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Chair

Mr. Leon Benoit

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● (1530)

[*English*]

The Chair (Mr. Leon Benoit (Vegreville—Wainwright, CPC)): Good afternoon, everyone. We're here today to continue our study of Atomic Energy Canada, the facility at Chalk River, and the status of the production of medical isotopes.

We have today four witnesses. Two are here with us, and two are by video conference. From the École polytechnique Montréal we have Professor Jean Koclas, from the nuclear engineering institute, engineering physics department. From the University of Waterloo we have Professor Jatin Nathwani, Ontario research chair in public policy for sustainable energy management, and executive director of the Waterloo Institute for Sustainable Energy. Welcome.

We have by video conference from Atlanta a gentleman from the University of Ontario Institute of Technology, Dr. Daniel Meneley, acting dean, faculty of energy systems and nuclear science. Welcome.

As an individual we have Dr. Harold Smith.

We will hear the witnesses in the order they are listed on the agenda. We'll start with presentations of roughly ten minutes each.

Professor Jean Koclas, please go ahead with your presentation.

Dr. Jean Koclas (Professor, Nuclear Engineering Institute, Engineering Physics Department, École polytechnique Montréal): Thank you, Mr. Chair.

I do not know if it's preferable to go in French or in English. I can do both and switch from one to the other.

[*Translation*]

If there are people who would like to hear me in French, I can begin the presentation in French. I may lapse into English sometimes, depending on my train of thought.

First, we were invited to come before this committee on very short notice. We therefore prepared the document you have before you very quickly, and I will refer to it throughout my presentation.

Currently, as everyone knows, we are faced with a worldwide shortage of technetium 99m, a large portion of which is produced by the NRU reactor of the nuclear laboratories in Chalk River, or rather the Chalk River laboratories. I worked for a long time for Atomic Energy Canada Limited in Chalk River. At the time, it was called Chalk River Nuclear Laboratories, and sometimes I forget and use the former name.

I would remind you that this Technetium 99 is not produced directly in the Chalk River nuclear reactor; it is produced essentially by Uranium-235 fission in special enriched uranium targets. The NRU reactor uses uranium that is enriched to just over 90% in Uranium-235, which produces a type of uranium that is not normally used for civilian activities. For the purposes of radio-isotope production, the system works very well, and the quality and efficiency of uranium production are very high given these highly enriched targets.

This highly enriched uranium, once it is placed in the reactor, undergoes fission, like the rest of the uranium around it. After a few days, this uranium is removed and chemically treated so as to extract one of the products of the fission of Uranium-235, that is, Molybdenum 99. This Molybdenum 99 is very useful, because although it is radioactive with a half life of almost 3 days, that is, 66 hours, it can be transported relatively easily throughout the world, given the means of very rapid transport that we currently have at our disposal.

The disintegration of this Molybdenum 99 gives rise to another isotope, Technetium 99, this time in metastable form. This Technetium 99 will disintegrate and have a half life of six hours. This metastable form is simply the form of the core of Technetium 99, an excited state on a layer of quantum energy. To reach its ground or unexcited state, it emits a gamma ray. Therefore, Technetium 99 is a pure gamma ray emitter. These rays are emitted at an energy at which the nuclear medicine detection systems are very sensitive, which means that this Technetium 99 technology has given rise to a vast array of nuclear medicine instruments.

Technetium 99 has the immense advantage of being a non-invasive technique, and is thus very popular in nuclear medicine. We have seen a steady rise in the demand for Technetium 99 the world-over, simply because from a demographic point of view, the population in North America and that of Europe especially are aging. Therefore, the number of treatments required to keep these people in good health is increasing steadily, on the one hand, and on the other, more and more inhabitants of emerging countries require Technetium 99-based treatments as well.

● (1535)

Furthermore, nuclear medicine technology has developed considerably in recent years, and therefore, more and more Technetium 99m procedures are becoming accessible to the public. This means that not only do more people need this treatment, but there is also an ever-increasing number of applications for this isotope, which means that the demand for Technetium 99 will only continue to rise.

This unique isotope is very difficult to produce in massive quantities outside nuclear reactors. Although a certain amount can be produced using cyclotrons, this method produces only Technetium 99m and not Molybdenum, and since Technetium has a half life of only 6 hours, the time available is very short.

This concludes our overview of technetium 99m. However, I would also like to point out that even the technique known as PET scan would not be able to meet all medical imaging needs, even if we were only talking about Canada.

To vary things a bit, I will now speak in English.

