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Chair

Mr. James Maloney

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● (0850)

[*English*]

The Chair (Mr. James Maloney (Etobicoke—Lakeshore, Lib.)): Good morning, everybody. Thanks for being here.

We have two sets of witnesses by videoconference. We're joined by Professor Mark Daymond and Professor Rick Holt.

Thank you, gentlemen, for joining us today.

We're also joined by Vince Robinson and John Robinson from Tyne Engineering.

Gentlemen, thank you for joining us.

Professors, we'll start with you. We're giving each group up to 10 minutes for a presentation, and then we'll follow that up with questions. You're more than welcome to answer in either official language.

Please go ahead.

Dr. Mark Daymond (Professor, Mechanical and Materials Engineering, Queen's University): My name is Mark Daymond. I'm a professor in mechanical and materials engineering here at Queen's. With me is Professor Rick Holt, who is an emeritus professor here at Queen's.

I have a few things to say to try to meet the list of questions that were given on what the committee is interested in.

First, I think the nuclear R and D at the universities in Canada is in very good shape. Largely that's as a result of the initiative that was taken by the industry, led in particular by Ontario Power Generation, to start the University Network of Excellence in Nuclear Engineering, or UNENE. I believe you've already had a witness from UNENE.

The nuclear materials program at Queen's is a good example. There was nothing here in 2001. It now comprises an emeritus professor; two professors, soon to be three, as we're advertising for a third; a research group of more than 20 graduate students and postdocs; and around $20 million of nuclear-focused research infrastructure—additional infrastructure that has come—and that includes a reactor materials research laboratory, which is an accelerator that we can use to explore aspects of radiation damage, simulating, if you like, the damage you would find in a nuclear reactor. There are other experimental facilities—at McMaster, at UOIT—all coupled with active undergraduate and graduate student programs.

In terms of the wider technology of CANDUs that are operating, I would say that the current technology to support operating CANDUs, to refurbish existing CANDUs, and to deliver new build in the short term, at least for medium-sized, moderate-sized, reactors in the next 10 or 15 years is in excellent shape. The expertise is held at the utilities, at support companies such as Amec and Kinectrics, and at Canadian Nuclear Laboratories, supported, as I've said, by the nuclear engineering university programs at Queen's, UOIT, McMaster, RMC, UNENE.

As we look to the next 20 years, I think the main challenge for the future of nuclear R and D in Canada is the loss of aging infrastructure. Most obviously that's the NRU reactor, though at the age of 60 years or so, it's probably reasonable that it was shut down. Certainly it was coming to the end of its life.

The main opportunity we have, perhaps, is to take advantage of the existing expertise we have in Canada within the nuclear regime, and there is a lot of expertise. I see a very significant potential demand for international build because of the unique characteristics of the CANDU design. On the other hand, if Canada doesn't do it, then India can. The design used in India is derivative of the Canadian design and very similar. Those unique characteristics of the CANDU design are available to the community in India. The opportunity at the moment is to integrate with PWR at-the-moment reactors—for instance in the U.S.—or fast breeder reactors, perhaps, in the future.

If we look at where successful nuclear construction has occurred internationally, primarily because of the upfront loading of costs, it's in places where governments have been able to give very strong support—the U.S., France, Japan, China, India. These are the countries where there has been strong government support and therefore a lot of successful build.

I should say that in the long run it can be cheaper economically to run a nuclear power plant than other sources, but it's because of the upfront costs that there are difficulties. Certainly, in terms of carbon dioxide, it makes a great deal of sense.

If we look at other opportunities rather than just going with the existing technology, the capability to supply larger-sized units for new build is somewhat shakier. By “larger” I'm thinking of things like the CANDU 9 design, which was abandoned about 10 years ago by AECL. That system was large enough to compete efficiently with the current PWR suppliers. That's because as you go to larger systems, there's a benefit of scale in terms of operating costs. Instead they went with the ACR, which is in many ways, I would say, impractical, and is also now being abandoned.

● (0855)

There would be an opportunity, I think, to revitalize the CANDU 9 design. The technology is very similar to that of the CANDU 6E, but it probably would require some federal government support to actually make that happen.

Then, as we go further into the future, the very long term, Canada has been participating in the generation IV forum. I think that effort needs to be supported and probably ramped up if Canada is going to continue as a nuclear power system supplier into the long term.

One of the other things that we were asked to comment on was what other opportunities exist. I think, for instance, nuclear power is potentially very powerful as a supply of heat. If you were to look at oil sands extraction, you could potentially significantly reduce the carbon footprint of the petroleum industry in western Canada by using a nuclear power station to supply that heat, perhaps even as waste heat after electricity generation. Of course, we do have significant energy resources in terms of the Canadian uranium reserves but also in terms of spent CANDU fuel. So the fuel that has already been used is actually still a significant energy resource. I'll come back to that.

The closure of NRU means that in the near term, any reactor-based research on fuel would have to be moved offshore until a new facility were to become available. I think that's certainly achievable and feasible. There are facilities that can do that, and you could support it with Canadian research, using accelerators.

Moving away from universities, the industry-sponsored R and D is mostly at places like Kinectrics, Amec, and CNL, Canadian Nuclear Laboratories. That is really, I would say, drawing on a somewhat diminishing pool of funds. At the moment, these organizations are a powerful resource, a very significant resource, for future development, but probably only if there's emphasis from the federal government, and perhaps the Ontario provincial government, on a long-term intent to pursue nuclear technology.

I see that CNL is at a somewhat critical juncture at the moment, with the situation it's in. It's difficult to see how nuclear R and D, in terms of build, can survive long term on the basis of R and D for profit as services to industry. I know that in many ways it was modelled on the United States' approach to large labs, but unlike the large nuclear labs in the U.S., at CNL we don't have a significant underpinning from DOE, Department of Energy, and the U.S. Department of Defense, because at those labs perhaps two-thirds of their R and D spend is that underpinning. Unless there's sort of a significant investment, you run the risk that CNL will devolve into a decommissioning organization. It won't happen any time soon, but this is looking down the way.

The final two comments are on waste disposal. The deep geological storage technology certainly seems technologically viable, and I think the NWMO has put in place all the appropriate financial provisions, it seems. The barriers to that are probably the siting process and perhaps skepticism from the public. Again, I want to emphasize that the spent CANDU fuel is a significant energy resource. Down the line we will want to access that as a country, so we shouldn't be disposing of that irretrievably. I think another avenue for nuclear R and D in Canada will be to address some of the technologies that could most successfully exploit that resource.

I think that's probably all I wanted to say.

● (0900)

The Chair: Great. Thank you very much, Professor. I appreciate that.

Mr. Robinson, thank you for being here. I understand there was some confusion with the room. I apologize if you were sent in the wrong direction, but thank you for joining us.

I'll turn the floor over to you.

Mr. Vince Robinson (President, Tyne Engineering): Thank you.

John and I are from Tyne Engineering. We're a private company. We assume that we've been invited to give a perspective from small and medium industry on how the decisions made will affect a company such as ours. We've been in the nuclear industry through the successful periods, through the 1960s to the 1980s, with John having worked in the overseas markets with CANDU development. We also experienced a sort of moratorium on nuclear, so we can tell you how a company like ours was affected and how we see the new opportunities that are emerging now.

The CANDU industry, for us, is an industry that we're proud of. It creates high-tech jobs within our company and for our peers. We see the CANDU nuclear industry as a clean source of plentiful, safe, environmentally clean power that's independent of overseas markets.

In terms of opportunities, as we see it, one major challenge we've experienced with the CANDU technology is the tritium issue that occurs in heavy water reactors. A lot of our focus over the years, both internally and with the larger organizations that were mentioned by the university—Kinectrics, OPG, AECL, etc.—has been associated with the tritium issue in heavy water reactors. There's an opportunity to advance the development of tritium extraction technologies and the demonstration of those technologies, which will in turn improve the chance of sales of the CANDU overseas.

With regard to the state of the CANDU technology, we attend a lot of international conferences as a smaller private industry, particularly conferences associated with tritium and heavy water management. We can say that the Canadian technology is still very highly respected as a source of the best data on R and D programs. Other countries are seeking Canadian input. However, we can say that through recent years, particularly at the tritium conference in France in 2013 and at the 2016 conference in Charleston, South Carolina, the Canadian representation is falling fairly dramatically compared to that of other countries in terms of the size and support of the Canadian contingent. When we were in Charleston, there was one representative from CNL, one representative from Kinectrics, and John and I. This is in comparison with contingencies from China, France, Romania, and the United States, which had in excess of 15, 20, or more people representing them. We see that as a problem if we're to continue to compete.

In terms of benefits of the CANDU technologies to other natural resources, well, there are particular spinoff technologies in particular that we've been involved in. One is associated with hydrogen technologies and the development of electrolysis that's used in heavy water management, upgrading, and tritium extraction. Those technologies in electrolysis are transferable to hydrogen as a fuel source industry.

