a huge fallout: never buy dried Turkish apricots or figs. The Turks were so upset about Chernobyl that they picked all their radioactive tea and sent it to Moscow so the Russians could have it.

So there is a lot going on in terms of health impacts related to nuclear power and radiation, but the worst thing is the radioactive waste. Huge amounts of it have now been made, and we are making more every day. You know, you make 250 kilograms of plutonium per year in a reactor, which must be isolated from the ecosphere for half a million years. And so what I predict is over time, as a physician, if this material leaks into the water supplies, the Pacific Ocean, the rivers, the lakes et cetera—

And do not buy any food grown in Japan. Much of the rice is radioactive, and they are mixing it with non-radioactive rice to dilute the impact. Do not buy any seaweed from Japan. Do not buy any fish et cetera, because you do not know what is radioactive.

Over time radioactive waste from nuclear reactors and the fallout from nuclear bombs will produce random, compulsory genetic engineering from all species for the rest of time, damaging a positive aspect of evolution. Evolution was caused by radiation from the sun, so fish developed lungs and birds developed wings. The bad mutations died and the advantageous mutations survived. Plus we evolved, with our huge neocortex. So random, compulsory genetic engineering for all species, congenital abnormalities as you have seen, cancer and leukaemia—for the rest of time, epidemics. And we are not the only species who develop cancer and leukaemia and genetic abnormalities.

So I think I will finish by saying I have no idea why Victoria is investigating this situation. As regards nuclear medicine, all isotopes we use in medicine can be made from cyclotrons. Indeed I think you have a cyclotron in Melbourne. I rang years ago, when I was writing this book, the head of nuclear medicine in America. And I said, 'Can all the isotopes we use in medicine be made from a cyclotron without fissioning uranium and having a nuclear reactor?'. He paused for quite a while and he said yes.

The reason we have got a nuclear reactor in Sydney is so we can retain our seat on the International Atomic Energy Agency. It is about prestige. It is about these nuclear physicists who do not understand biology—radiation biology. And there is a sort of lustre to the power of the splitting the atom, which is inherent in reactors but also obviously in nuclear weapons.

Thorium—you can ask me questions about thorium. Thorium is not naturally fissionable, like uranium or plutonium. They are the only two elements that are naturally fissionable. So to make a thorium reactor you have to mix the thorium with either highly enriched uranium, which converts the thorium to uranium-233, which

then is fissionable; or mix it with plutonium, which makes uranium-233, which is fissionable. Then you take out the fuel, you melt it in concentrated nitric acid, you remove the uranium-233 and then you put it back in the reactor and you have got fissionable uranium. But one of the by-products of this is uranium-232, which is highly dangerous. It is a huge gamma emitter, like X-rays. It is terribly dangerous to the workers and it pollutes the thorium reactor very much so.

And because of this, in America they have given up on thorium reactors and they have got a lot of uranium-232 stored in a place I cannot remember—Oakridge, Tennessee—which is leaking out of barrels and stuff. So everywhere you look in the nuclear industry from uranium mining—in the past, 75 per cent of miners developed lung cancer from inhaling radon. Now it is much less because they ventilate the mines, but still the miners are subjected to gamma radiation over their whole body, including their testicles, and to inhaling radon, which is a gas which is emitted from uranium—radon is now known to be one of the main causes of lung cancer in America, where it concentrates in the cellars of people's houses.

So the whole situation from a medical perspective is unacceptable. And you know we spend our lives, I have, trying to save children with very serious diseases and save people with cancer. And we understand that cancer is a horrible disease and can recur. Really, if you look at it from a medical perspective, nuclear reactors are cancer factories. So there are no social benefits for Victoria, no environmental benefits.

Children who live within 5 kilometres of a nuclear reactor—this is been found in Germany, Britain and France—have double the incidence of leukaemia because nuclear reactors continuously emit tritium into the air. Tritium is radioactive hydrogen, H-3, and it combines with oxygen to form tritiated water, $^{3}H_{2}0$. It is highly carcinogenic. It is not contained by anything. You cannot contain it except with gold; it cannot escape out of gold. Tritiated water in a fog near a reactor actually enters through the skin. It induces brain cancers, congenital deformities—there is a huge literature on tritium in the journal of *Health Physics* written by nuclear physicists and the like. They are very scared of tritium. They do not talk about it, but a nuclear power plant emits tritium continuously. When they have to change the fuel once a year there is a huge purge of radioactive materials into the air and into the water. Nuclear reactors require 1 million gallons a minute of water to cool them—1 million gallons. In a country like Australia where we have droughts, we are losing our water, the artesian basin is being used for other things, we have got very little water. We cannot afford to have a nuclear reactor with a million gallons of water a minute. Oh, I suppose we could use seawater, like Fukushima, but then that water that is emitted is relatively radioactive.

