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Chair

Mr. Greg Kerr

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● (0850)

[*English*]

The Vice-Chair (Mr. Peter Stoffer (Sackville—Eastern Shore, NDP)): Good morning, everyone. Welcome back to the halls of Parliament.

We continue our study on depleted uranium and Canadian veterans. Today we're very pleased to have, from Atomic Energy Canada Limited, Mr. Nicholas Priest, the section leader for radiation biology and health physics.

Am I correct in that, sir?

Mr. Nicholas Priest (As an Individual): Yes, except I'm representing myself, not AECL, at this meeting.

The Vice-Chair (Mr. Peter Stoffer): Very good, sir.

Thank you very much for coming today. We look forward to your presentation. Afterwards we will have questions from both sides of the desk.

Again, sir, we thank you very much for being with us today.

Mr. Nicholas Priest: Thank you for inviting me.

It came as a bit of a surprise to be asked to give a presentation. I wasn't aware that I had to give an introduction, but I've made a few notes, and I just hope that's okay. If you have problems with it, please indicate and I'll clear it up.

I'm a toxicologist. I have a Ph.D. in medicine from the University of London. Following my Ph.D., I worked for 13 years for the National Radiological Protection Board in the U.K., where I studied toxicity and behaviour in the body of materials that deposit in the skeleton. That's most metals, including uranium, radium, plutonium, and all sorts of things like this.

I then for ten years was head of biomedical research at the United Kingdom atomic energy establishment at Harwell, which is the sister organization to where I work now, at Chalk River. It was started by the same people at the same time.

Then we had a reorganization, and the organization was effectively broken up. I left the UKAEA—or AEA Technology, as it was called then—and moved to a university chair in London, where I was a professor of environmental toxicology.

In 2007 I was approached by AECL in Canada and asked to come over and look after biological research at Chalk River Laboratories. I readily agreed, because after 10 years in the university, that was enough.

I think Joe Oliver is meant to give a talk, perhaps even this week, on the future of the Chalk River laboratory. I just hope that I don't get caught, the second time in my life, when a laboratory is broken up.... Never mind.

So I came out here and subsequently picked up additional responsibilities for radiation dose symmetry at Chalk River and also for environmental technologies.

In the context of my experience with uranium, which I guess is the major issue here, it started at the NRPB, where I undertook studies on the way in which uranium behaves in the body and also on the toxicity of uranium—specifically, forms of uranium that are radioactive, or the opposite end of the spectrum to depleted uranium, if you want to put it that way.

I also was asked by the BBC to go with them to do a two-week investigation of depleted uranium exposures in the Balkans. I was in both Bosnia and Kosovo collecting urine samples from the general population, bringing the samples back to the U.K., and then using the technique, an isotopic technique, to detect depleted uranium in the residents living there.

I found a very small amount. The amount of natural uranium they were excreting was larger, but about 20% of the uranium they were excreting at that time, which wasn't very long after the war, gave a signature that suggested it was depleted uranium.

I was invited back by the German army a couple of years later. I went back with them to Kosovo, and this time to Serbia. When I was in Kosovo, I went back to the original people I had measured and took more samples from them. I found that now there was no indication of any depleted uranium excretion in the population whatsoever, which to me indicated that the people had a small continuous exposure after the war and that they didn't have a significant body burden of uranium; otherwise, it would have been excreted when I went back the second time.

I was asked in 2001 to write a review for *The Lancet*, which I did, on the toxicity of uranium. I was asked as a consultant, or asked basically as an *agent provocateur*, to sort of criticize evidence that was being provided to the Royal Society in their review of depleted uranium following the Iraq war, the Gulf wars.

I was a member of the U.K. Ministry of Defence depleted uranium research review group, and the IAEA asked me to go out on a field expedition to Iraq to look at the situation with regard to depleted uranium. That never came up, because the security position in Iraq was always such that the mission couldn't be undertaken.

In the context of this report, I was approached by Pierre Morisset and asked if I would be prepared to review the report. I agreed only too happily. I reviewed it. I made some comments, most of which were picked up. So as far as you're concerned, then, I have no problem agreeing with the conclusions of that report.

Thanks.

The Vice-Chair (Mr. Peter Stoffer): Mr. Priest, thank you very much for your presentation.

The format, sir, is that we go back and forth between parties for a variety of questions. They're normally five minutes each, but we certainly won't cut any of your response time.

Obviously, you're aware of translation services.

● (0855)

Mr. Nicholas Priest: That's happening now. I'm swapping from French to English.

The Vice-Chair (Mr. Peter Stoffer): I just have to ask a personal question. What is your favourite football club in England?

Mr. Nicholas Priest: The Tottenham Hotspur.

The Vice-Chair (Mr. Peter Stoffer): Yes. You're a good man; we're going to get along fine. There are not many Hotspur fans in the world. It's nice to see one. Thank you, sir.

We'll start with Mr. Sylvain Chicoine, for five minutes.

[*Translation*]

Mr. Sylvain Chicoine (Châteauguay—Saint-Constant, NDP): Thank you, Mr. Chair.

Mr. Priest, thank you for joining us today and for sharing your comments with us.

In your presentation, you said that you analyzed or looked at the blood samples of British soldiers, I believe, and that you detected traces of depleted uranium. Could you give us a little more details about that? We have mostly heard about uranium in urine. We have not heard about blood samples.

Could you tell us a bit more about those two ways—blood and urine—of analyzing traces of uranium?

[*English*]

Mr. Nicholas Priest: Thank you very much for the question.

No, I didn't actually analyze blood samples. I analyzed urine samples.

There are several ways of doing this. The way most normally used in North America, both in Canada and in the United States, is to measure the amount of total uranium in the urine sample and then compare it with the background levels of uranium excretion in the population, which can vary quite a lot.

I didn't use that method. I used a method that was used in the U.K. when they looked at their own forces. What we do there is measure the ratio of certain uranium isotopes in the urine. If we see an isotope ratio is typical of natural uranium, then all the uranium in the sample is natural. As we see the ratio shift towards depleted uranium signature, we can say how much of the uranium in the sample was depleted uranium and actually work out the fraction that is excreted as DU.

That's a very sensitive method. I think Matthew Thirlwall and I were the first to use it, but it was subsequently picked up and used to analyze those people in the British armed forces who actually wanted uranium measurements. They were offered the opportunity, and a significant fraction didn't actually want to have their urine analyzed.

So it wasn't blood, it was urine. But we used isotopics to identify depleted uranium in urine, rather than total uranium.

● (0900)

[*Translation*]

Mr. Sylvain Chicoine: Thank you.

You have used sampling a lot and you have made a lot of observations. With the Germans, your observation was that they had eliminated it all. Have you seen any samples with traces of depleted uranium, the way you did with the British soldiers in the study you briefly talked about? What did you find? Finally, were there some traces of uranium or none at all?

[*English*]

Mr. Nicholas Priest: Firstly, the people whom we measured in Bosnia, Kosovo, and Serbia were members of the public. We collected urine samples, and we had urine samples from everybody, from babies all the way up to senior citizens.