Obviously, as I've described, the tritium technologies have benefits in pharmaceutical and other monitoring industries. Radiation monitoring in general is a very strong focus of our company and the R and D that we do. Radiation monitoring is transferable to, for example, mining. Those skills seem to be transferable.

● (0905)

The last item is helium-3, a by-product of the decay of tritium. When tritium is removed, as it is at the Darlington reactor, and stored on metal hydride getter beds, over time the tritium will decay to helium-3. There's an opportunity for extracting that helium-3, not only to satisfy a need to release pressure from those getter beds but also to create spinoff industries. Helium-3 is a highly valuable gas that can be used to create the most sensitive neutron detectors, that can be used in homeland security applications as well as the highest-quality medical imaging equipment.

As to the future of R and D, with the shutdown of the NRU, our company has found that the strength in the Canadian nuclear industry over the years was primarily due to some focal points in R and D, such as the NRU reactor and the fusion industry. That's how our company was created. We've managed to commercialize those technologies, but it was due to the government focus on key specialized areas, such as the NRU, the CANDU fusion research... and a focus on transferring the R and D that's created on some of those larger organizations that were mentioned by the university. The key that we found is to transfer that to small and medium industries, because we are the ones that commercialize and create commercially viable products. We've done that with ionization chambers, radiation monitors, electrolysis systems, tritium extraction, etc. We've found that in areas of commercialization we've been able to do that more efficiently than a larger organization, but we need the government to focus on transferring those technologies to us rather than competing with us.

As to waste management, our company doesn't operate heavily in that realm. As a general comment, Canada is a very geographically large country, so clearly it has areas where the risk of doing that would be lower than in other countries. We see it as a good area for the government to focus on. It's large, and there are a lot of remote areas where waste could be stored in solid rock or salt formations. We have the strong regulatory standards and structure within which to do that.

On decommissioning, we have worked a lot with CNL and have people on our staff who have done a lot of work on the hot cells that are available at CNL. Clearly that is an area where there's a lot of expertise that could be further developed. We have some of the oldest reactors in the world that are being decommissioned, so there's an opportunity to be ahead of the game. Those situations will appear in our other markets down the road, and if we develop decommissioning technologies now, we'll reap economic benefits in the future.

That's our introduction for the committee.

● (0910)

The Chair: Thank you.

Mr. Serré, I believe you're up first.

Mr. Marc Serré (Nickel Belt, Lib.): Thank you, Mr. Chair.

Thank you to the witnesses for the presentations this morning.

My first question will be for the Queen's University professors.

You indicated during your presentation that the U.S., France, Japan, and India had strong government intervention. Perhaps in bullet-point form, in the short amount of time we have, could you expand on the recommendations you would have for the Government of Canada to support the nuclear industry the way other countries have done?

Prof. Rick Holt (Professor Emeritus, Mechanical and Materials Engineering, Queen's University): If the Canadian government has the will to continue as a nuclear supplier, then they have to focus on future technologies. The current system is pretty well commercially developed, and most of the services have been spun off into private companies. We're in a situation where if we want to advance our reactor systems beyond the current CANDU 6E, then we have to invest a fair bit of money into that. If the Government of Canada foresees having a long-term future in nuclear supply, then they're going to have to invest that money.

The emphasis should be on a future system, perhaps the synergy between CANDU and the generation IV-type reactor, particularly a fast breeder reactor, which would be able to recycle CANDU fuel and both extract that energy that's reserved in the fuel and greatly diminish these products that have to be disposed of.

The current situation seems to be that CRL is in a position where its site is being refurbished. It has a new management system, but it's not at all clear where and how [*Technical difficulty—Editor*] for them to carry on R and D [*Technical difficulty—Editor*]. We believe, here at Queen's, that unless there's a strong push from the Canadian government to want to advance and continue with nuclear technology, then what will happen is CRL will become a decommissioning site. That will then spin off to the rest of the country gradually. These programs [*Technical difficulty—Editor*] and so on will shut down if there's [*Technical difficulty—Editor*] industry.

We've built this up for the last 15 years, and now we're at a critical juncture as to where to go next [*Technical difficulty—Editor*].

Mr. Marc Serré: Thank you.

Mr. Robinson, when we look at exports, what can we do to support small and medium companies? We talk about clusters. We talk about the importance of having R and D, the commercialization, and the education part of that. What can we do to support small and medium businesses on the export side?

Mr. Vince Robinson: A lot of the projects in the nuclear industry have a lot of international participants from very large organizations. We bid on projects with Areva, Westinghouse, and those types of companies. Typically the dollars get into areas that are difficult for a smaller company to support, so certainly the Export Development corporation may be favourable support for nuclear exports through the EDC. It would allow us to qualify with the performance guarantees progress payment structures that are imposed upon us.

Second is the international representation at key trade shows and industry events. When we go to those events, our peers from other countries appear to have very strong government support to create the image and provide that momentum to compete, which is very helpful. It's expensive to do that for the smaller companies.

● (0915)

Mr. Marc Serré: Thank you.

With previous witnesses, we've talked about the R and D aspect when we look at water reactors, waste, or the small modular reactors. Some witnesses have said that we have to pick a lane and focus on being the best in the world in very specific areas. Others have said, and I'll use the term, that we have to “water many flowers”.

Can I have both of your opinions and recommendations along those lines?

Mr. John Robinson (Chief Executive Officer, Tyne Engineering): I can give you my thoughts on that.

I've been in nuclear power for many, many years, and I think for a county the size of Canada, it has to be able to focus. It has to focus on not everything but on something, do it very well, and support its own people in doing that.

CANDU, of course, is a very good example of this. What we find, and this partially ties into the comments that have just been made, is that the advantage that other countries have over Canada is localization. In other words, the Korean governments and some of these other governments that were discussed before will support their people very strongly, both financially and providing information for them, more so than we do.

In fact, we find as a small company that we're often in competition against our own government. I think that's totally wrong. In my belief, in some aspects the government's involvement is absolutely essential. That has to do particularly with pure research. People have to think of new ideas and they have to follow those ideas. Companies like ours can't afford that kind of research. Ours has to be very directed. It has to end up with a product, and that product has to end up with a sale, otherwise we can't do it. So that has to be left to somebody else. As far as I'm concerned, there's a tremendous opportunity for partnership between governments and smaller companies, and I'd like to emphasize the smaller companies rather than the larger companies. The smaller companies are the ones that want to grow or expand. They want a product that they can develop the company around. They're the ones really who need the support.

We have several products ourselves that we've been developing over the years. It's a very, very long-term proposition because of the cost. In many cases, as well, companies like ours will be short of not only the kind of expertise that might be available but also the testing equipment and the validation equipment that, let's say, governments have. We should have access to those. In fact, it should be more than access. There should be people from government looking after our shoulder, pushing the work that we do. I think that people, like at Chalk River, should be evaluated not on the work that they do, but on the achievements of the small companies that the government works with. I think that's what the objective should be.

The CANDU needs research, and I think that is the item that we should be pushing. I think it's about CANDU stations. The truth is that we haven't sold one in Canada for 20 years or so. There's not really very much effort to do that. We haven't developed CANDU 6, which has not been implemented, and the CANDU 9 as well. The advanced CANDU 9 is not implemented.

We talk about putting in—

The Chair: Mr. Robinson, I'm going to have to interrupt you and ask you to wrap up.

Mr. John Robinson: Sorry. I beg your pardon.

The Chair: Thank you.

Ms. Gallant.

Mrs. Cheryl Gallant (Renfrew—Nipissing—Pembroke, CPC): Thank you, Mr. Chairman.

Your ears must have been burning, because at our last meeting your company name was raised, as was your passive autocatalytic recombining. With that technology, it's my understanding that you were actually situated right in CNL as that was being developed, and for the initial manufacturing. Can you describe how that worked?

● (0920)

Mr. John Robinson: That's not quite the way it was. We are interested in recombiners. We've done development work on some recombiners. This particular one, the “PAR” system, as it's referred to, was developed in order to remove the hydrogen from reactor buildings so that it would minimize the opportunities for explosion. We have always been interested in that, and we have the skills in our organization to be able to take those if they're given to us and shown to us by AECL. It was AECL who had created this in the first place. It's their discovery, not ours.

We have subsequently been able to build these. We make them very successfully, but we can't sell them. We have an arrangement with Candu Energy whereby they do the marketing for them. Frankly, I think the prices are too high, and we don't compete with the Koreans. Our personal prices are very low, but the prices that go to other countries I think have been too high, and we don't sell any. We can't market them. We're not allowed to market them, but we have the capability, and we've made the laboratories and equipment to do that. It has cost us money. We even set up a building at Chalk River, which now we're closing down simply because we can't market these or we can't sell them.