What else? Medicine, scientific research? Well, we can make isotopes in other ways. Barriers to participation, including limits by federal or local laws? Well, in fact it is really strange for me because I was the one in the 1970s who got around to unions all over Australia—the Transport Workers Union, the railway workers union in Sydney, the TLC in Adelaide—and I addressed unions all over the country telling them the impacts of radiation upon their testicles, upon their bodies, upon their children, upon their genes et cetera. And as a result of my education—over about six months I travelled all over the country—the ACTU passed a resolution to ban uranium mining, to ban transport and to ban export of uranium. It was not until Bob Hawke got into power that he then introduced the three-mine policy, and that is like me saying to a patient, 'Well, don't worry, dear, you're just a little tiny bit pregnant'. That opened the whole thing up to uranium mining again. So can we possibly get back to educating the unions again about the medical implications of mining uranium to themselves and to all future generations and their families, or is it too late now as the Murdoch press—in fact, Murdoch created my career by publishing a front-page editorial in the *Australian* in 1971, I think, when I was educating people about the medical effects of the French tests when we got bombarded with radiation.

The CHAIR: Dr Caldicott, can I interrupt because we—

Dr CALDICOTT: Yes, you may. I have talked too long.

The CHAIR: No, no, no, it is actually excellent information that you have provided to us and I think you have covered all sorts of topics there.

Dr CALDICOTT: I think I have, yes.

The CHAIR: You have probably answered many questions, so we are really appreciative of that. It is very important. Now we will go to questions, but before I do that I will just let the committee members know that we have an extra 15 minutes we can use until 11.15, as the next witness is actually running behind schedule and

we started a bit late, so we have got a bit of time. I will start off with a question: do you accept that advances in nuclear technology have reduced many safety risks, like the small modular reactors? We have heard evidence from various parties, and I know you did send us a copy of an article about small modular reactors. Do you mind talking about that?

Dr CALDICOTT: I said that I would not testify unless every member of the committee read the papers that I have submitted.

The CHAIR: We have! We can guarantee we have. I cross my heart, we have.

Dr CALDICOTT: Well then, I do not understand why you asked me the question about small modular reactors, because you got an article on it.

The CHAIR: Well, there you go. I thought you might like to give some verbal evidence on it, but if you do not need to we can leave it—

Dr CALDICOTT: No, no, listen: small modular reactors—as they say, they are turnkey reactors. They have to be produced in bulk by corporations to make any money. That has not worked. There have not been enough, and the Chinese can make their own reactors anyway, so it has really been a failure. It has not worked in America at all, and if it does not work in America it is not going to work here. They are very dangerous. The high-temperature gas-cooled reactors or pebble-bed reactors, you have read, have got 5 billion tiny fuel kernels consisting of highly enriched uranium or plutonium. Five kilograms of plutonium is critical mass, and if you get that together you get a nuclear explosion.

These little kernels are encased in graphite, and graphite was what burnt at Chernobyl. The graphite moderating rods caught fire, because graphite is carbon and it is terribly dangerous, and so if they lose the cooling of the helium gas you could have a Chernobyl-type reaction. Liquid-metal fast reactors, fuelled by plutonium, if you please, cooled by liquid sodium—I remember when I was a student in chemistry, first-year medicine: liquid sodium if exposed to air is flammable and explodes. So if there is a leak in the cooling system of a liquid-metal fast breeder reactor and you have got plutonium as the fuel, first you will get a fire and you will lose your coolant of sodium, but also you can have a nuclear reaction as plutonium reaches critical mass, which is 5 kilograms, and you will explode and scatter plutonium all over the place. When one millionth of a gram is carcinogenic, it is not a good idea.

The CHAIR: Yes. No worries. Thank you for that. Now, who would like to go first? Mr Hayes, Deputy Chair; and then Mr Meddick.