The amount of total uranium excreted by the people in the area was not too dissimilar from the levels found excreted by people in Ontario, Canada.

The next thing we found was that a small fraction, somewhere between 10% and 20%, of the uranium they excreted was from depleted uranium. Now, that wasn't present in the water supply, but the water supply was discontinuous at that time. At the time, I think in Bosnia there were about three tonnes of depleted uranium used as munitions fired by Warthog aircraft, and in Kosovo about 10 tonnes were used. When this happens a small amount of the uranium is vaporized and that would have gone into the atmosphere.

So the question is not whether people were exposed to DU but how much exposure they had to it and whether or not it was significant.

Our conclusions were that the amounts were insignificant. But we saw that signature and we wondered where they were getting it from, and it was probably because they drinking from the rainwater running off their roofs. Also, they probably preserved a lot of vegetables and things like that, which were possibly subject to having materials deposited on them. They stored these vegetables over the winter and they would still have been eating them the next year, which would have tiny trace amounts of DU on them.

When uranium enters the body, about 80% to 90% of what gets into the blood is very rapidly excreted. So what we were measuring was that fraction of the uranium that was rapidly excreted following its entry into the blood.

We went back two years later and measured some of the same individuals. We actually found the same individuals in Kosovo we had measured two years previously. They provided us with some more samples then and when we measured them we could find no trace of depleted uranium. So we think this was a transitory, low-level exposure subsequent to the conflict.

It's interesting that of the British veterans who came back from the Gulf War, there was no real indication of any significant intake of depleted uranium by them. I think there were hundreds of people measured, again using this isotopic method. It rather bears out our suggestion that it was coming from food and rainwater and things like that because, quite clearly, that wasn't the source of food and water for the British army. Even though they're quite badly off sometimes, I don't think they resorted to using rainwater and locally stored foods for feeding the army.

So I think that's a reasonable suggestion.

The Vice-Chair (Mr. Peter Stoffer): Thank you, Mr. Priest.

Now we'll go over to Mr. Hayes for five minutes, please.

Mr. Bryan Hayes (Sault Ste. Marie, CPC): Thank you, Mr. Chair.

Welcome, sir.

You've touched on your past research and it's significant. I'm just curious how your findings compare with other international research. Is there consistency across the board in the findings with respect to depleted uranium? Or are there areas of disagreement in any way, shape, or form?

● (0905)

Mr. Nicolas Priest: I don't think there are any areas of disagreement. Certainly people will interpret the same data in different ways. For instance, in the United States the army chose to just measure total uranium, except in the individuals who were caught in friendly-fire incidents. None of the military personnel showed uranium excretion levels falling outside the normal distribution of those within the population. That's reasonable because depleted uranium is less toxic than natural uranium. If somebody is excreting levels of total uranium that are within the normal band, then you haven't got any cause for concern. It suggests that even if they were excreting DU, the toxicity level would be lower than within that normal band.

I don't think there's any real disagreement. There was some disagreement at first about the use of isotopic methods. There were some early studies that were not very good because the method was being worked out. There was resistance from some sources because they thought that if we used these methods, then we might find things that we don't want to find. In the end, as I said, in the U.K. we do those isotopic measurements, and Americans do them as well. It makes sense.

Mr. Bryan Hayes: As for your peer review of this particular report, you made some comments, most of which were picked up, you said, and that you agreed with the conclusions. Did you at any point, while reviewing that report, have to challenge its findings at all?

Mr. Nicolas Priest: No. What I was doing was trying to add context.

I put in some things like the sort of levels of uranium that are found in Ontario. Most people have quite a low level of uranium intake because they're drinking town water supplies, which are controlled. People on well water can have huge concentrations of uranium from that water. Normally, you might have, oh, I don't know, but say 5 micrograms per litre, or even less. You can then find wells where there's 800 micrograms per litre. In Bosnia we found some wells that were between 2,000 micrograms and 3,000 micrograms per litre. There's a huge variation in the amount of uranium taken up within the population. Almost everybody in Finland, for instance, drinks water with more uranium in it than the standard set by the World Health Organization. Again, it's a consequence of the local geology and the fact that water contains a lot of natural uranium.

Mr. Bryan Hayes: How's my time, Mr. Chair? I'm still okay.

Could you explain what experience you were referring to when you wrote in a 2001 article titled “Toxicity of depleted uranium” the following:

> experience supports the claim that health effects produced by the radioactive decay of depleted uranium in the body are extremely unlikely....

What experience was that?

Mr. Nicholas Priest: That's a quote from my *Lancet* paper. If we start off with the fact that depleted uranium, chemically speaking, has identical toxicity to natural uranium and that radiologically it's less toxic, because most of the more radioactive isotopes are reduced in the uranium, then we can go back and look at the experience within industry where people have been working with uranium for years.

There were two large studies, one conducted in the United States with about 20,000 people and one conducted in the U.K. with about 20,000 people. The one in the United States looked at cancer and the one in the U.K. looked at all causes of death. The conclusion of both was that they could find no evidence of any adverse effects in those populations, even though in the early days of the nuclear industry when most of the exposures occurred people just threw uranium yellow cake around without taking very many precautions. People sometimes wore dust masks, sometimes they didn't wear a dust mask. So there were considerable exposures in those days, but there's no indication of any toxicity within those groups.

One or two studies suggest there might be a link with lung cancer, but the suggestion is very weak, and lung cancer studies are notoriously difficult to interpret because you have to control for smoking, and unless you know exactly what the smoking habits were of every one of the subjects, it's difficult to interpret.

If it were a more radioactive form of uranium, the more toxic one, and you asked me what I would expect, I would tell you that when that uranium is breathed in, it is breathed in as particles and goes into the lungs. About one-third of it is exhaled with the next breath. Most of the remainder is deposited on the airways of the lungs, and about 6%, depending on the size, is deposited in the deep lung, meaning the respiratory sacs, the alveoli, of the lung.

That which is on the airways rapidly comes up and is swallowed. So there is a flow of mucous up the respiratory tract, but you swallow it. So within one or two days that would have cleared. Then you have 6% left behind in the lung and that gradually dissolves. It can take a long time to dissolve. More insoluble forms of uranium can take months or years to dissolve in the bottom lung. While it's there it irradiates the lung. So one risk that we would associate with a highly radioactive form of uranium, like uranium-233, which is an isotope, is lung cancer.

When it gets into the bloodstream, the vast majority of it is excreted. While it's being excreted, some of it gets hung up in the kidney for a while. So you get a radiation dose to the kidney and might expect to get kidney tumours.

The other thing is that because uranium behaves in the body like calcium, it goes into the skeleton and some of it is in the skeleton. There you might expect to find bone tumours.

So the three tumours that you would be looking for within a population exposed to uranium would be lung tumours, bone tumours, and renal tumours. And those are not found, as I said—with the possible exception of lung cancer, but with a very big uncertainty associated with that. Some studies suggest there's an excess, some suggest there's no excess, and it depends critically on whether there's any smoking.