Mr. Vince Robinson: There's a lack of sales on the PARs. One market that we approach continuously is India, but it's still against Candu Energy's governance to offer any proposals to India on the PARs. The sales opportunities have diminished drastically for the PARs, and that's the reason we closed down our Deep River building. We are looking for other opportunities. We still have the building, and we can still build the PARs, but since the technology now.... The sales activity has been transferred from AECL fully to Candu Energy. We have to wait until they come up with the sales. We bring them ideas and opportunities in places like India, but so far the sales have been quite disappointing.

Mrs. Cheryl Gallant: It was mentioned that you found it beneficial to actually work in the government labs—for example, CNL. How important is it that a high-flux neutron source remain in place for your type of technology as well as for other industries that depend on nuclear research?

Mr. John Robinson: I don't know how you classify the importance of that, but certainly we were very interested in it. Vince was talking about helium-3. Helium-3 is used in neutron detectors, and you can develop, using helium-3, very high-quality neutron detectors, but to build those, to do that kind of work, we need access to neutron sources, which, by the way, we can get currently from CNL. There is the opportunity for doing that at a certain cost, and there's encouragement for doing that. There are some very good people there who can give us very good advice.

I think that should be enabled, although we see the current new development that's taking place at CNL to be contrary to what we would have hoped. It seems to me to be going in the wrong direction. It's so important for us that we have that kind of access. I think the NRU reactor, for instance, was a good focal point anyway for work within.... I'm wondering now, if they don't have reactors up there, what will focus their research work and so on. I think you need something like that, something like a Candu, an NRU, or an ITER, something to focus research attention.

Mrs. Cheryl Gallant: Your technology is based on hydrogen. There is a new hydrogen lab situated at CNL.

● (0925)

Mr. John Robinson: Yes, there is.

Mrs. Cheryl Gallant: Is that being utilized at all?

Mr. John Robinson: Yes, it is. In fact, we've made a lot of the products for that lab as well, and hopefully.... They intend to sell services to people through that lab. I don't know how they're going to do that, of course, as I'm not party to that.

We're very familiar with the laboratory and the equipment that we have. We've actually got a piece in our laboratory at the moment now, a glovebox of some magnitude, which could be used and is partially planned for use with these ITC containers that contain the tritium at OPG, as we were saying. It can handle those kinds of conditions. This is a sort of general purpose tritium-handling facility. It belongs to that hydrogen lab. They have some good facilities there.

Mr. Vince Robinson: The lab is a very impressive lab, but we don't see a lot of activities there in our recent visits. It has been used because of the new CNL governance to support some of our competitors in the United States, simply because the focus was on, for example, selling some catalyst that could be used in tritium extraction rather than promoting Canadian industry, which would have a lot of future benefit.

Mrs. Cheryl Gallant: The topic of next-generation reactors was mentioned, and we know that some of them require some enriched uranium. There is opposition to the transport of our HEU and repatriating it to the United States. If the opposition is so great that we're not able to carry through with that, we're left with reprocessing it ourselves. Right now, does it make sense to have that HEU repatriated process so that we can buy it back for the next-gen reactors? I'd like to hear your thoughts on that.

Mr. John Robinson: I can't really help you very much on that, I'm afraid.

Mrs. Cheryl Gallant: All right. Thank you.

The Chair: Thank you.

Go ahead, Mr. Cannings.

Mr. Richard Cannings (South Okanagan—West Kootenay, NDP): Thank you to all of you for being here this morning.

I think I'll start with you, John. I think one of you said that CNL was going in the wrong direction.

Mr. John Robinson: Yes.

Mr. Richard Cannings: Could you expand on what that wrong direction is and what you think the right direction is? Is it just a matter of focusing on something, or...?

Mr. John Robinson: Of course, I might be speaking out of turn, and I might have some ideas wrong. I say that because CNL is a large place, and we have a fairly focused access to them. We deal with the hydrogen people and we deal with some others, but there are a lot of things going on that we don't deal with. I shouldn't generalize in any case.

The way I see it is that CNL now is being forced to lend out its services almost as a private industry. In other words, it will perform a certain act at whatever they can get in terms of money for that act. There's some sense in that, of course, because it makes it financially viable.

Personally I think that's wrong, because I think CNL provides an opportunity for the Government of Canada to feed very good information. There are a lot of very smart people at CNL, and they have a lot of good equipment that most small companies—no small companies, I think I'm probably right in saying—could possibly provide themselves. That access can spawn industries—small industries, perhaps, but small industries add up. Take the helium-3 we're talking about. It's a small industry that's not huge, but it would add up and it's high tech.

By the way, we do that with a number of things. We've been developing electrolyzers with CNL. We've been developing electrolyzers that are tritium-compatible. That's what makes them so original. But because of that we have developed what is sometimes being referred to by others as a robust electrolyzer that could be used for hydrogen and perhaps that also has spinoff advantages.

We are very interested in tritium and tritium handling. These are big things, though, and they are extremely expensive for us. We need not only the technical support and the encouragement but also financial support. We can't pay CNL prices that are four and five times the prices that we use in our own offices. We can't get far enough that way, and we can't make those kinds of commitments. We don't have it. It's not possible.

If the Government of Canada wants to take advantage of an expanding industry this way—and the right kind of industry, as far as I'm concerned, because high tech is good work, that's long-term work and it's what we want to do—why don't we focus some funds and a lot of energy into the smaller companies? They could focus, not on the bigger ones who are going to just design and build what we've already got, but on the smaller ones that are developing bubble technology, tritium lights, or the numerous other possibilities. Why don't they spend more time on doing that?

That's what I mean when I say they are going the wrong way. They have some great people. They are very easy to talk to. They have lots of capability and knowledge to give. Why don't they give it, not sell it?

● (0930)

Mr. Richard Cannings: Right.

To the Queen's team here, you mentioned that we have to work on developing technologies to use that spent fuel we have and make sure it's available in these repositories. I'm just wondering what directions we need to go to get there, how the government could assist that, and who would do that work.

Dr. Mark Daymond: I think it sort of goes back to the previous question about where Canada should focus. I think Canada has some unique opportunities because of the CANDU design, and we should be focusing on building on our strengths and building on the momentum that has been reignited over the last 15 years or so when there has been more nuclear research. I think within the CANDU design you can find ways to use some of that spent fuel, and perhaps —as Rick already said—by connecting into the fast breeder program.

Where would that research have to be done? I think CNL is the obvious location to initiate that research. As we heard from Tyne Engineering, if you start the research at CNL, so long as the governance is correctly positioned, then there will be spinoff opportunities, and that's where you will see the commercialization and opportunities to actually implement. The research has to be done at a big research lab, though.

Rick, do you have anything?

Prof. Rick Holt: I'm just going to touch on another point that came up earlier about the way CNL is and has been run. In the days when I started at CNL, in 1968, everything was funded by the federal government. CNL had a very open policy of spinning off their technology to companies that wanted to build a nuclear business. That was quite successful for many years.

With the cutbacks in the eighties and nineties, an emphasis was put on these labs having to support themselves as much as possible. That's where this commercialization and going into competition with the private sector came in. A number of labs around the world have attempted to do that, and it has never been very successful.

I don't think CNL has ever made a very significant contribution to its overall operating costs from the commercial R and D that it's done, except during the period of 1990 to 1997, when there was a big agreement with the Ontario government when hundreds of millions of dollars were spent on CANDU.

The old model, where AECL does technology and spins it off to industry, seems to me like a good one, and I think our other guests here would agree with that perception.

The focus now seems to be on forcing CNL to continue only on the basis that it will obtain commercial R and D funding. Under that regime, there will be no new reactors developed, and there will be no neutron source ever built at Chalk River. Canada's nuclear capability will die out, and Chalk River will become a decommissioning site.

For nuclear technology to really continue in Canada, it needs the will on the part of the federal government to have a long-term nuclear future and to invest in that. Success will probably come from focusing on one system, the way CANDU was focused on. The focus was on CANDU in the early days for various reasons. We were going to use natural uranium. We couldn't build a big pressure vessel, so we had a pressure tube reactor. That kind of formed the way the CANDU reactor looked. We just focused on that, and it was very successful for the last 40 years. Now we need to look forward to what's coming next, and my—

● (0935)

The Chair: I'm going to have to stop you there, Professor, unfortunately.

We go over to you, Mr. McLeod.

Mr. Michael McLeod (Northwest Territories, Lib.): Thank you to the university and to Tyne Engineering for these presentations.

I'm from the Northwest Territories, and we don't have any facilities in the north, I believe all of the north, including Nunavut and Labrador. We don't have any companies that provide these types of services or power or heat. We do have really high costs in the Northwest Territories, as you can imagine. Everything is a little more challenging; it's colder, and there's very little infrastructure. We are looking at ways to lower our costs for power and heat. It's really difficult. Almost every community in the north gets its power through diesel generators.

We've had some discussions on alternative energies and ways to do things. I've heard a couple of things about nuclear. First of all, there might be the possibility of running a line from the reactors or nuclear plants in Ontario to the north, but that's quite a way. I don't know if that's doable. I've also heard of small modular nuclear reactors that are safe and environmentally clean and use spent fuel.