Mr HAYES: Thank you very much, Dr Caldicott—a very enlightening submission. We have heard from the nuclear industry quite a bit in the last few sessions, and a lot of what I am getting is that what you are saying is very much scary stuff from the 1980s and that—

Dr CALDICOTT: Oh, for God's sake, so it has changed since the 1980s?

Mr HAYES: Apparently.

Dr CALDICOTT: What I learned in medicine has changed?

Mr HAYES: Anyway, one thing that interested me was they said that Fukushima has sort of been blown up these days to be more than it was—that really there were no deaths and there is no significant radioactivity coming from it anymore and there was a bad mistake with where they positioned the power plant and they would not make a mistake like that again. So I just wonder if you could briefly comment on that. Then I wanted to ask you a question about: they say that waste can be stored safely on site these days and there is so little waste that comes from these reactors now, it is not really a problem.

Dr CALDICOTT: How dare they say that! How dare they. I have not got the total amount of radioactive waste that has been produced. I do in one of these papers. There are hundreds of thousands of tonnes of radioactive waste stored mostly still at the reactors. They have nowhere to put it in America. They dug a huge hole in the Yucca Mountain in Nevada, but they found it was transected by earthquake faults so they cannot use that. There is nowhere to put it. They are taking it to Texas. They are putting it in waste dumps around the country. I mean, how dare the nuclear industry say there is hardly any waste. I wish I could find out the total

amount—it is 250 000 tonnes of radioactive waste in the world, but that includes America, England, France and Russia. I mean, they are lying to you, and what I suggest is that you do your research, please. You just need to go to Google and ask Google how much high-level radioactive waste there is in the world.

What they are doing, I think, by saying, 'Well, we've got to store radioactive waste in Kimba in South Australia'—first of all the radioactive waste from Lucas Heights, which is reprocessed in England and comes back, I think, as transmuted into glass, can be stored at Lucas Heights. There is enough storage at Lucas Heights. They do not need to open up a radioactive waste storage in Kimba, but I think it is an opening to bring in the world's high-level radioactive waste through Whyalla and the like, and that is terribly, terribly dangerous. Why would we be such mugs as to introduce radioactive waste into a country that is a desert. We could have earthquakes, we could have ice ages—we could have all sorts of things; this is a million years. So we are being taken for a ride by the nuclear industry. They lie. For them to tell you that there is hardly any radioactive waste and it can be stored safely is a lie.

Mr HAYES: Stored safely on site is what they say these days.

Dr CALDICOTT: On site—what does 'on site' mean? At the nuclear reactor?

Mr HAYES: That where the reactor is it can be stored.

Dr CALDICOTT: Well, mostly it is. At San Onofre in California they have stored it beside the reactor in the sand at the beach. And it is transected—that is a major earthquake fault running through San Onofre. And also there could be tsunamis and the like—stored safely? The casks they are putting it in last not for a hundred years. They are thin-walled casks. They are made by Holtec, and they are deficient.

Mr HAYES: Thank you very much.

The CHAIR: Thank you. Can I now ask Mr Meddick.

Mr MEDDICK: Thank you, Chair. Dr Caldicott, thank you very much, first of all, for your years of dedication to this particular subject—

Dr CALDICOTT: Thank you.

Mr MEDDICK: and for being at the forefront, really, of exposing some of the things that are said about the industry overall. Just by way of explanation about what you have already submitted and what you asked the committee to read, I think I need to expand a little bit on what the Chair was saying. Often these proceedings are broadcast live, so many of the people watching would not perhaps have had the chance to read your submissions.

Dr CALDICOTT: Right.

Mr MEDDICK: Sometimes we will ask a question that might have already been answered in those submissions so that those watching get the chance to hear what that is about.

Dr CALDICOTT: Thank you.

Mr MEDDICK: No problem at all. Mr Hayes covered some of what I was going to ask you, but I will go down and give you a little bit more of a chance to expand on those things. Look, we have had an array of witnesses before us who were either companies directly involved in the production of reactors and therefore they are pushing the SMRs, or they are organisations representing them.

Dr CALDICOTT: What companies are they?