● (0910)

Mr. Bryan Hayes: Thank you.

Thanks, Mr. Chair.

The Vice-Chair (Mr. Peter Stoffer): Thank you, Mr. Hayes.

Now we go over to Mr. Casey, sir, for five minutes.

Mr. Sean Casey (Charlottetown, Lib.): Thank you, Mr. Chairman.

Dr. Priest, I want to ask you, first of all, about a section in the report that talks about the experience of uranium miners and the fact that they have a high incidence of lung cancer. The conclusion drawn by the authors of the report is that the major contributing factor in this cohort is radon and not uranium. I'm sorry if this sounds like a stupid question, but I'm not a scientist. Can you explain the relationship between radon and uranium?

Mr. Nicholas Priest: Okay. Uranium is radioactive, which means that its nucleus is unstable and at some point, depending on how unstable it is, it will decay away to another nucleus that is smaller. It will lose some of the nucleus. Then if that's stable, fair enough. If that is radioactive, it will decay away to another material, and you go down through a chain. We call that a daughter chain. So you start with a parent radionuclide like uranium and you get a succession of radioactive decays all the way down—in the case of uranium—through radium. Then radium decays to radon. Then there are more alpha particles and more radiations, until you come down to lead. When it gets to lead, it's now stable and there's no further radioactivity.

Radon is a gas, and whereas the uranium stays in the rocky material, the radon diffuses out. In the early days when the mines were poorly ventilated the concentrations of radon in the mines in Canada and elsewhere in the world were really very high, so the lung doses from the inhaled radon were very high. The amounts of uranium these people inhaled were very small. The bigger problem was actually inhalation of silica.

So yes, in that case, if you work it out and do the dose symmetry, asking how much of the radiation is coming from the uranium and how much of it is coming from radon and the daughters of radon, you find the dose from uranium is minuscule compared with the dose from both normal radon, which comes from uranium, and another radon isotope that we call thoron, that comes from thorium, which is present in the uranium deposits. Those two, and their daughters, contribute 99.9% of the dose when you work it out.

● (0915)

Mr. Sean Casey: So radon is decayed uranium.

Mr. Nicholas Priest: Yes. The nucleus starts with a mass of 238 for uranium, the major isotope. When it decays it loses four of those. It gets rid of part of its nucleus and forms new mass weight. It now becomes something with uranium 234, with mass 234. Then it decays away, and you go down through a chain like this. At each stage the nucleus of the atom gets a bit smaller. Sometimes it becomes more stable and sometimes less stable. Eventually it gets down to a state where the nucleus has the right balance of protons and neutrons and it's stable. It no longer wants to break up. With these decay chains that is normally lead. It's occasionally bismuth, but normally it's a lead isotope.

Mr. Sean Casey: Is depleted uranium one of those stages of decay?

Mr. Nicholas Priest: No. In natural uranium, there are three isotopes. It's basically just three forms of the uranium which have different atomic masses. As I said the weight, some are less stable and some are more stable; you've got the most stable one, which is uranium-238, with a mass of 238. The next one is uranium-235, with a mass of 235, and then there's uranium-234. In normal, natural uranium, these are present in a fixed ratio.

When you use uranium to make fuel for reactors, then you sometimes want to increase the amount of uranium-235 in the fuel, which is the fuel component in the uranium. You can burn uranium-238 in fast reactors, but not in normal reactors. So they enrich the uranium by putting it through a separator, which means there's more 235 than there normally is. Instead of being about 0.07%, it goes up to 3% or 5%. At the moment, the big argument is because the Iranians are producing 20% enriched uranium, which means that 20% of the atoms would be this 235-type.

When you do that, you end up with uranium that has less uranium-235 as a by-product. We call that depleted uranium. The original thought was, well, we'll use this as breeding material in plutonium-generating fast reactors. That was the idea. Then other uses came up. It was used as a chemical because it's safer than natural uranium. Almost immediately all the fine chemicals used in chemistry labs and things like that, including uranium salts, were switched over to depleted uranium salts. Its weight was used by Boeing as counter-weights in the surfaces of aircraft. It's used in a wide range of applications, including military applications for penetrators, and also armour. The United States actually uses depleted uranium as part of the armour in their Abrams tanks.

So there's a wide range, but that's the leftover product, so it's not a decay product. It's basically where you've taken the natural uranium and you processed it so that part of it is enhanced, and in the process of doing this you've created some uranium that has less radioactive material in it. You typically get about a 60% reduction in uranium-235, and 80% or 90% reduction in uranium-234.

The critical thing is that people tend to think of depleted uranium as something that is fixed, but the reality is that any uranium containing less uranium-235 than found in natural uranium is officially depleted uranium. So depleted uranium hasn't got one composition, but a variety of compositions, depending on where it came from. Most of the material that was used by the armed forces came from the Paducah plant in the United States, and there the composition always remained the same. That's the material that's used in three places. The U.K. uses it for its CHARM3 armour-piercing rounds in tanks and it's used in Phalanx guns as well. The Americans use it as well in the Warthog A-10 aircraft, which Britain doesn't operate. Those are the three uses for it.

I think in Canada, then, the only usage was in the Phalanx in the navy, and I'm not even sure if that's still ongoing. That gun has probably been taken out of service.

● (0920)

The Vice-Chair (Mr. Peter Stoffer): Mr. Priest, thank you very much.

Now over to Mr. Lobb for five minutes....

Mr. Ben Lobb (Huron—Bruce, CPC): Mr. Priest, forgive me if I'm repeating things, but when you did your studies over in the Balkans, did you have an opportunity to go there twice?

Mr. Nicolas Priest: Yes.

Mr. Ben Lobb: When you were over there, did you have a chance to test both.... I'm assuming there would be former military personnel over there—

Mr. Nicholas Priest: It was just members of the public.

Mr. Ben Lobb: Just maybe by happenstance, did any of those members of the public have any shrapnel or anything like that in them?

Mr. Nicholas Priest: No, the only weapons that were used in the Balkans were A-10 Warthog rounds. The anti-armour rounds fired by tanks are very precise; they normally hit their target. Normally they try to put two rounds through the target just to make sure it's knocked out. The A-10, on the other hand, operates in a different way. It fires hundreds of rounds at very rapid rates, and you strafe the target. So very few of the depleted uranium rounds actually hit the target. Most of them get embedded in the road or in the local environment and things like that.

Where you're talking about the environmental aspects, they arise mostly from the rounds not hitting the target but other things. You can go around and see the holes in the road. We did that, and if you dig deeply enough, you find the penetrators. They were being picked up. Teams were clearing mines and they would occasionally find the penetrators and pick them up, put them in a plastic bag, and take them back for disposal.

Mr. Ben Lobb: I don't know if this is relevant or not but I'll ask the question anyway. Is there any relevance to ranking the risk of exposure, whether it's inhalation or ingestion? If you possibly have shrapnel in your body by fluke, is there any way of saying that this shrapnel or exposure by inhalation put you at higher risk? Has that been determined?