I'm just wondering if either the university or you have ever looked at how nuclear could be utilized in the north.

Maybe you could start first.

Mr. John Robinson: A straight answer from us would be, no, we haven't looked at that specifically.

We support CANDU energy, nuclear energy, 100% as a clean source of energy that's not going to destroy the environment and that's safe. We get a lot of objections to that, I know, but for example, I have been in nuclear energy since 1959, both in England and then subsequently for 10 years or so overseas, always with CANDU reactors, and I've never come across a serious nuclear accident. I can't say that with any other operation that I can think of: aircraft, automobiles, oil company, gas company.

I think nuclear energy is worth looking at very closely. I know there are still these connotations around nuclear energy, and of course you can run into occasional problems like Fukushima, and they're very serious. I accept that, but you have to put your money in something that gives power. Nuclear power, I think, is the right solution.

Whether in the cases you're talking about the preference for small nuclear power stations would be better, these are all in development at this stage in the game. Hopefully they will produce the kind of power you need. I think for the moment nuclear power is our future. I'm not close-minded about that. If wind were better, if solar were better, I would support them to the hilt. We want the best there is. In my opinion, at the moment it's nuclear. It produces good quantities of power and it's clean power.

I think that's what you'd need.

● (0940)

Mr. Michael McLeod: Perhaps I could get the Queen's University professors' perspective on that.

Prof. Rick Holt: The modular reactor certainly has some of the focus of the proponents of modular reactors, those that would be suitable for small communities like the communities you're talking about. I can't think of any other version of a reactor that would provide power to the Northwest Territories, but the proponents of the modular reactor are keen on selling it in the north.

Dr. Mark Daymond: There's not a whole lot of research being done in Canada, I think, on SMRs. Certainly other countries are investing quite heavily in SMRs, and there are technologies that make sense in terms of SMRs, from sort of reinvigorating older technologies that have been looked at historically to modifications of even things like the PWR. You can imagine passively safe—meaning that you don't have to have active systems to maintain them safe—small modular reactors. Definitely it's doable. One of the things from the Canadian point of view is that if we're not in a position perhaps to immediately go forward, you need to ensure that the bodies that would advise the government and the provincial governments or the territory governments as to what would be the appropriate system are well educated in what the options are and on safety, so I suppose CNSC and CNL would be the locations of that expertise.

To have a Canadian SMR design, there is still a lot of work to do.

Mr. Michael McLeod: Thank you.

My next question is on something you raised, John Robinson. Regarding the view of how safe nuclear energy is, in the Northwest Territories some companies have come to the north wanting to do presentations. They received strong opposition, to the point where one company just walked out of the room because there was so much yelling and screaming and protesting.

It seems as if this is the way to our future—that's what you've said—but we haven't created a lot of education or awareness in this area. Can you talk about that a little bit? Who should be doing it? Is it the government that needs to do a better job? Is it the industry? Is it a combination of both? What can we do to get people to realize that this is a safe...?

Mr. John Robinson: Of course, you're getting really out of the realm of where I can help very much. We build things. We make things. But we come into contact with a lot of that kind of discussion.

Clearly you need government support. That's one thing, because that would influence the media and the media needs that support. People need to have confidence in things, reasonable confidence. We're not saying that it's the be-all and end-all and that other alternatives shouldn't be searched after, and one of these days there will be a much better alternative and that's the one that we have to have. But if you're making a selection that's going to affect you, your family, and your children, you want to make the best selection, whatever that is.

There seems to be a general feeling that Canadians are now a little bit more in favour of nuclear than, let's say, 10 years ago, when everybody was dead against it. I think it should be tempered always with some understanding that they are dangerous substances that you're handling and that great care has to be taken and there has to be emphasis on safety. But all those things being considered, I think it is a good solution, temporary though that might be, until a better one comes along. I think the government has to support that.

● (0945)

Mr. Vince Robinson: If I could just comment—

The Chair: Please be very brief, I'm sorry.

Mr. Vince Robinson: Our process engineering division manager, Peter Ozemoyah, is the president of the Canadian Nuclear Society, and they do CNS conferences at various locations around the country, not necessarily at a nuclear hub, and the involvement of young people from universities is a big focal point. That does seem to provide that information to the community, to families, through the young people. Maybe you could look into the possibility of CNS doing some of their conferences or events in the north with participants in the universities.

The Chair: Thank you very much.

That brings us to the end of our time for this segment of the meeting. Thank you to the witnesses, our two professors and our two Robinsons, for attending today. It's been very helpful. Unfortunately, we have run out of time. These hours go by very quickly, but thank you again for joining us.

We'll suspend for two minutes and then we'll begin the second hour.

● (0945)

(Pause)

● (0945)

The Chair: Good morning. Thank you all for joining us today.

We have from SNC-Lavalin International, Justin Hannah; from TRIUMF, Jonathan Bagger; and from MDS Nordion, Richard Wiens and Emily Craven.

Thank you all for being here this morning. Some of you may have been here for the first session.

The process is that each group has up to 10 minutes to deliver some remarks, and then we'll open the floor to questions. We follow tight timelines, so sometimes I'm going to have to interrupt people and cut them off in mid-sentence. I'm not trying to be rude. It's just that we have to adhere to the time frame so that everybody has the chance to ask their questions.

I'll open the floor with TRIUMF.

● (0950)

[*Translation*]

Dr. Jonathan Bagger (Director, TRIUMF): Good morning.

My name is Jonathan Bagger and I am the director of TRIUMF, the national laboratory for particle and nuclear physics and accelerator-based science.

I am accompanied today by Mr. Sean Lee, who is responsible for external relations at TRIUMF.

I thank the members of the Standing Committee on Natural Resources for having invited me today.

[*English*]

Let me start by saying a few words about TRIUMF. We are a large science research facility, located in Vancouver, that is owned and operated by 19 universities stretching across Canada. We employ approximately 500 staff and students, making our laboratory one of the largest of its kind in Canada. We are also an interdisciplinary laboratory, with world-class programs in the physical and life sciences, quantum materials, and accelerator science. We have a deep-seated commitment to the commercialization of our technologies.

Ultimately, what we do can be stated quite simply. TRIUMF is a factory for discovery and innovation that advances research for science, medicine, and business. From the abstract to the applied, we solve problems for the benefit of Canadians.

This morning I would like to highlight Canadian expertise in accelerator science, explain how this translates into a competitive advantage for medical isotopes, and argue that Canada risks losing this advantage unless the federal government assumes active stewardship of this field.

As you well know, Canada has a storied history as a world leader in nuclear technology. However, Canada's expertise extends far beyond nuclear reactors. Since TRIUMF's founding nearly 50 years ago, Canada has been a global leader in the development of particle accelerators. Such accelerators are at the heart of everything we do at TRIUMF. Our laboratory is home to the world's largest cyclotron, as well as a new superconducting linear accelerator that will open opportunities for generations to come. Accelerators are used in fundamental science and also for a host of applications in advanced materials, clean technologies, electronics and aerospace, defence and security, data sciences, and natural resources exploration.

Particle accelerators also have a proven capability in life-saving medical isotopes. TRIUMF is a world leader in this endeavour, and this is the area on which I will focus this morning. TRIUMF's history with medical isotopes dates back decades. Together with Nordion, we produce more than two million doses of medical isotopes per year that are shipped to patients in over a dozen countries. It is an enormously successful public-private partnership, one of which Canada should be proud. Beyond this, TRIUMF helped pioneer PET imaging in Canada and today supports the diagnosis and treatment of diseases ranging from cancer to Parkinson's. We are, in fact, the only proton therapy treatment centre in Canada.

TRIUMF is the hub of an innovation cluster that includes clinical and academic partners, with an industrial base that has commercialized our technology and made it available to the world. The value of this cluster came to light in 2007 and 2009, following NRU shutdowns that resulted in global shortages of technetium, a critical medical isotope used in 80% of nuclear medicine scans. Facing this crisis, the federal government launched the ITAP program to develop alternatives to the reactor-based production of technetium.

A TRIUMF-led consortium rose to the challenge and developed a new technology that produces technetium using medical accelerators. Our solution is environmentally friendly and enables locally sourced production of technetium, ensuring isotope independence for any region or country that adopts it. TRIUMF's technology was recognized with NSERC's prestigious Brockhouse prize, presented by Governor General David Johnston in February 2015. It is currently in the final stages of Health Canada review, and full regulatory approval is expected in late 2017. TRIUMF's innovative technology is now licensed to a spinoff company, and there is growing interest from international markets.

● (0955)

All this achievement and early promise, however, might well come to naught. The reality is that TRIUMF's technology is struggling to take root because of a lack of government leadership on the medical isotope file. With the end of ITAP, and the cessation of isotope production at the NRU, NRCan has decided to close its file. No one else has stepped up to claim ownership, so the isotope file is an orphan.