Mr MEDDICK: They are not necessarily the actual companies themselves, but they might be organisations representative of those companies or even associations that purport themselves to be independent but have very clear and strong ties to the industry. Now, a common theme among them when I have asked them about the disposal of waste, as Mr Hayes has done here—the questions are around, for instance, the risks involved with disposal and the methods used, which you covered a moment ago—is very much a downplaying of those risks and what seems to me as a layman, from my perspective, a somewhat simplistic approach to disposal in

comparison to the enormous amount of research and time that they present in the actual production of the power and the technology around the reactors themselves. There is a very simplistic approach in an answer to waste. Can you just, I suppose, elucidate a bit more and expand upon those particular points?

Dr CALDICOTT: Yes. I have just found the data. Australia exports uranium for use in nuclear power to 12 countries, including the US, Japan, France, Britain, Finland, Sweden, South Korea, China, Belgium, Spain, Canada and Taiwan. Two hundred and seventy thousand metric tonnes of deadly radioactive waste exist in the world today, with 12 000 metric tonnes being added yearly. Each reactor makes 30 tonnes per year, and there are over 400 reactors in the world. The Congress in the States has no idea what to do with the waste, and they have a bill called the Waste Confidence Bill, that is, that they have confidence that in the future they will be able to store the waste safely—I cannot remember, but it imports that in time they will find the answer to the storage of radioactive waste. It was thought that they could put it in rockets and send it out to the moon. They put plutonium in a rocket and it exploded in the atmosphere, increasing the level of plutonium by a factor of five in the atmosphere. They have no idea what to do with it—no idea. And they just turn their backs and practice psychic numbing, whereas the populations in areas which are highly radioactive and polluted are suffering from cancer, but no-one listens to them. No-one listens to them; no-one cares about it.

I created the organisation Physicians for Social Responsibility. We had, I think, 130 000 doctors, and we educated people in America about the medical implications of nuclear power and nuclear war and radioactive waste. At the time, people were well educated and understood. As President Jefferson said, an informed democracy will respond in a responsible manner. And that is what we did in the 1970s in Australia; we informed the unions. The electrical trade workers now are still adamant about their opposition to uranium mining and nuclear power. But you have got to be educated, because if you are not educated you do not understand. We need to let every Mr and Mrs Joe Sixpack watching their television hear what I have said today to understand what we are talking about.

We have got a lot of uranium in Australia, and it has been irresponsible and an absolute tragedy, what we have done in Ranger and polluting in the areas up there. We are very responsible, so what we are doing is inducing cancer epidemics around the world by exporting our uranium. You know, in medicine we take the Hippocratic oath: do no harm. We spend our lives trying to save our patients, and here is a carcinogenic industry. A nuclear power plant is a cancer factory, period.

The CHAIR: Thank you. Can I jump in. Can I ask Ms Bath, Dr Bach or Mrs McArthur, because I know you are due to go at about 11.

Ms BATH: Thank you, Cesar.

The CHAIR: Can you go first, then I will come back to the rest of the committee between 11 and 11.15.

Ms BATH: Thank you very much, Chair, and thank you, Dr Caldicott, for your presentation and indeed your passion for people—

Dr CALDICOTT: I am a doctor.

Ms BATH: and particularly children. Dr Caldicott, it is interesting that you have just raised about informed democracy, so I am going to be the one that asks the question in relation to other information that is out there that I want you to comment on. *Chernobyl's Legacy: Health, Environmental and Socio-Economic Impacts* by the Chernobyl Forum of 2003 to 2005, and updated in 2006, talks about the fact—I will quote from it and I would like you to respond; so this is I guess a counterpoint to your discussion so far—that:

> There have been many post-Chernobyl studies of leukaemia and cancer morbidity in the populations of 'contaminated' areas in the three countries. Most studies, however, had methodological limitations and lacked statistical power.

It goes on:

> There is therefore no convincing evidence at present that the incidence of leukemia or cancer (other than thyroid) has increased in children, those exposed in-utero, or adult residents of the 'contaminated' areas.

Can you provide your opinion on these sorts of documents?

Dr CALDICOTT: Yes. This book, *Chernobyl*, published by the New York Academy of Sciences, is a collation of 5000 papers from Russia, Belarus and Europe. Now, it is not all statistically absolutely spot on according to the way Americans do studies, but it is a study on the ground by physicians, by doctors, by epidemiologists, of their patients. The Chernobyl Forum that you quote has never been to examine patients on the ground in Russia or Belarus or anywhere else. This is a most extraordinary summary, and there are graphs and charts on leukemia and diabetes and heart attacks and atmospheric contamination, by some of the best scientists in Russia. It is not as absolutely spot on, as I say, statistically as Americans would want it to be, but it is the only study of its kind in the world, on the ground, looking at patients.