Mr. Nicholas Priest: I guess the risk increases as the amount in the body increases. Quite clearly if people have bit of depleted uranium metal in them—which some of the people involved in the friendly fire incidents both on the U.S. and U.K. sides do have—they will have the highest amounts of uranium in their bodies and would be at highest risk. But the studies done in the U.S. have not shown any adverse effects in these people, to the point that they've not considered it necessary to remove all of the shrapnel. They've removed the big bits but often they've left smaller pieces of shrapnel in the individuals concerned. There's no evidence of any toxicity.

Many other metals are much more toxic, including the conventional rounds that are used by the armour-piercing rounds, which contain nickel and cobalt and tungsten. If you look at it from a chemical toxicity point of view, they're probably much more toxic than depleted uranium. Uranium is not very toxic as a material. I would quite happily wear a watch made of depleted uranium, except that it tends to oxidize and my arm and my shirt would be black. Other than that, it wouldn't worry me because the radiation under that piece of uranium would never reach a level where I would expect to see any damage to my skin.

Similarly, if I completely surrounded myself with gamma rays from depleted uranium, I wouldn't exceed the radiation worth a dose limit in a year. If I wanted to get up to the same dose that I get every year from natural background radiation, I'd have to eat about a teaspoonful of uranium, about five grams.

● (0925)

Mr. Ben Lobb: That's interesting because Bruce Power is in my riding. You will be well familiar with Bruce Power when it was trying to move the steam generators to Sweden to get them recycled. You remember that ongoing debate. The argument was that there's more radiation in a pacemaker than in a steam generator. There are tonnes of data in the nuclear industry to back up the science behind the procedures that have taken place, but quite often the public chooses to ignore those facts, I think.

Mr. Nicholas Priest: Can I be brutally honest with you as well?

Mr. Ben Lobb: Sure.

Mr. Nicholas Priest: I often think that it's politicians' perception of public opinion that is actually driving things rather than public opinion itself. We did a survey looking at the acceptability of nuclear technologies in Canada, and we did it pre- and post-Fukushima.

After Fukushima, acceptance of nuclear technologies across Canada rose, including in Quebec, which has a slightly different attitude to nuclear technologies. It didn't fall, and yet the perception among the political class was that it was a gut reaction. This must mean there's going to be more opposition to nuclear within Canada, Germany, or other countries.

What happens is that people are beginning to realize that we've had a succession of nuclear accidents or power plant failures. I don't like calling Fukushima a nuclear accident because it was 100% predictable, given the circumstances there. The reactor wasn't designed to meet what was thrown at it. People realize the consequences are quite small; they're mostly economic consequences. You can go back to the first one, the Three Mile Island reactor accident. Nobody was harmed as a consequence of that accident. Go to Chernobyl. The predictions were that thousands and thousands of people were going to die as a consequence of the radiation from Chernobyl. The reality is that there is no excess in anything as a result, except childhood thyroid cancer, and that's treatable. You've only had about a few tens of deaths that you can attribute to Chernobyl.

From Fukushima, the doses are really quite low. The doses around Chernobyl now in the exclusion zone are lower than they are in Cornwall in southwest England. Similarly, people were being moved from areas around Fukushima where there was some contamination, but they were being moved into areas in Japan where the natural background dose was higher than the areas they had come from. There are lots of things involved, and I think the problem is that the perception is very difficult to fight.

The reality is that if I had 200 people and I irradiated them with so much radiation that half of them were going to die in the next week or so, of that 100 remaining, 80 would never see any radiation-induced cancer. The reality is that radiation is a remarkably poor carcinogen; it's not very carcinogenic. That's why we can use radiation for radiotherapy. Otherwise we'd be inducing as many tumours as we were trying to treat. That sort of perception, that sort of message, is not there, even within our own workforce at Chalk River. We had issues with misperceptions about risk and radiation. I remember the incident with those devices being taken away from Bruce Power. It didn't make any sense, but that was the perception. In fact, they're clean.

● (0930)

The Vice-Chair (Mr. Peter Stoffer): I appreciate your time. Thank you.

Now we go to Ms. Mathyssen, please. Thank you.

Ms. Irene Mathyssen (London—Fanshawe, NDP): Thank you very much, Mr. Chair.

Thank you very much, Dr. Priest. I have a number of questions.

First of all, you said that the British and the Americans are still using depleted uranium to build vehicles of war or combat vehicles.

Mr. Nicholas Priest: The British are not using it in the construction of the Challenger tank. I believe that the Americans use it as shielding in the construction of the Abrams tank. But both in Britain and the United States, the armies use depleted uranium in anti-armour piercing rounds as one option for their tanks.

Ms. Irene Mathyssen: Thank you.

Are they continuing studies on the impact of depleted uranium, since they're still using them for armour plating? Or have they stopped?

Mr. Nicholas Priest: I think it's fair to say that both in the U.K. and the U.S....but I am less familiar with the latter. I was asked to go there to make some comments on its monitoring program, but that was a while ago and I'm not sure what's happening now.

My feeling is that there is still monitoring. The biggest problem they had in the U.K. is that when we asked people whether they wanted to have measurements, a large fraction of the people who were approached didn't want to bother.

But there will be continuing monitoring, as there always is. We have monitoring now. We're seeing some cancers that were induced in military personnel by the explosions from nuclear weapons testing after the war. There is possibly some excess there.

We're still monitoring our populations, and people do it all the time. It's exactly the same in Canada, where we're monitoring our nuclear workers. There's a continual monitoring of them to make sure there's no excess adverse health effects in the worker population.

Ms. Irene Mathyssen: From what you have said and the report that was brought to us by Dr. Morisset, there is a very real sense that the concern around depleted uranium is not borne out in reality, that it's not this toxic and dangerous substance.

If that is the case—and there you made mention of nickel, cobalt, and tungsten—should we be looking at something else? Are we spinning our wheels here? Should we be concerned about some of the other toxins that veterans or populations might be exposed to? I'm thinking of the Gulf War syndrome, with veterans reporting fatigue and sleeplessness, headaches, and forms of depression. Are we going down the wrong road here with this concern about DU?

Mr. Nicolas Priest: There were lots of issues. I'm talking about the Gulf War situation now rather than the Balkans. There was a sand fly problem, and so organophosphate insecticides were widely used. The tents were sprayed with them, and all sorts of things like that.

People were given injections, which were not normally, I understand, given.

Can I say something here? My knowledge in this area is hearsay, from talking to people, okay? I don't want....

But I understand that a number of injections were given to armed forces members against possible biological agents that the Iraqis might use. There was extensive use of organophosphate insecticides. There were other exposures there, and as a toxicologist, a lot of things I see in the Gulf War syndrome are more easily attributed to organophosphates to my mind than to depleted uranium. I think of the list of all of the ones that could have caused it.

Undoubtedly with those issues of the Gulf War syndrome, I think it's much more likely it was something like organophosphates rather than uranium.

● (0935)

Ms. Irene Mathyssen: Are studies being done in regard to these organophosphates or the injections?