This brings us to where we are now—at a critical crossroads. With strong stewardship from the federal government, Canada is well positioned to extend its lead in medical isotope technologies, but without such a commitment, Canada will miss the opportunity, risk another supply shortage, and lose the capacity and expertise we have assembled over decades.

Our proposed institute for advanced medical isotopes, or IAMI, will ensure that Canada stays at the cutting edge. Details about IAMI are contained in the brief that we submitted to the clerk. Championed by TRIUMF, the BC Cancer Agency, the University of British Columbia, and Simon Fraser University, IAMI is a facility that will strengthen Canada's capacity in nuclear medicine for both research and clinical use.

On the one hand, IAMI will provide a reliable supply of the life-saving technetium isotope. It will demonstrate TRIUMF's technetium technology and serve as a model that can be replicated across Canada and around the world. On the other hand, IAMI will future-proof Canada's medical isotope R and D. Leveraging the experience and the unique capabilities of TRIUMF, IAMI will produce next-generation isotopes, many of which have tremendous therapeutic potential for treating cancer and other diseases. In fact, TRIUMF is one of the few places in the world capable of producing large quantities of these therapeutic isotopes. IAMI will provide the necessary infrastructure to ensure that Canada remains at the centre of this fast-moving and innovative field.

Despite this great promise, IAMI and initiatives like it are falling through the cracks. TRIUMF is working to build Canada's future in nuclear medicine, but we cannot do it alone. The federal government, and parliamentarians like you, must decide whether Canada should continue to play a leadership role in this sector. The benefits are many, but without clarity, commitment, and leadership from the federal government, we risk letting our position slip away.

[*Translation*]

Canada's work in nuclear research and development generates many advantages. We encourage the committee to take into account the contributions we can make to nuclear medicine today and in the years to come.

[*English*]

I'd be happy to answer questions when you have the time.

Thank you.

The Chair: Thank you very much, sir.

Mr. Hannah, go ahead.

Mr. Justin Hannah (Director, Marketing, Strategy and External Relations, SNC-Lavalin International): Good morning, Mr. Chair and committee members. My name is Justin Hannah. I'm the director of marketing and external relations for SNC-Lavalin and Candu Energy.

I'd first like to thank you for the opportunity to speak to this committee to discuss the future of the nuclear energy sector. As a tier one nuclear company, SNC-Lavalin has a significant role in shaping and leading the direction of this important sector to the benefit of all Canadians. The global reach and pedigree of our organization puts us in a unique position to pursue significant opportunities that will help the Government of Canada achieve many of its objectives in the areas of innovation, climate change, and sustainable development.

Canada has played a leading role in the nuclear sector since the 1950s, and it is vital for this committee to understand the key issues and how government policy can support this further. Our role as a tier one nuclear nation is to some degree at risk, and it is important for this committee to understand the role Canada can play as technologies, issues, and new nations rise to the forefront in this sector.

The threat of global climate change is one of the most daunting challenges we face as a civilization. Decisions that are made over the next decade will have a profound effect on future generations. It has been widely recognized by credible organizations around the world that nuclear energy must play a significant role in any scenario that reduces global CO2 emissions.

In Canada, our unique CANDU technology, and the men and women who fostered its development, have made significant contributions to the economy and industry on a domestic and international scale. The Canadian Nuclear Laboratories, known as the birthplace of CANDU technology, has been a source of significant innovation over the decades. As one of the largest R and D facilities in Canada, it has made scientific contributions in the areas of physics, nuclear medicine, and material science, to name a few. It has also contributed to the careers of two Nobel Prize winners from Canada, Dr. Bertram Brockhouse and Arthur McDonald.

CANDU technology has been exported successfully to China, India, South Korea, Romania, and Argentina, among others. The technology remains one of the single largest R and D investments ever made by the federal government, and it still supports many of its key policy priorities.

Going forward, our organization, with the support of the government and the Canadian nuclear supply chain, is well positioned to capture nuclear projects in the areas of nuclear new builds, life extension, and decommissioning.

We have expanded our geographic footprint to new markets, such as the United Kingdom and United States, and we are engaged with several others. Each one of these multi-billion dollar opportunities plays an important role in helping the industry flourish and expand. There are over 200 small and medium-sized enterprises throughout the country that benefit from ongoing investment in the sector. Just recently, a major step to a new CANDU unit in Argentina is both a significant milestone for SNC-Lavalin and an opportunity for the industry.

A project of specific interest is the joint development of the advanced fuel CANDU reactor with our partners at China National Nuclear Corporation. The project is aimed at adapting the unique design of the CANDU reactor to utilize recycled uranium fuel, and in the longer term, thorium. This significant innovation positions the AFCR as a more sustainable nuclear solution through its ability to consume spent nuclear fuel and to reduce overall waste volume by 30% to 40%. It will also allow China to expand its nuclear fleet while reducing dependence on imported uranium and coal-fired electricity, all while meeting the highest safety standards and environmental protections.

Just this past September, SNC-Lavalin and CNNC signed a joint venture agreement in Ottawa, in the presence of the Prime Minister and Chinese Premier Li, to signify the bilateral commitment of our organizations and countries to further progress this innovative technology.

The Government of Canada has a clear commitment to combatting climate change. We are encouraged by the feedback we have received on the role nuclear plays in reducing carbon dioxide emissions and in contributing to low-carbon power. Canada was one of eight countries that identified nuclear energy as part of it mission innovation commitments at COP21 last year. More recently, the Ministry of the Environment and Climate Change submitted a report to the United Nations that outlined the country's road map to meet its climate change commitments. Five of the six scenarios showed a significant need for increased nuclear generation capacity in Canada to meet these promises.

In Ontario the life extension of the ten CANDU units at Bruce and Darlington is one of the single largest investments in low-carbon technology in North America. It will allow these units to operate and continue to provide clean, low carbon power past 2050. The earlier restart of two nuclear units at the Bruce site was one of the key enablers that allowed Ontario to shut down its last coal-fired power stations and become one of the lowest-carbon jurisdictions in Canada.

I would be remiss if I didn't mention that the sector does have its fair share of challenges. The entire Canadian nuclear industry is keenly aware that delivering projects, such as Bruce and Darlington, on time and on schedule is critical to maintaining the faith of the public and stakeholders in government.

● (1000)

In addition, our ability to engage the public to maintain and strengthen social licence is an ongoing responsibility of the industry. We need to ensure that the public is engaged in a science- and fact-based discussion on the merits of nuclear technology and as one of the options before them as key policy decisions are made on energy.

The reinvestment of Canadian Nuclear Laboratories under the government-owned contractor-operated structure will also have a significant impact on the nuclear industry's future direction. The emergence of small modular reactor technology and the end of operating life of the NRU research reactor create both opportunities and challenges for the lab as it maps out its further direction.

Lastly, the establishment of a long-term spent fuel repository under the mandate of the Nuclear Waste Management Organization will be critical to assuring the public that the impact on future generations is strongly taken into consideration.

In closing, it is our view that nuclear energy and the Canadian nuclear industry have a significant role to play in the country's low-carbon future. Our accomplishments, our human assets, and our experience are world class. They put us in a unique position as a country to make a significant impact both domestically and internationally in the areas of climate change, but so much more. As the proud stewards of Canadian CANDU technology, SNC-Lavalin recognizes the leadership role we have in shaping the future of the Canadian nuclear industy and its future success. We view the Government of Canada as one of our key partners to enable this through sound policy, judgment, and support.

Thank you very much.

● (1005)

The Chair: Thank you very much, Mr. Hannah.

Mr. Wiens or Ms. Craven, I'm not sure which one of you will present.

Mr. Richard Wiens (Director, Strategic Supply, Gamma Technologies, Nordion): That will be me.

Good morning. My name is Richard Wiens, and I'm the director of strategic supply at Nordion. I'm joined by Emily Craven, our marketing manager.

First of all, I'd like to thank you, Mr. Chairman and members of the committee, for providing an opportunity for me to speak today.

In the early 1960s the Government of Canada, through AECL, was a major contributor to the creation of an important industry that endures today and benefits the health and well-being of millions of people in Canada and around the world. The lifeblood of this industry is a radioisotope called cobalt-60. Cobalt-60 is produced in nuclear reactors and is used to sterilize more than 40% of the global volume of single-use medical devices, things like drapes, gowns, syringes, gloves, and those sorts of things. If you go into a doctor's office or a surgical suite or an outpatient clinic today, almost one in two of everything you see lying around will have been sterilized with cobalt-60. A special form of this isotope is also used for the treatment of cancer and other diseases.

Today the majority of cobalt-60 is produced in CANDU reactors in the province of Ontario, although the isotope was first produced at Chalk River Laboratories. The isotope was produced and sold by a division of AECL, known at the time as the Radiochemical Company.