It is now estimated that over a million people have died as a result of Chernobyl in Russia, Belarus and over Europe. In fact babies who were in utero in Sweden during the accident—and their mothers inhaled the radioactive material—many of them were deficient mentally because the developing brain is very sensitive to radiation. I could refer you to many documents.

If you go to the International Physicians for the Prevention of Nuclear War in Germany, they have done some fantastic studies on Chernobyl. So you need to go to the proper scientists.

Ms BATH: Thank you.

Dr CALDICOTT: The Chernobyl Forum that you quote is done with statistics, and they are estimating how much radiation got out and estimating the doses, but they did not measure the doses.

Ms BATH: It is always going to be an interesting juxtaposition because there will be competing forums and information, and I note this one has the World Health Organization on there as well. I am not discounting your position by any stretch; I am just saying that there will always be some counterpoints to the argument.

Dr CALDICOTT: Yes, supporting the nuclear industry. That is right. Because they are powerful and they have got a lot of money. And they are very powerful in the Congress, and because congressional people do not understand nuclear physics or anything else, they elevate them. They are like the wizards of Oz, whereas when I go in and testify before Congress and the Speaker of the house et cetera—and I have done that many times—they listen to me because I am a doctor, and my colleagues, and we have got much, much more credibility, because everyone who gets sick goes to a doctor and because we know what we are talking about and we are ethical.

Ms BATH: Thank you, Dr Helen Caldicott.

The CHAIR: Thank you. Mrs McArthur or Dr Bach, who wants to go first? Bev?

Mrs McARTHUR: I am happy to go, Chair. Thank you, Dr Caldicott. I just wonder if you could tell us the difference between the cancer rates in France and Australia.

Dr CALDICOTT: No. I should know that, but I do know that the study was done in France to show that children under the age of five living within 5 kilometres of a reactor have double the incidence of leukaemia and I think solid cancers as well. As related to Fukushima, the only cancer that they are looking at is thyroid cancer in Fukushima. All cancers can be caused by radiation. So they looked at children under the age of 18 at the time of the Fukushima accident. The—

Mrs McARTHUR: Thank you, Dr Caldicott. I asked about France, actually, so if we have not got—

Dr CALDICOTT: But this is relevant.

Mrs McARTHUR: any information on France, that is fine. I am just wondering if you could tell me, then: the cancers caused in Australia, are they related to nuclear issues?

Dr CALDICOTT: We got a lot of fallout from the English tests, particularly in Adelaide. I arrived in Adelaide just before they set off a huge bomb in Maralinga, and we got a huge fallout. A scientist who studied sheep's thyroids found a huge amount of radioactive iodine in the sheep's thyroids at the med and vet institute in Adelaide. His paper was unable to be published for two years. There was never an examination of humans. I remember a young woman aged 30 with thyroid cancer, a ballet dancer who was dying, but that is an anecdotal

expression. But there has not been an epidemiological study of people in Adelaide post those tests in 1956, which is an absolute tragedy.

Mrs McARTHUR: So the cancer was caused in Australia?

Dr CALDICOTT: We do not have the data.

Mrs McARTHUR: Right, so then we cannot actually say that the cancers in Australia are not caused by uranium fallout or anything else? So the cancers now in Australia are related to nuclear energy?

Dr CALDICOTT: If we have not done the studies, we cannot comment. If we have no epidemiological studies, we cannot comment. And we have no nuclear—

Mrs McARTHUR: Thank you very much, Dr Caldicott.

Dr CALDICOTT: Well, we have one reactor in Australia, at Lucas Heights, and I do not think the people around there—and there are a lot of kindergartens around there—have been studied either epidemiologically or medically. So you cannot comment without the data.

Mrs McARTHUR: So should we ban nuclear medicine?

Dr CALDICOTT: No. I told you: nuclear medicine is very important. All isotopes we use in nuclear medicine can be made in a cyclotron, which does not use uranium, which does not make nuclear waste.

Mrs McARTHUR: Thank you.

Dr CALDICOTT: The nuclear elements we use in medicine anyway are quite short lived and can be stored in the cellar of a hospital, and they decay in a short time.

Mrs McARTHUR: Thank you.