Mr. Nicolas Priest: A lot have been done, because these were the sorts of things that were used in sheep dips and things like that, where you had exposures among farmer populations. So there's a long toxicological knowledge of the effects of exposure.

Similarly they had a problem in the Gulf when they were trying to grow their own crops in the desert in the United Arab Emirates. People were using fertilizer, but fertilizers and pesticides had the same name in Arabic, I think, being translated as chemicals. So people were putting huge quantities of organophosphates onto the food crops, thinking they were fertilizers. I think there were problems there as well.

There is a body of knowledge on the toxicity of these types of things. I'll be honest with you. Within the U.K., and possibly within Canada and the United States as well, there has been more emphasis on saying that it's not uranium than on trying to work out what caused it. That's a personal opinion.

The Vice-Chair (Mr. Peter Stoffer): I appreciate that. Thank you.

Now we go over to Mr. Lizon, please.

Mr. Wladyslaw Lizon (Mississauga East—Cooksville, CPC): Thank you, Mr. Chair.

Thank you, Mr. Priest, for coming to the committee this morning.

First, you mentioned the uranium in drinking water that's found naturally, and you mentioned Finland, where the levels are quite high. I'm asking this question because I also drank well water for a good part of my life: does this have a lasting effect, that you know of, on people's health?

Mr. Nicholas Priest: No. I've never seen any data that suggested there were any toxicological consequences to drinking well water.

Can I tell you how the WHO derives their drinking water limit for uranium? They start off with something they call the "lowest observable adverse effect" level. They go through all the experimental evidence and find the lowest concentration they can find in effect.

Now, when you're exposed to uranium, the kidney does adjust. It actually changes. It becomes more resistant to uranium. So we're not quite sure whether the lowest observable effects are actually adverse or whether they're adaptive—but that's besides the point.

So we find these levels, and these levels are found in animals. Then the WHO says, right, because this is a lowest adverse effect level, we'll say that the no adverse effect level is ten times lower. We're putting a conservative factor of ten so that this is now the level at which we would expect no effects. We're confident there are no effects in these animals at below this level. But we don't know how the animal works relevant to man, so we're going to put another safety factor of ten to account for the possible differences between the animal model and man.

Then they turn around and say, yes, and we don't know if there are sensitive individuals within the population, so we'll put another factor of ten in to account for those sensitive members of the population.

We now have a level that is a thousand times lower than the level that was shown to produce these effects, which may or may not be adverse, in these animal populations. So I'm really not surprised that people drinking well water have never seen any adverse effects in the population.

There are some ways that you can find out. You can actually get your urine tested to get an estimate of what your uranium burden is. Also, if you do have kidney damage or changes in the kidney, there are some proteins that are increased in the urine. You also increase the level of an enzyme called catalase, which makes hydrogen peroxide bubble if you put hydrogen peroxide in the urine.

But no, there's not.... And as I said, it's hugely variable. Some water wells contain none and some contain huge quantities. Really, the more worrying thing is that radium is a daughter of uranium, and radium tends to be much more soluble than uranium. If you have high uranium in water, then often there's a lot more radium there as well.

I was asked to participate in an engineering project in Jordan, where an aquifer had been discovered that actually spanned across Israel and Saudi Arabia as well. They wanted to use it to extract water for the population. The levels of radium in that water were high. What they wanted to do was to dilute it. They wanted me to say how much it had to be diluted with clean water, such that it could come under the regulatory limits.

I said, no, you can't do that, because you're just halving the dose to twice the people, and that's of no benefit. So I didn't participate.

But no—and I'm wandering, sorry—there's no indication that uranium in our well water is harmful.

● (0940)

Mr. Wladyslaw Lizon: Thank you.

Going back to the report review, you were one of the three individuals who were tasked with reviewing the report. Can you tell us the specific role that the scientific advisory committee on veterans health tasked you and your colleagues with?

Mr. Nicholas Priest: Pierre Morisset gave me no preconditions. He said, "This is the report. Can you go through it? Can you find anything that you think is factually inaccurate? Can you find anything that we've missed? Can you add something that will help?" Basically, I was given a free hand to completely review the document.

I made one criticism. These reports follow on from each other, and there's a tendency, I feel, for people to review the previous reviews rather than go back to the original data. I made the comment that, personally, I thought that the review was a bit heavily reliant on the IOM study in the United States, but it's minor because I've got confidence in the IOM study, and I'm not really worried by that. But there's a tendency to do sequentially review each previous review rather than going back to the original data. But I'm completely happy with the report.

Mr. Wladyslaw Lizon: If there were changes to be made, what was the process for editing the report?

Mr. Nicholas Priest: I produced comments in the form of suggested changes. I have here all the suggested changes that I made. As I said, some of them were picked up, some of them weren't. That's fair enough. Some of them were a little bit to one side. But on things like depleted uranium, it's not an absolute thing where you can be pedantic. You get a graph or a table, and it says "Isotopic Comparison of Natural and Depleted Uranium". I just put "U.S. sourced" in. It wasn't picked up; it wasn't necessary. But those are the sorts of things I was suggesting.

That's how I did it. I went through the document making changes within the document in MSWord and highlighting where I made changes and then sent them back to Pierre and the committee to either accept or reject. I guess they did that for each of the reviewers, and some comments they accepted and others they thought didn't add very much, and so they left them out.

● (0945)

The Vice-Chair (Mr. Peter Stoffer): Thank you, Mr. Priest.

Now we'll go on to Mr. Zimmer for five minutes, please.

Mr. Bob Zimmer (Prince George—Peace River, CPC): Thank you, Chair.

Thanks for coming, Mr. Priest. We're glad to have your expertise at our committee today.

I have about six questions, so I'm going to try to be as rapid as I can, and if you could agree to answer fairly rapidly—

Mr. Nicholas Priest: I'll try to answer quickly.

Mr. Bob Zimmer: I realize that with your wealth of understanding, it's tough to stop at a small answer.

Again, to refer back to the reason this study was enacted, it was to really get to the bottom of the health concerns of our veterans.

Mr. Nicholas Priest: Yes.

Mr. Bob Zimmer: We care about them and we want to make sure that they're being treated correctly. If this is the wrong target, then we should move on and find the right one.

In your opinion, was the scope of the report great enough to provide a helpful scientific opinion on the potential health effects faced by Canadian Forces members due to depleted uranium?

Mr. Nicholas Priest: Yes.

Mr. Bob Zimmer: You think it is. Okay. Good, that was quick.

The Vice-Chair (Mr. Peter Stoffer): Mr. Zimmer, can you repeat that again, please?

Mr. Bob Zimmer: Sure.

In your opinion is the scope of the report great enough to provide a helpful scientific opinion on the potential health effects faced by Canadian Forces members due to depleted uranium? And the answer —

Mr. Nicholas Priest: And I said yes.

Mr. Bob Zimmer: —was yes.

The Chair: Thank you.

Mr. Bob Zimmer: I know you've just spoken about how familiar you are with other international studies. Do you agree that the report's findings are in line with the findings of most other international studies on depleted uranium?

Mr. Nicholas Priest: Yes, I do.