The Chair: Mr. Wiens, can I interrupt you for a second? I understand the interpreters are having a little difficulty keeping up, so perhaps you could slow down just a slight bit.

Thank you.

Mr. Richard Wiens: Just as a point of record, we were introduced somewhere along the line as "MDS" Nordion. MDS doesn't exist anymore, so they don't own us.

In the 1980s this business was sold to a private company. Nordion has changed ownership several times, but continues to exist as a leader in the industry, proudly using this Canadian technology for the prevention and treatment of disease.

Production of cobalt-60 supports hundreds of high-quality jobs in Canada and represents significant exports. Virtually everything we produce is exported out of Canada. Canada is recognized globally for its contribution to the industry. Cobalt-60 sources are also produced in China, Argentina, and India, based on the original Canadian design, as well as in Russia on a different design. Nordion is the largest producer of cobalt-60 sealed sources in the world.

To produce cobalt-60, you take those cobalt-59 slugs, the little cylinders that are about an inch long and a quarter of an inch in diameter—25 millimetres and five millimetres, for those of you who are metric—and irradiate them in nuclear reactors. The cobalt-60 is removed from the reactor after about a two-year cook time and shipped to Nordion's facility, which is about 25 kilometres west from where we are sitting today. We use that and we make it into a sealed source. We take 16 of those slugs, we stack them together in a zircaloy tube, weld the ends, put that tube in another tube, and make what's called a "double-encapsulated" sealed source.

These sealed sources are shipped to about 200 facilities globally in more than 40 countries, where they are used for the treatment I described earlier: primarily sterilization of medical devices but also for the treatment of food and consumer products—cosmetics, pet treats, those kind of things. Sealed sources have a useful lifespan of about 20 years, or in radiological terms four half-lives. After those 20 years they're considered spent, and they get returned to Nordion. Today almost all those sources are recycled into new sources. We take the spent sources, cut them open, take the slugs out, mix those slugs with new fresh slugs from reactors, make a new source, and send them back out into the industry. The industry accepts this practice as really good stewardship.

Eventually, however, those sources can't be recycled any further and they're going to need a final home. The sources that don't get recycled get returned to the reactor site, where they're held in long-term storage very similar to the way that fuel is handled.

Currently there's no permanent disposal facility for these sources in Canada. Just for reference, the physical volume of all the sources produced to date probably number somewhere in the 80,000 range. If you took all those sources, most of which are still in use in the field, and collected them all, they would represent a volume of about 15 cubic metres, the size of an office cubicle, not very big at all.

This almost goes without saying, but the entire supply chain of cobalt-60, from production to transportation, to possession and use, and ultimately return, is highly regulated, both by the CNSC in Canada and other competent authorities around the world. The industry has an impeccable safety record, and the tracking of these sealed sources is thorough and extensive throughout their life cycle.

The Canadian government was one of the first signatories to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, also known as the "joint convention", and has since been joined by more than 40 other countries. One of the principles of the convention is that radioactive waste is recognized to be the ultimate responsibility of the state, and that waste should be disposed of in the state in which it was generated. Furthermore, article 28 of the joint convention specifically makes reference to the disposal of disused or spent sealed sources.

● (1010)

Having an appropriate return and disposal path for sealed sources reduces the likelihood of a sealed source becoming orphaned or otherwise abandoned by its owner, which would create a security or safety concern.

The CNSC requires that manufacturers of sealed sources, like us, post a financial guarantee for the ultimate disposal of sealed sources. This creates a conundrum, because there is no current final disposal site for sealed sources in Canada, and as per the joint convention, they should be returned to the place where they were manufactured.

The industry that uses sealed sources is a for-profit industry and they are willing and able to support the cost of developing and maintaining long-term storage and disposal paths. Again, this is similar to what's happening in the reactor world around fuel. The Government of Canada, however, needs to develop and support policy that will allow this to happen, meeting its commitment to the joint convention and the obligation created by pioneering this industry more than 50 years ago.

We believe there are several options available in this regard. The first involves the NWMO, the Nuclear Waste Management Organization, mandated to develop a disposal solution for spent fuel from reactors and currently pursuing the development of a deep geologic repository, as you've heard. By design, cobalt-60 sources have a very similar form to spent fuel and could therefore be integrated into the spent fuel waste stream. However, the current mandate of the NWMO restricts it to spent fuel only. A change in scope to accommodate the very small volume of sealed sources I spoke about earlier seems to be a logical solution that could be supported financially by our industry in much the same way that the DGR is being supported by reactor operators today.

Another option involves the use of the facilities at Chalk River Laboratories, currently operated by CNL. While we're pleased to see that CNL is moving forward with plans to build a near-surface repository, we would need, and they would need, additional government approvals before they could accept new types of waste like spent sources or increased volumes of waste as well.

In summary, we would like to invite the Government of Canada and the related stakeholders to work closely with us in developing alternatives that will support the ongoing contribution of this really important industry to the health and well-being of people in Canada and around the world, while ensuring a safe, secure, and commercially viable final disposal path. This would also provide an opportunity for Canada to demonstrate leadership in the area of nuclear waste management and fulfill its commitments to the joint convention.

Thank you.

The Chair: Thank you very much, Mr. Wiens.

Mr. Tan, we'll go over to you.

Mr. Geng Tan (Don Valley North, Lib.): Thank you, Chair.

I had one question for the previous witness. I didn't get a chance to ask it, so I'll ask you at SNC-Lavalin. Actually, your company relates more directly to my question.

We heard from some witnesses from industry that there's a so-called competition, to use their language, between government and industry. A few years ago, OPG had a new-build proposal to build new reactors at Darlington. At that time, the Government of Canada made an announcement asking for the open bid process. It was willing to accept any nuclear technology. Actually, very likely the CANDU technology is not the technology to be chosen.

So everything looks fine because we have transparency. We have an open process and we have a focus on nuclear safety and security. But if you look into the whole picture, you see there is still something strange. If the Canadian nuclear industry cannot get a deal or a contract domestically, how can the industry survive? Why did the government not support its own child, its own Canadian nuclear technology? If it's a decision based on nuclear safety, where was the government? Why was the nuclear safety technology not ready at that time?

To me, clearly there was lack of long-term planning or vision from the government on the survival and the development of nuclear technology in Canada. Maybe the current government can learn from that lesson.

Maybe you can comment more on that.

● (1015)

Mr. Justin Hannah: Sure. I'd be happy to comment.

There were two procurement processes for nuclear new-build run by the Government of Ontario, actually, not the federal government. In 2009 I was an employee of Atomic Energy of Canada Limited, a federal crown corporation. There was a lot of discussion, to your point, on the support for the domestic nuclear industry vis-à-vis international vendors. What I can say is that the approach and the mandate of the provincial government, which was running the procurement, was to find best value for the taxpayers and also have an open and transparent procurement process.

We were one of multiple bidders on both the 2009 and 2011 process. In 2009 there were three bidders, and in 2011 it was two. Neither of those two procurement processes ended up moving forward on nuclear new-build. But you're quite right in saying that it would have been a significant setback for the Canadian nuclear industry, and particularly CANDU technology, if an alternative technology were chosen for new-build in Canada. From a practical operations standpoint, almost all of the infrastructure in Canada supports CANDU technology, and it would have been a significant departure from the R and D and the whole body of engineering work that's been done over the past 50 years to support that technology.

Mr. Geng Tan: Thank you.

For a person like me, who worked in the nuclear industry for many years, if our CANDU technology were not chosen, I would have said that's the end of the Canadian nuclear industry. Anyway, that's another story.

I know that SNC-Lavalin purchased Candu Energy, which it's called right now, a few years ago. Since that time, how has your company maintained your technical talent that you inherited from AECL? The committee heard from many witnesses that the Canadian nuclear industry needs access to the global market if it's going to remain sustainable. Let's assume that you have just signed a contract with another country. Would you still have the necessary technical resources here in Canada to carry out that project?

Mr. Justin Hannah: That's a very good question. We do have a number of significant project commitments in our pipeline, as I'll call it, playing a significant role in the life extension of both the Bruce and Darlington stations. I mentioned the commitment for new-build in Argentina.

Candu Energy's nuclear business, based in Mississauga, has approximately 1,000 people—engineers, scientists, technicians—who support the development of technology. We did, through the restructuring of AECL, streamline those operations to a private sector company with private sector rigour, and did, through attrition primarily, lose a lot of knowledge and skills that we are slowly rebuilding.

Based on the work that we foresee over the next three to five years, we expect, just in 2017, to hire up to 300 new engineers to execute the work that we have. That's not an easy task. As you know, Mr. Tan, nuclear engineering is a specialized field. There is a huge draw of talent and a huge competition for talent by both the Bruce and Darlington projects. What we offer is a unique opportunity for both mid-career professionals and new professionals to be part of the next chapter of CANDU deployment internationally and hopefully in Canada in the not-so-distant future.