The CHAIR: Thank you. Can I go to—maybe in that order, if that is okay—Ms Taylor, Mr Limbrick and then Ms Terpstra. Is that okay, Ms Taylor?

Ms TAYLOR: Sure. Thank you, Dr—Caldicott. I cannot get my words out; that is a bad start, isn't it? I actually got your book years ago.

Dr CALDICOTT: Good woman.

Ms TAYLOR: This one. I did not get that out specially today; I have had it on the dining table, and I have had it for years. There are probably two things I will go to. I think you have spoken to really many of the concerns that I have had, longstanding, about this industry, fundamentally about human health but also about this disrespect in terms of, 'Oh, we'll just chuck the waste out on Aboriginal lands, and it doesn't matter' sort of thing—those two factors that really irritate me horribly.

I just did want to pursue, and more for the benefit of the audience that might be watching, with regard to the storage of waste and this idea that in a hundred years they will repackage it and then presumably for another hundred years. I wonder about the safety elements, because you have talked about leakage and the corrosive elements of the packaging in any case. But I wonder about the safety of repackaging at that hundred-year point and workers who are in proximity to that and how you can guarantee that they will not be at risk. So that is one of my key questions. Maybe you would like to speak to that.

Dr CALDICOTT: Well, I do not know what we are going to be like in 100 years with global warming proceeding apace. I think it is going to be so hot that many of us will not survive. I am also very worried about the risk of nuclear war. The *Bulletin of the Atomic Scientists* says that we are closer to nuclear war than we have ever been before. The doomsday clock has been moved to 100 seconds to midnight, the closest it has ever been, because more and more countries are building bombs. America is becoming very belligerent with China, and India and Pakistan are at odds and have nuclear weapons. So I do not think we will be here in 100 years, quite frankly. But if I think that anyone would be here, to undo those casks which will be leaking anyway is

extraordinarily dangerous and they will be exposed to plutonium, americium and all of them. So that is a concept which is a fatuous concept. They have dreamt it up in their heads to justify what they are doing.

Do not trust nuclear physicists. There are a few who are good but mostly they lie, and they fantasise about what can happen in 100 years. How do we know what is going to happen in 100 years? How dare they, and how dare we leave that material to our descendants to cope with? Has anyone thought about that? The Department of Energy in America is trying to work out what signs to put over storage of radioactive waste for people thousands of years from now so they do not dig into it and look at it, and they have not been able to work out what sort of sign or a skull and crossbones or what language people will be speaking in 1000 years. It is quite extraordinary, really, if you think about it in logical terms.

Ms TAYLOR: Okay. Thank you, because that is one of my major concerns. Because the nuclear industry has ostensibly been around for some time and yet they still have not come up with a solution for the waste, and there may never be one. That is the other thing.

Dr CALDICOTT: There will not be one. There will not be one.

Ms TAYLOR: Yes, okay.

The CHAIR: Sorry. One more? Can I come back to you?

Ms TAYLOR: Yes, you can.

The CHAIR: Can I ask Mr Limbrick to go next?

Mr LIMBRICK: Thank you, Chair, and thank you, Dr Caldicott, for appearing today. I would like to go back to what Ms Bath was talking about with the Chernobyl forum. I mean, this was overseen by the WHO and the UN. There were hundreds of scientists involved, and the data that they came up with was nothing like a million people died—it was dozens actually. Like, what is your explanation for why they would come up with something so radically different to what you are talking about?

Dr CALDICOTT: Because they support the nuclear industry.

Mr LIMBRICK: So you are saying the WHO and the UN support the nuclear industry.

Dr CALDICOTT: Yes, and I have written about it extensively, and I just do not know if I can find it—where I have written about it. See, what they do is: their physicists and their mathematicians estimate, by equations and the like, how much radiation got out from Chernobyl. They then estimate what dose people were subjected to—whether it was gamma radiation. They did not even look at internal emitters—the material in the food, the milk, the mother's milk, the caesium, the strontium. They did not look at internal emitters. But they estimated, according to the wind flow and the atmospheric conditions, what dose people got. They took the whole population and then worked out from that dose how much cancer would arise. They never, never went on the ground to visit clinics and hospitals—never did the epidemiological studies that were done in this report by the New York Academy of Sciences. So it is a fantasy, make-believe stuff, and they have no idea, really, what diagnoses people are developing at all. And so it is a make-believe game. But I wish I could find out—

Mr LIMBRICK: Do you think that these organisations—

Dr CALDICOTT: And I include the WHO.