Mr. Bob Zimmer: You do.

Boy, you're too fast, and I'm going to have more time than I need. That's okay.

Since the study summarizes and assesses the research conducted to date rather than proposes new research, do you agree that the committee effectively reviewed the current research on depleted uranium?

I can repeat that if you wish.

Mr. Nicholas Priest: No, I'm just thinking, because it's actually quite wide. Where do you draw the line? line?

Mr. Bob Zimmer: Right.

Mr. Nicholas Priest: Certainly most of the relevant research relates to uranium rather than depleted uranium. Has it picked up and reviewed all of the available evidence on uranium toxicity? No, it hasn't. But there again, the Royal Society report was two volumes thick. The IOM report was extensive. I think the Capstone report that the Americans produced was about 1,000 pages long.

Mr. Bob Zimmer: Right. So I guess the key word is "effective", right?

Mr. Nicholas Priest: As for whether I think it has adequately covered the area, I think the answer is yes.

Mr. Bob Zimmer: Yes, that's fair.

And last, in your opinion, does this final report complete the tasks requested of the committee, which were to "review and summarize the published scientific literature on the human health effects of depleted uranium and evaluate the strength of the evidence for causal relationships"?

Mr. Nicholas Priest: Yes, I think in respect to the latter part of that, it has done very well, in that it has gone back and looked at all of the relevant epidemiological data for uranium. I can't think it has missed anything, okay. It picks up all the major studies.

Mr. Bob Zimmer: And you agree with the findings?

Mr. Nicholas Priest: I agree with the findings there.

As I said, it's difficult to know where to draw the line. I'll tell you why. Uranium isn't toxic, radiologically. It's not uranium that causes the problem. It's the alpha particle that is generated the moment uranium disappears, and an alpha particle is an alpha particle. So strictly, the only thing that uranium does is determine where in the body that alpha particle is released. And other different materials, such as plutonium or radium, would have a different distribution so the alpha particles will be released in a different place.

So if you were going back and saying where do you draw the line, I could make a very strong argument to say, "Look, since it's the alpha particles that are causing the toxicity, you should go back and review all of the data on all of the materials that emit alpha particles".

That would be a nonsensical thing to do, but it would be logically coherent. Okay? But I think that in terms of the scope of this, a reasonable job was done. Yes, you wouldn't get the same level of knowledge and understanding from a group reviewing it like this as you would if it were an expert group that came up and did it, but there again, you'd probably end up with a report you couldn't understand.

So I think they've done a reasonable job, a good job.

● (0950)

Mr. Bob Zimmer: So for all intents and purposes, and the purpose of this study, DU cannot be attributed as a factor in the negative health effects. Is that what you're saying?

Mr. Nicholas Priest: Personally I can think of no way that depleted uranium exposures of Canadian, British, American, or French personnel in either the Balkan or the Gulf War could have given rise to the adverse health effects that are claimed by the Gulf War veterans. Personally, if I were doing it, I would look at it given that the level of worry amongst veterans varies according to nation, and I believe that the French army has fewer concerns about Gulf War syndrome. It might be best to go back and look at some of the differences in practices between different operational groups within the Gulf War to see whether you can correlate the level of concerns within the population, the veteran population, with those practices.

The uranium aspect is the most unlikely of all, I think. It's not something that worries me in the slightest.

The Vice-Chair (Mr. Peter Stoffer): Thank you, Mr. Priest.

We'll now go to Ms. Papillon for a shorter round of four minutes in our second round.

[*Translation*]

Ms. Annick Papillon (Québec, NDP): Thank you, Mr. Chair.

Mr. Priest, thank you for your testimony. Thank you for explaining why you agree with the report submitted by the Scientific Advisory Committee on Veterans' Health.

You also agree that there is no scientific research. Really the report is just a compilation of research and studies that are currently available around the world. So nothing has really been updated. In addition, like me, you saw that the case studies were excluded from the scientific approach in the report.

In light of that, do you still agree with that method, with the scientific approach that was used in the report?

[*English*]

Mr. Nicholas Priest: Could you repeat the first part of your question, please?

[*Translation*]

Ms. Annick Papillon: The report does not include any new scientific research. It is simply a compilation of studies on depleted uranium, mainly American studies, as you said. In addition, the sample case studies were specifically excluded from the report. The samples were probably considered too small to carry out a proper analysis of the situation.

In light of that, do you still feel that the right scientific approach or method was used in dealing with the small sample, which may very well change everything?

[*English*]

Mr. Nicholas Priest: Okay, thank you very much. I apologize for asking you to repeat it. I was concentrating so much on the second part of your question, I forgot the first part.

Regarding the new scientific research, there haven't been any studies published recently, and that's because when you're studying populations and looking at these effects, you look at them over their lifetime. Then you might give occasional progress updates. For example, people are still studying the victims from Nagasaki and Hiroshima, the atomic bomb survivors.

So, you follow a cohort of people from the time of exposure to the time they die, and when the cohort has completely passed away, you can make a conclusive statement on whether or not you have any adverse effects.

In that respect, the studies that are the most important are the studies of workers, which were undertaken in the forties and fifties in Britain and the U.S.A., because there were a large number of people in those studies. If you have small studies, then they're subject to significant error. This is just a consequence of small numbers. If you toss a coin 1,000 times, it's going to be closer to a one-to-one ratio for heads and tails than it is if you toss a coin three or four times. So there is an inevitable concentration on the larger studies, because those are deemed to be the most powerful. Studies of people from a while ago—a lot of whom have died, and so we have a good history on those individuals—are the most powerful ones as well.

That is why I think it's justified to do that. I think it's very important to realize though that these individuals, these people, who claim to be damaged have real problems. Something caused those problems, and it's important to find out what caused those problems. I don't believe it was uranium.

● (0955)

[*Translation*]

Ms. Annick Papillon: Exactly. The one case in a million may make all the difference. For instance, one individual may be particularly affected compared to the rest of the population.

The seventh conclusion in the report indicates that, when an individual needs appropriate care, physicians are responsible for providing that care, regardless of whether they have a diagnosis or not. Perhaps it is not possible to do the necessary tests for a diagnosis.

Do you feel that the individual must receive the proper care and that veterans must be given the benefit of the doubt?

[*English*]

Mr. Nicholas Priest: There's no real indication of super-sensitivity in individuals, which is, I think, what you were suggesting with the one person in a million. If we'd had super-sensitivity in people, I think it would have been identified by now, because, as I said, there are a huge number of people who are exposed to quite significant amounts of uranium in the world. It's a common thing. Everybody has uranium in them.

With regard to the treatment, it's not really very amendable to that. If you have uranium in the body, it's one of the materials that are difficult to remove. It gets deposited in the skeleton.

[*Translation*]

Ms. Annick Papillon: Let me interrupt you for five seconds to ask you something. If the doctor says—

[*English*]

The Vice-Chair (Mr. Peter Stoffer): Madame Papillon, I'm sorry, but you're over your time. If you let him finish what he was saying, we'll carry on.