● (1020)

Mr. Geng Tan: Thanks very much for your answer. It's very encouraging to me, because right now there's a concern in the nuclear industry about the future of our industry. We just heard professors from Queen's University, and I agree with them, that it's quite likely that the future of Chalk River is going to be just one of decommissioning.

We know right now that there are 4,000, or probably closer to 5,000, dedicated people—scientists, engineers, other researchers—at Chalk River. I don't believe that by doing only decommissioning we can support so many talented people over there, so there's got to be some strategy from the government on how to maintain our talent, otherwise we're going to lose this talent. Once they've gone, you can never call them back.

I have a quick question for Nordion. You just mentioned that your main business is in cobalt-60. But from your presentation, I don't see any need to.... There's no impact on you. The recent closure of NRU has no big impact on your company, because you still get a main supply from Bruce Power, from Pickering's six, to harvest that cobalt-60. I don't think NRU is a big supplier of cobalt-60 for your company.

Mr. Richard Wiens: There are two parts to that answer.

The Chair: Mr. Wiens, I'm going to have to ask you to answer it as quickly as possible

Mr. Richard Wiens: Yes.

We do two things. We do cobalt-60 and we do medical isotopes. NRU was the primary supplier of our medical isotope molybdenum-99, and that has stopped. That had a gigantic impact on our business. NRU also continues to be a cobalt-60 supplier for that specialized segment of cobalt-60 for cancer treatment today. But you're correct that the majority of our industrial cobalt comes from power reactors.

The Chair: Thank you.

Mr. Barlow.

Mr. John Barlow (Foothills, CPC): Thank you very much, Mr. Chair.

I appreciate our witnesses being here today. It has been a very interesting study. We learned a lot about some of the options that we've had.

I'm going to direct my first question to Mr. Bagger, but a couple of other witnesses might want to chime in on that as well.

Certainly as we're going through this study we understand that we have to look at alternative options in terms of energy for Canada. There has always been a discussion about renewables, whether it's solar or wind. In terms of my riding in southern Alberta, we don't have nuclear in Alberta. It has certainly been a hot topic of discussion for decades but never has gotten that along. I have 600 wind turbines in the southern part of my riding, which is very controversial. I know some of my farmers and ranchers would rather run them over. It's interesting that earlier in this study we heard that nuclear could be done at a fraction of the cost of wind and solar. When we're talking about alternative energy, we rarely talk about the opportunities with nuclear.

I look at Ontario, where nuclear is 60% of the energy for that province, where wind is around 10% and solar less than 1%, yet we spend millions or probably billions of dollars on the research for those two sources when we could be looking at a much more stable, reliable energy source in nuclear.

Can you maybe talk about the opportunities that are there to invest in nuclear and the opportunities that are there to have additional nuclear energy as a renewable energy source rather than wind and solar, and maybe compare nuclear with wind and solar and the chances there?

● (1025)

Dr. Jonathan Bagger: I'm probably not the right person to answer that question, because TRIUMF is primarily a laboratory in areas of fundamental nuclear physics. On the other hand, we do a fair amount of material science, which is useful for testing the materials, for example, that would go into nuclear reactors.

One thing we are very focused on, though, is increasing the public awareness and acceptance of nuclear technologies broadly writ, so we are increasingly investing in our communications efforts. We train 150 students a year who come through TRIUMF, and they are also being exposed to the nuclear technologies, the nuclear industry. I think our job at TRIUMF is to really break down some of the misconceptions about the role of nuclear physics.

Now, speaking more as a layman and as an educated scientist, I would argue that the future should be a mix of technologies. Nuclear is a very important piece of that mix, especially once the waste issues are resolved. There is another nuclear technology that's up and coming, called “accelerator-driven fission”, for producing nuclear power. I believe China is investing heavily in that area. That's where you use particle accelerators to drive the reactor critical. It is not ready for deployment; it's an area of future research, and it's an area where we would be positioned to contribute if the country wished to investigate that way further.

Mr. John Barlow: Thank you.

To Mr. Hannah, I was pleased to hear you talk about advanced fuels. Certainly earlier in this study we heard about molten salt reactors and advanced fuels and some of the opportunities that are going to be there. Can you perhaps talk about a couple of things: how many CANDU nuclear power facilities are being planned globally; and are the opportunities there with the advanced fuels?

I think the key to this is two things. One is to change the misperception with nuclear across Canada. Certainly I'm in the heart of the oil and gas industry in southern Alberta. I understand the fight that you have, because we deal with that every single day, about pipelines, which is obviously a very hot topic right now. Are there some advancements in terms of the cost associated with the CANDU reactors? Is there a future for CANDU reactors in Canada? Do we have some opportunities here too, or is your future of CANDU around the world and not in Canada? Do we have some chances to make affordable opportunities within Canada as well?

Mr. Justin Hannah: That's a very good question. Thanks for letting me have the opportunity to answer it.

I'll talk about the international front first. I talked a little bit about how we've been successful in exporting CANDU technology. We are pursuing right now four major new-build opportunities. I talk about Argentina, where a single CANDU unit project is being committed, as per our press release about a week and a half ago; Romania, where there are two additional CANDU units; the U.K., concerning which we're conducting a study in which the eventual decision would be for the deployment of four CANDU units; then China, where the initial discussion is for two new CANDU units—there are two existing there already. Those two demonstration units, as we're calling them, for the AFCR are being planned, and we're looking with our partners at a large-scale fleet of CANDU reactors. We're talking about six to twelve units.

In the Chinese context, we're positioning the AFCR as a synergistic technology with China's existing light-water reactor fleet. China is going to build about 150 reactors in the next 20 years, and we've shown that through the use of CANDUs consuming recycled uranium, the optimal ratio for deployment is about 4:1. When we talk about 100 units, we can talk about 20 CANDU units in the long term.

The numbers I just gave you there are for something we'd talk about as happening in the five- to ten-year term, but this is still a substantial number, eight to ten units.

Within Canada we're always pursuing opportunities. Some of my colleagues, when we were AECL, were pursuing opportunities in the oil sands back in about 2008 and 2009, particularly working with oil companies on finding ways to decarbonize oil extraction technologies. We had a lot of progress there.

New Brunswick has a licensed site and would be very interested in building another CANDU unit there. At the Darlington site there is an environmental assessment and availability for two additional CANDU units. It's a function of load growth within the various provinces.

I mentioned the environment and climate change report that they submitted to the UN, which saw five scenarios, in which there's a fivefold increase in nuclear in Canada. That would have to happen outside of Ontario. Whether it's in Alberta, Saskatchewan, New Brunswick, Quebec, British Columbia, or the north, there have to be opportunities outside of the province of Ontario.

We think there are a number of opportunities. For Saskatchewan, Premier Brad Wall actively talks about the role that nuclear plays, as they have uranium there. Alberta has not been a hotbed of activity, I'll call it, these days, but the move towards a carbon pricing mechanism and decarbonization presents a real opportunity for nuclear in that province. These are discussions that we're very interested in engaging in.

We won't deny that nuclear is a politically sensitive topic. Windmills and solar panels are not so, in some contexts, but as your colleague mentioned, when people start talking about nuclear, sometimes there is a lot of negative reaction.

Our view, as per my statement, is that we want to engage, as I said, in a science- and fact-based discussion. That really should be the underpinnings of the policy decisions that are made.

● (1030)

The Chair: Mr. Cannings.

Mr. Richard Cannings: Thank you all for being here this morning.

I want to start with you, Dr. Bagger, to let you expand what you were saying, that there was a lack of government leadership on the isotope file. You mentioned your proposal for IAMI. Maybe you could expand on that and let us know what you think the federal government should be doing on that file.

Dr. Jonathan Bagger: Sure. Thank you.

The medical isotope file is presently housed in the federal government in NRCan. That is primarily because of the fact that the NRU reactor was a prolific source of medical isotopes, many of which were in fact marketed through Nordion. Now that the reactor is closing down, NRCan has declared its exit, really, from that space. They said this is not really their responsibility.

Who should be responsible for medical isotopes in the government? They're strategically important for health and for other reasons, so somebody needs to be looking and ensuring that there's an adequate supply across Canada. Where the private sector can provide the isotopes, that's fantastic. Where the private sector cannot, because of subsidies elsewhere or inefficiencies in the market, is the place for the government. Where should the home be? I could imagine three homes. One is that NRCan continue its responsibility for isotopes. I can imagine ISED, because of the fantastic opportunities for innovation that come through novel applications for isotopes. I could also imagine Health Canada, since one of the primary applications of isotope technology is in the field of health.

Right now, with our proposal for the IAMI facility, which really is to ensure isotope security in Canada, we're being passed from agency to agency, and nobody is willing to stand up and say, “We'll speak with you”.

Mr. Richard Cannings: Thank you.