Mr LIMBRICK: So the WHO, the UN and these hundreds of scientists—you are saying that they are, what, corrupted?

Dr CALDICOTT: Yes.

Mr LIMBRICK: Right. Okay. So you do not trust what the UN and the WHO are saying?

Dr CALDICOTT: Yes. They are not doctors, they are not clinicians, and what they do is they take the data from the Hiroshima bomb. Now, people were impacted by gamma radiation from Hiroshima. That is like X-rays. And the Hiroshima data is a sort of groundwork that we use to calculate cancer risk and doses, but it

was fallacious because they did not start looking at Hiroshima victims until five years after the bombs dropped, during which time the most vulnerable people and the people with the greatest radiation dose died. Those people are not subjected to internal emitters, and the food around Chernobyl et cetera is highly radioactive in some areas. The area in Polissia, where pregnant women are eating the mushrooms et cetera loaded with caesium—they are the ones who are having babies with gross deformities and Siamese twins. There is a very big literature about that, which I can send you. They do not look at that. It is all estimates and guesstimates according to mathematics.

Mr LIMBRICK: What is their motivation to be corrupted, then?

Dr CALDICOTT: What do you think it is?

Mr LIMBRICK: I have no idea why they would be corrupted. Do you think that the nuclear industry is controlling these scientists somehow?

Dr CALDICOTT: Yes. Let me read you this:

> … the International Atomic Energy Agency … produced a United Nations report on Chernobyl, claiming that only fifty-six people had died as a result of the accident.

this is 2005—

> The IAEA has a conflict of interest when it comes to monitoring the health consequences of radiation because, in 1959, the IAEA signed a somewhat diabolical agreement with the World Health Organization (WHO), preventing WHO from researching health consequences emanating from atomic, military, and civilian use of the atom, even preventing them from issuing warnings to exposed populations. Dr Michael Fernex, formerly on the faculty of the University of Basel, who worked with the WHO, said in 2004, 'Six years ago we tried to have a conference. The proceedings were never published. This is because in this matter the organizations at the UN are subordinate to the IAEA …. Since 1986, the WHO did nothing about studying Chernobyl. It is a pity. The interdiction to publish which fell upon the WHO conference came from the IAEA. The IAEA blocked the proceedings; the truth would have been a disaster for the nuclear industry'.
>
> So in order to prevent a disaster befalling the nuclear industry, the magnitude of the *true* disaster is deliberately being obfuscated.

The CHAIR: Thank you.

Mr LIMBRICK: I have got one other question.

Dr CALDICOTT: I would request that you research this, please. It is on all the—

The CHAIR: Mr Limbrick, just a quick question and a quick answer, because I need to go to Ms Terpstra and then back to Ms Taylor and we have got about 8 minutes to go, so Mr Limbrick.

Mr LIMBRICK: One other thing: there has been talk about the linear no-threshold theory of harm from radiation damage and whether that is actually valid science. I mean, what is your view on that?

Dr CALDICOTT: The National Academy of Sciences, which is the academy in America, subscribes to the linear no-threshold dose. We all do. In medicine we all do. We know that is a fact. So the National Academy of Sciences—go to it and have a look at it.

Mr LIMBRICK: Wouldn't we expect to see, if that was true—there are areas in the world with naturally higher and lower levels of background radiation due to the natural environment—

Dr CALDICOTT: Yes, Brazil and India with thorium salts, and some of them have higher incidences of cancer and congenital anomalies, including mongolism.

Mr LIMBRICK: So you think that people should not live in places like Brazil and move somewhere else?

Dr CALDICOTT: Not Brazil—highly radioactive areas. Where they did uranium mining in America it was mostly in Indigenous areas. Native Indians—they have a high incidence of cancer. Their water is polluted, their crops are polluted. I could read you that too. I have got the statistics for them.

You need to understand what radiation means. Look, my husband was a radiologist. In the past the radiologists were a bit blasé about radiation, and they used to—

My husband has had cancer. His colleagues had cancer. In the past the old radiologists who were blasé—many of them died of cancer. We know about radiation. We know. Also now when you get a CT scan, that is quite a high dose of radiation, and there are a lot of studies now collecting the people who have had CT scans to find that they have a higher incidence of cancer. Children are 10 to 20 times more sensitive to radiation and cancer than adults. Little girls are twice as sensitive as little boys. Foetuses are thousands of times more sensitive. Do not walk through an X-ray machine at the airport.