Mr. Nicholas Priest: I don't think there is any effective way you could easily remove uranium from the body of somebody without causing skeletal problems, because you have to mobilize the skeleton in order to release the uranium.

There are ways of removing it from the lungs, because you can remove particles. If people have cystic fibrosis, they do something they call lung lavage, whereby basically they pass saline down into the lung and wash the lungs out. You can actually do that; if somebody had a huge dose of particulate radioactive material, this is one of the things they would do, and you can wash the activity out. But you would never do that for depleted uranium exposure.

The Vice-Chair (Mr. Peter Stoffer): Thank you.

Now we go on to Mr. O'Toole, please, for four minutes.

Mr. Erin O'Toole (Durham, CPC): Thank you, Mr. Chair.

Thank you, Dr. Priest. It's very helpful to have you here today.

I'm going to change the order of my questions, first to address or perhaps clarify my colleague Madame Papillon's question, which I think didn't reflect the total report. She asked why not new research, as distinct from a global overview of existing research.

Wasn't it clear in the report—and please comment on your review of this when looking at the Balkans and the Gulf—that even with the close-in weapon system or CIWS on our ships, that is the Phalanx, there was no area of likely exposure for Canadian Forces personnel to DU anyway? That was a finding of the report, is that correct?

● (1000)

Mr. Nicholas Priest: Yes. There's no obvious route to exposure for Canadian Forces or for the vast majority of British or American or French forces that operated in the Gulf—

Mr. Erin O'Toole: So in those circumstances, wouldn't a review of the existing literature be appropriate?

Mr. Nicholas Priest: Yes. As I said, it's not true that no research is being done; these populations will continue to be monitored for the rest of their lives as part of epidemiological studies. It's just that you don't report epidemiological studies every year. You come back every five or ten years, or perhaps at an even longer interval than that, to report the study, particularly if nothing has been found.

Mr. Erin O'Toole: Thank you.

I'm going to be quick, partly because when you're in the second round you have less time.

You would have reviewed in your overview, your peer review of the study, the seventh conclusion, which talks about a small number of veterans who have persistent symptoms, many of whom had thought that DU might explain some of those persistent symptoms.

Let me ask a question similar to the one Mr. Zimmer asked. While we all agree that the symptoms, however they manifest themselves, are real, do you agree with the conclusion of the report that DU would not be the cause of these symptoms?

Mr. Nicholas Priest: I believe that there's real concern amongst the veteran population. Why we have this problem I don't know, but I'm convinced it's not related to depleted uranium.

Mr. Erin O'Toole: Okay.

On that point, you mentioned in your testimony—in fact, you stopped yourself at one point to say—that the next little section was based on hearsay, when you talked about some of the biologics or the organic phosphates. Because you're here as an expert, as a doctor in the area, I'd ask you to put aside hearsay or speculation and respond from your own research or your own background: have you seen any peer-reviewed studies that would attribute a cause to Gulf War syndrome or some of the symptoms that manifest themselves as a syndrome? Specifically, is there any peer-reviewed study that actually attributes a cause, as opposed to speculation?

Mr. Nicholas Priest: No. About 99% of the attention has been on depleted uranium, and I haven't seen any studies that would indicate causation. I may have missed them, because I'm a radiobiologist and so tend to be more conscious of the radiobiological literature. In relation to this, then, the information I picked up, I picked up when I was a member of the Ministry of Defence review group. Things may have been published subsequently of which I'm unaware.

Mr. Erin O'Toole: Quickly and finally, you're a radiobiologist and an expert in toxicology, as you've said, and have studied that. Given the fact that there's now a lot of research on DU and other research on Gulf War syndrome, do you feel that—and this is related a little to Ms. Papillon's question—to address some of the symptoms, these real symptoms that our veterans are struggling with, it is best to try to focus on the appropriate treatment for them, as opposed to the root cause, which may never be attributable to one source?

Mr. Nicholas Priest: Symptomatic treatment, palliative symptomatic treatment, yes, fair enough, but it would be really nice if we knew what caused it, because if you know the causation, then you can develop treatment regimes that are designed to stop the problem.

Perhaps she was referring mostly to treatment of the symptoms, but it's difficult. The symptoms are so varied: lassitude, inability to sleep, inability to concentrate, disparate weaknesses, muscle weaknesses, and disparate body pains. The spectrum of symptoms is very wide and is not even consistent between one individual and another. I don't know how you approach this, but I think we do need to find out what caused it. I'm pretty sure of that.

● (1005)

The Vice-Chair (Mr. Peter Stoffer): Thank you, Mr. Priest.

Now we'll go on to Mr. Chicoine for four minutes, please.

[*Translation*]

Mr. Sylvain Chicoine: Thank you.

Could you provide us with more details about your last conclusion?

When Dr. Morisset was here, he also seemed to say that it was very unlikely that uranium was the cause of the seemingly recurring health problems of our veterans from past wars. Actually, from one war to another, we see veterans with health problems and the symptoms are not exactly the same. But some symptoms come back anyway. Depleted uranium was also far down Dr. Morisset's list.

You also talked about organophosphates, which might be a more likely cause of health problems. What other possible causes can you think of?

[*English*]

Mr. Nicholas Priest: Mr. Chairman, can I make a suggestion here? Rather than my trying to recall some of these things, would it be permissible for me to go away at some stage and then come back and answer your question in written form?

Could I actually go back and try to identify some of these specific things and provide the committee with a written response to that question? Would that be acceptable? Because it's to one side of my normal area of competence, I'm not too happy about officially saying things here, and I'd prefer to have the opportunity to go back, look at this properly, and give you a proper and thought-through response to that important question.

The Vice-Chair (Mr. Peter Stoffer): Mr. Priest, that would be most welcome. Please take your time. At your convenience, any additional information you can provide us would be most helpful for all members of our committee.

Thank you.

Mr. Nicholas Priest: Okay.

[*Translation*]

Mr. Sylvain Chicoine: I would also be very happy with an answer in writing. I think it is important to try to find other causes of those health problems.

I would imagine that, in light of the report, depleted uranium will not be completely ruled out as a possible cause of those problems, as Dr. Morisset mentioned as well.

According to your results, in light of all the studies that have been done, can we completely rule out depleted uranium as a cause? Is there still a small chance that it is the cause of veterans' health problems?

[*English*]

Mr. Nicholas Priest: Politicians would like science to provide absolute answers. They do it all the time, whether on mad cow disease or whatever. The reality is that scientists look at the evidence available at the time, and they draw a conclusion from the evidence available at the time. All the evidence I have leads me to the conclusion that DU is not responsible. Am I excluding the possibility that something in the future may come up that would make me change my mind? I cannot completely exclude that possibility, but I think it's highly unlikely.

[*Translation*]

Mr. Sylvain Chicoine: Thank you.

You dealt with everything I wanted to discuss.

Did you have another quick question to ask, Irene?

[*English*]

Ms. Irene Mathyssen: We're spending an inordinate amount of time in this committee looking at DU, and I'm beginning to feel that it's time that is not well spent, given what you Dr. Morisset have had to say. I would really like to look at something that is meaningful and pursue a study that has real relevance and impact in regard to veterans. From what you've said in regard to other toxins, I'm right back to feeling that we're spinning our wheels here.