Mr. Hannah, the nuclear industry is kind of new to me. I've learned a lot here over the past few weeks. I've heard of CANDU 6, I've heard of AFCR, I've heard of CANDU 9 and your partnership with China on these things. I just wonder if you could explain how CANDU 6 relates to CANDU 9 and whether your deal with China has applications that your company can use within Canada or in marketing that technology to other countries.

Mr. Justin Hannah: Absolutely. The joint venture agreement that we signed was for a joint partnership to complete the development of the advanced fuel CANDU reactor for deployment, initially in China, but then for international deployment together.

With the geneology of CANDU reactors, the CANDU 6 reactor is what I would call the workhorse of the international fleet. It's a 750-megawatt pressure tube reactor that uses natural uranium that we deployed internationally in the markets that I mentioned.

The enhanced CANDU 6 is what we call the generation III variant of that design. That went through the three stages of pre-licensing with the Canadian Nuclear Safety Commission. That meets all of the post-Fukushima safety and regulatory updates that were required. We designed the reactor to meet those qualifications.

The AFCR is basically taking an additional variant on the EC6 design, taking all of those upgrades and making what I would say are minor modifications to optimize it to use this recycled uranium-type fuel.

Fundamentally, all of the reactors, including the ones at Bruce and Darlington, come from the same fundamental concept, which is horizontal pressure tubes utilizing natural uranium fuel and heavy water as a moderator.

● (1035)

Mr. Richard Cannings: Just getting back to Mr. Barlow's question, I believe, about possible new nuclear reactor builds in Canada, they would likely be using, if they were using CANDU technology, something like that AFCR design?

Mr. Justin Hannah: It would most likely be EC6. We offered the EC6 in the Ontario government procurement process as a design. AFCR is applicable in Canada. We will have the intellectual property rights to deploy that in Canada. If so, likely the challenge in that regard is availability of recycled uranium. There are hundreds of thousands of tonnes of stockpiles of recycled uranium from recycling of spent nuclear fuel, none of which exists in Canada. We are blessed with abundant resources of natural uranium in the Athabascan basin, and so it makes a lot of sense to use natural uranium.

From a policy perspective, should the decision be made to utilize recycled uranium, whether for costs, or safety, or security reasons, we could procure that, but it would be from outside of Canada.

There are options there with what type of technology we want to use and what type of fuel source we'd like to use.

Mr. Richard Cannings: Okay. I believe we heard from a witness earlier this morning about ensuring that for the DGR system that was used, we should be able to design that so we could retrieve that spent fuel for future use.

Mr. Justin Hannah: Absolutely. The chemical and physical compositions of CANDU spent fuel are quite different from light-water reactor spent fuel. There are technologies—I think some colleagues mentioned fast reactor technology—that could use CANDU spent fuel as a waste product, to feed into it as a power reactor. What we are doing with the AFCR is adapting this reactor design to use light-water reactor spent fuel. Light-water reactors constitute 90% of the global fleet of approximately 440 reactors, and so what we're doing is utilizing the spent fuel from there.

You could move to what's known as a three-stage cycle—I don't want to get too technical—to use that. There is still a considerable amount of energy in CANDU spent fuel that could be used in other reactor types, such as the molten salt reactors and the fast reactors that we talked about, but that wouldn't be in a CANDU reuse application, per se.

Mr. Richard Cannings: Thank you.

The Chair: Thank you. That's right on time.

Mr. Lemieux.

[*Translation*]

Mr. Denis Lemieux (Chicoutimi—Le Fjord, Lib.): Thank you, Mr. Chair.

My first question is for Mr. Hannah, from SNC-Lavalin International.

First of all, do you think that the new CO2 emissions pricing will help you to market CANDU reactors in Canada?

In addition, do you think that this new policy will enhance your international image and help you to sell CANDU reactors?

● (1040)

[*English*]

Mr. Justin Hannah: That's a very good question.

The seemingly widespread adoption of carbon levies or carbon pricing mechanisms is a big opportunity for the nuclear industry. We think it really levels the playing field for nuclear energy, because we believe it takes into account the full cost of energy production. As you may or may not know, nuclear energy is the only form of electricity generation that, by law, is required to internalize all of its costs, including its waste costs.

We believe that, through the leadership of the federal government and the co-operation of the provinces, a carbon levy or carbon pricing mechanism will alter the economic dynamics, the economic competition, and will create a renewed interest in nuclear technology as carbon prices are applied to coal-fired power generation and natural gas-fired power generation, in Canada firstly, and also in international jurisdictions.

Yes, I believe it's a significant opportunity for nuclear energy.

[*Translation*]

Mr. Denis Lemieux: I would also like to hear other witnesses' opinion on the same topic.

[*English*]

Dr. Jonathan Bagger: I would certainly agree with that. It seems to me that the concern about the carbon footprint of energy is a big boost for the nuclear industry, yes.

Mr. Richard Wiens: I would also agree. As Justin points out, nuclear is really the only energy source that is accountable for the waste that it creates. Making the other sources of energy accountable as well I think will only stand to provide an opportunity for nuclear once so-called full cost recovery is better understood.

[*Translation*]

Mr. Denis Lemieux: My next question is also for Mr. Hannah.

I am wondering about this. Some witnesses told us that the future of Canada's nuclear sector lies mostly in exports. You mentioned that you were considering building 5 to 10 power plants elsewhere in the world in the medium and long term.

What are your objectives? Tell us about your figures. What sales do you expect to achieve over the next 5 to 10 years elsewhere in the world? What will be the economic benefits for Canada? What will be the spinoffs in terms of jobs and subcontracts, and on the technical and manufacturing levels?

[*English*]

Mr. Justin Hannah: It's a very good question. As the discussion with your colleague alluded to, we are looking at the market opportunity in the medium term—we'll say five to 10 years—of approximately five to eight new CANDU reactors to be built internationally. Each one of those contracts or projects is unique and will have various economic spinoff benefits, not only to SNC-Lavalin but to the downstream supply chain, the 200 SMEs I spoke about.

What I can reference is that in 2013 we commissioned the Conference Board of Canada to do an economic modelling study on the economic impact of the export of two new CANDU reactors internationally, in what I'll describe as a standard model. The findings showed that the economic impact was up to 37,000 person-years of employment, with a net GDP increase of approximately $3.8 billion. Now, those are large numbers, and that's not something we would glean from all of the export projects, but you can get an order-of-magnitude understanding of the type of economic impact that would entail in terms of these export opportunities.

I talked about the short-term or medium-term CANDU prospects in the five- to eight-year window period. In Asia alone there will probably be, our estimates show, between 150 to 200 new reactors built. That's driven by economic growth, people moving, and the middle class growing, but is also buttressed by decarbonization pushes within that region.

We see a large opportunity there. I talked about what we're doing in China. We also work very closely with countries like South Korea, as well as Southeast Asian countries such as Malaysia, that are looking at new nuclear.

We think the prospects are quite bright for us, not only in nuclear new build but in services and life extension as well. There's an opportunity for us to life-extend the three remaining CANDU units in South Korea at the Wolsong site. We've already begun discussions with the client there. We've already life-extended one. Those projects alone are multi-billion dollar investments from which the downstream supply chain gleans a large benefit.

● (1045)

[*Translation*]

Mr. Denis Lemieux: My question is again for Mr. Hannah.

Do you think the Government of Canada is providing sufficient support for your efforts to market the CANDU reactor abroad?

[*English*]

Mr. Justin Hannah: I would have to say that we are very encouraged at the signs we've gotten, both from this government as well as the previous government to some degree. This new government has been very open-minded and supportive, from a political perspective, in terms of supporting nuclear.

I talked about mission innovation being a sign of this government's being open to nuclear as part of clean technology innovation. So from a political support perspective, having Prime Minister Trudeau witness our signing, and our accompanying Minister McKenna on a mission to China as part of the business delegation there, I would say the support has been quite strong.

Another area the Government of Canada should consider for expanding the Canadian scope or economic impact, we'll call it, is the availability of export credit support for offshore projects. The availability of export credits for offshore projects is critical to maximizing the economic impact. We've had a number of discussions with the ministers' offices, as well as Export Development Canada, on a number of opportunities. We want to ensure that not only SNC-Lavalin but the Canadian supply chain is included to the largest degree possible. Availability of export credit will be a direct correlation to that economic impact, because it allows offshore clients to then procure or purchase Canadian goods and services from Canada, to the benefit of Canadian exporters.

That's something we've had a number of discussions on over the years. All of the CANDU exports, historically, have been supported by export credits. The Government of Canada supported the two-reactor build in China, which happened in the late 1990s and early 2000s, through export credits to the tune of $1.5 billion. That was critical in maximizing the Canadian impact on that.

So I would say that's critical. We're encouraged, as I said, by the signs we've had so far. More is always better. We understand that the government has a number of priorities, but we think we've had very strong signs of support thus far.

The Chair: Thank you very much.

Unfortunately, we're out of time. Thank you very much to all of you for joining us today. Your evidence, answers, and information have been incredibly helpful. We appreciate your time.

The meeting is adjourned.