The CHAIR: Thank you. Can I ask Ms Terpstra to ask a question. We have got 5 minutes left, so if we can keep the questions and answers straightforward, great—and sorry Ms Terpstra; it is the last.

Ms TERPSTRA: Thank you, Mr Chair, and thank you, Dr Caldicott, for your fantastic and very detailed and in-depth presentation. I have learned a terrible lot today just listening to you this morning. It is probably a follow-on from Ms Taylor's question. I am interested in hearing a bit more about medical and health conditions for workers who work in the nuclear industry. Could you just go into a little bit of I guess more detail for us about some of the health impacts for workers who are working in reactors around the world?

Dr CALDICOTT: Yes. I should have that data in this book. They are fairly careful in the nuclear reactors now. They have not been in the past, and I would have to look up that data about the incidence of cancer amongst nuclear power workers. I am involved in a case as an expert witness about a welder that spent a lot of time in a very high-radiation area where there had been an accident and water had escaped and he was welding a pipe and I think he developed a cancer and also early dementia, which can be caused by high doses of radiation. So I would have to go back into the literature. If you would like, you can contact me—you have got my email address—and I will send you the references to the question that you ask.

Ms TERPSTRA: Perhaps what we can do is take that on notice, Mr Chair, so Dr Caldicott can forward that. You can do that if you would like to take that on notice—

Dr CALDICOTT: Certainly.

Ms TERPSTRA: and forward that to us. So yes, that would be brilliant. Thank you.

The CHAIR: Thank you. Ms Taylor, have you got a follow-up question?

Ms TAYLOR: The other issue I was thinking of is the discussion about reprocessing of waste and spent fuel, and this is where I will be limited in my scientific knowledge, but what do you think the capacity of that is and the safety implications of that?

Dr CALDICOTT: Reprocessing—all our waste from Lucas Heights has been sent to England or France to be reprocessed. So what you take is these extremely radioactive fuel rods. If you stand next to one for a few seconds, you will incur a lethal dose of gamma radiation. They are terribly radioactive. They are chopped up in pieces and then they are melted in concentrated nitric acid, and from that radioactive solution is removed plutonium—it is precipitated out—and the plutonium is then used for weapons. Or they wanted to put it in breeder reactors or in modular reactors, which actually has not happened. It is terribly dangerous, and the waste that is left is full of all the isotopes that I showed you on that chart, the long-lived ones. It is terribly radioactive. It has to be cooled for a while, and then I think in France they have vitrified it—turned it into glass—and they are sending it back to us, because that was the agreement: they would reprocess it. And why did we want it reprocessed? Why did we want plutonium from our nuclear waste at Lucas Heights? God only knows. Do we want to make bombs? It is the only use we would have for it. Menzies wanted to make bombs. That is why he allowed the British to test in Maralinga. And so it is terribly radioactive. It comes back, and that is the stuff they want to bury in South Australia, which must be isolated from the ecosphere for 1 million years. We did not need it to be reprocessed at all.

The CHAIR: Thank you. Mr Hayes very quickly just got in, and we have got about 40 seconds for his question.

Mr HAYES: Thanks, Dr Caldicott—very interesting this morning. I just wanted to ask one more question. Is there any hope in looking at nuclear fusion in the—

Dr CALDICOTT: No. I always say it is like a physicist's wet dream. If you look at the literature, it will never happen. So do not think about nuclear. I mean, in Australia we are blown by wind and baked by sun. We could become the renewable energy superpower of the world. We can employ hundreds of thousands of people putting solar panels on all the roofs in Australia, on all the garages, all the electric cars solar powered. We could show the world how to survive in this very dangerous world. We could be the leader, a pioneer and create hundreds of thousands of jobs.

The CHAIR: On that note, that is I think a good closing. Dr Caldicott, thank you very much for your time today. It has been appreciated.

Dr CALDICOTT: That is my great pleasure. Thank you for having me.

The CHAIR: We appreciate your time and the effort you have put into your submissions and the evidence today. Thank you very much, and all the best. Our report will be handed down by the end of the year. On that note, all broadcast and Hansard equipment must now be turned off.

Witness withdrew.