● (1010)

Mr. Nicholas Priest: One problem you might run up against, which we ran up against—and I have to be careful what I say sometimes—is that some of the operational issues in the Gulf are secret. In other words, you receive information, and they say that you can't talk about these agents because they're secret. They use them in order to prevent problems with agent X or Y, and if people knew that we had these anti-toxins and things like this, then they would become less effective. You do run up slightly against that sort of barrier.

I've never seen an exact description of what was given to the veterans in terms of prophylactic treatment or in terms of the way in which things behaved, so I'd have to be a bit careful. But I agree with you. If there's an ongoing concern, then it should be aimed at trying to find the things that are most likely to have caused the problem rather than spending an inordinate amount of time on the thing less likely to have caused the problem.

I guess there are some people who are quite happy that everybody's concentrating on depleted uranium. It's a cynical view, but true.

The Vice-Chair (Mr. Peter Stoffer): Now we go on to the parliamentary secretary, Ms. Adams, for four minutes, please.

Ms. Eve Adams (Mississauga—Brampton South, CPC): Thank you very much for appearing before us today.

As a refresher, it was actually opposition members' calls regarding the issue of depleted uranium that resulted in the Minister of Veterans Affairs establishing an independent scientific review committee tasked singularly with reviewing depleted uranium. At the time I recall very well many of the members who are present today raising concerns that the work we are doing is underwhelming, perhaps. I suppose that's what they're getting at. These were the very same people saying that there was some heinous, horrible thing going on that needed to be studied. So a proper methodology was developed. The minister struck an independent scientific review committee that examined all known literature on this subject. That report was tabled, made public. It was peer-reviewed by you and some others, and that is how you come to be here today, sir. I thank you for your work.

Can you tell me, was there unanimity amongst the reviewers of the report?

Mr. Nicholas Priest: I don't know, because I didn't talk to the other reviewers.

Ms. Eve Adams: Thank you.

Mr. Nicholas Priest: So I can't answer that. I could have contacted my colleague at IRSN in France, but I didn't. Peer reviewers should never talk to each other; it completely skewers the process.

Ms. Eve Adams: Absolutely. Thank you very much for pointing that out and putting that on the record.

Dr. Priest, in 2001 you authored a report entitled, "Toxicity of depleted uranium." In that report you state:

> Exposure to radiations emitted by uranium metal presents a negligible radiological hazard. Completely surrounding a worker with depleted uranium for 8 h a day for a year would not result in radiation doses that exceed the maximum annual occupational dose limit for radiation workers.

Is that true?

Mr. Nicholas Priest: Yes. That's why it's used as a shielding material around some radiotherapy machines. It's light. You can shield with it better than with lead. It self-shields because you get gamma rays from the middle of the uranium. They never get to the edge of the uranium because it's shielding itself. You only get gamma rays coming out from the edges of the depleted uranium. So you don't get very high doses.

Ms. Eve Adams: That's why earlier today you mentioned that you would happily wear a watch that was made of uranium.

Mr. Nicholas Priest: Except that it would be dirty as hell.

Ms. Eve Adams: Except for it tarnishing....

Your research indicates that if uranium maintains indefinite contact with the skin that such a dose is not large enough to produce tissue damage. That's correct also?

Mr. Nicholas Priest: Yes. That's what I was saying about that watch.

To be honest, the British cover their DU munitions with a very thin layer of aluminum to stop this dusty material coming off. It also means that people don't have to worry so much about contamination when they're handling the rounds. CHARM3 is the official designation of the rounds; it protects them.

● (1015)

Ms. Eve Adams: Dr. Priest, in a nutshell, if I might say, you are clearly terribly well-informed on this subject matter. You've clearly done a great deal of research on depleted uranium. Would you feel comfortable touching depleted uranium?

Mr. Nicholas Priest: Yes. I have no reservations about touching uranium whatsoever.

Ms. Eve Adams: All of this is to say, of course, as eloquently stated by my colleague Mr. O'Toole, that some of our veterans do suffer when they return home and it is imperative that we assist our veterans in any way that we can.

Mr. Nicholas Priest: Of course.

Ms. Eve Adams: Thank you very much.

The Vice-Chair (Mr. Peter Stoffer): Thank you very much, Mr. Priest, on behalf of the committee. That ends our questioning for now. Thank you very much for appearing before us today to allow us to expand upon your expert knowledge on this issue. Also, we look forward to the written documentation that you would like to present to the committee.

Mr. Nicholas Priest: Mr. Chairman, could you arrange for a transcript of the precise questions to be sent to me?

The Vice-Chair (Mr. Peter Stoffer): Yes, we can have that done for you.

Also, you were referring to a document that you had regarding some comments you had made. Some of your recommendations may have been accepted and some not. Is it possible to receive a copy of that, sir, at your convenience?

Mr. Nicholas Priest: I think it would be fair for me to ask Pierre Morisset first. I have no objections to your having it. There's nothing in there that is highly controversial, but I prefer to ask Pierre Morisset first. I'm meeting him after lunch. He called me this morning. If he has no objection, I'll happily give you my annotated version of the report.

The Vice-Chair (Mr. Peter Stoffer): That would be very kind of you.

Mr. Priest, on behalf of our chairperson who, unfortunately, could not be with us, thank you very much for your time today.

Before we go, are there any last issues the committee should address?

Mr. Casey.

Mr. Sean Casey: Nothing for this witness, but I had given the committee notice of a motion back in November, which I would like to present now, given that we still have 30 minutes to work.

The Vice-Chair (Mr. Peter Stoffer): Okay. I'll just say goodbye to our witness first and then I'll ask for the view of our committee.

Mr. Priest, thank you so much for your time.

Mr. Nicholas Priest: Thank you.

Could I ask one final question?

The Vice-Chair (Mr. Peter Stoffer): Yes, sir.

Mr. Nicholas Priest: Is there any way my costs could be remunerated?

The Vice-Chair (Mr. Peter Stoffer): I love a hot first-hand. May God love you. We'll definitely be looking into that, sir. Our analysts and the clerk of the committee will definitely be in contact with you very soon.

Mr. Nicholas Priest: Thank you very much.

The Vice-Chair (Mr. Peter Stoffer): You're more than welcome.

Ms. Adams.

Ms. Eve Adams: I would move that we move in camera.

The Vice-Chair (Mr. Peter Stoffer): Okay, but we'd need a vote on that. We'll wait for one moment before doing that.

All right, folks. We have Mr. Casey wanting to discuss this. Ms. Adams has moved that we go in camera. We require a vote on that motion.

Those who wish to support Ms. Adams' motion to go in camera, please raise your hands.

● (1020)

Mr. Sean Casey: Could we have a recorded division, please?

(Motion agreed to: yeas 6; nays 4)

The Vice-Chair (Mr. Peter Stoffer): Okay. Thank you.

[*Proceedings continue in camera*]