● (1540)

[*English*]

I will give you my point of view on the MAPLE 1 and 2 reactors at Chalk River.

I must say, first of all, that I have very little technical information or precise information about these reactors.

If I can go back to a long time ago, in 1992 the Chalk River Laboratories decided to shut down the NRX reactor because its useful lifetime had been essentially reached and this reactor was no longer reliable. NRU, which was a nuclear reactor right next to NRX, became de facto the only nuclear reactor in Canada able to produce these radioisotopes on a very large scale.

At the time this situation arose, it was clear that the NRU reactor would reach the end of its useful life quite soon. Twenty years before, in the early seventies, the calandria of this NRU reactor had been changed, and, if I am not mistaken, the design lifetime of this calandria was only 20 years. So the calandria of NRU should have been replaced in 1995, or around there. But the MAPLE reactors were put forward as an alternative to NRU, and each of these two reactors was to be able to produce more than 100% of world demand in radioisotopes.

Of course, these two nuclear reactors, as we know, have given rise to a variety of technical problems, technical issues. Many of them were solved. One could question the quality of construction, so I think AECL spent some time going through quality assurance to make sure that the reactor was built according to design. Most of the technical problems were solved.

If you don't know how the nuclear industry works, usually when you modify something in a nuclear reactor, when you bring forth a new type of reactor, most of the time you have unforeseen difficulties. You can think of the Darlington reactor, which was just an increment in size of a standard design, and engineering problems arose that took more than a year to solve. So I think the MAPLE reactors, MAPLE 1 and MAPLE 2, do not escape these sorts of engineering constants.

However, there is a larger MAPLE reactor operating in South Korea, the HANARO reactor. So as far as we know, the MAPLE reactors were stopped last year mostly because one technical issue has not been solved, namely the positive reactivity coefficient. This reactivity coefficient was predicted to be negative, as it is also predicted to be negative in larger CANDU reactors. Similar calculations to those done on the MAPLE project were performed by other laboratories in the United States, all of them reaching the conclusion: this positive power coefficient should have been negative.

● (1545)

It was, however, measured as positive. Although some efforts were made by Atomic Energy of Canada Limited to explain this positive power coefficient, the full explanation was not found.

When you find yourself in a situation where you cannot predict as simple a coefficient as the power coefficient, then can you be sure that the nuclear safety analyses, which are based on calculations, are correct?

We hope that the MAPLE reactors were simply put in a mothballed state rather than truly dismantled. It is our opinion, however, that the MAPLE reactor project should be reinstated and that sole technical difficulty be tackled by a group of people involving not only AECL but also those from outside this company, maybe some other organizations, including universities, where we have, over the last few years, made very powerful modifications to transport theory, nuclear reactor calculations, fluid flow, and heat transfer.

I think we should put together the resources to analyze the situation and predict correctly the positive power coefficient so that this technical issue can be solved and the molybdenum–99 and technetium-99m problem can be solved once and for all. It is my opinion that this country should put some of its resources into solving this problem.

[*Translation*]

We are not raising anything new when mentioning the advanced age of the NRU reactor. This reactor, which was designed in the 1960s following successful operation of the NRX reactor, had an exemplary career in its capacity as a nuclear reactor. Not only did it produce radio-isotopes, but it also supported research activities that were important to the Canadian nuclear industry as well basic research, for example, in the area of neutron spectroscopy.

We should be fully aware that the NRU reactor was not originally designed to produce radio-isotopes, but solely to support research. It was not until later, around 1975, that radio-isotope technology really began developing for use in nuclear medicine. Gradually, the NRU and NRX reactors were tailored to this situation in order to supply a considerable portion of the radio-isotopes used throughout the world.

In 1995, the calandria reached the end of its 20-year useful life. With the announcement of the MAPLE project, it was simply decided that the useful life of the NRU reactor would have to be extended until the two MAPLE reactors came on line. But given that the MAPLE project went on longer than expected, the useful life of the NRU reactor was extended to support the production of radio-isotopes during this transitional period.

The NRU reactor is now the only one in Canada that can produce significant quantities of radio-isotopes. Last year, authorities at Atomic Energy of Canada Limited decided to put an end to the development of the MAPLE reactors, but the calandria of the NRU reactor, which should have been replaced in 1995, was not. So it is no surprise to us that the calandria is now leaking. It has gone well beyond its useful life of 20 years: in fact, it is now up to 35 years, that is, over 50% longer than its projected maximum life. We believe that the NRU reactor will experience recurring problems of this kind.

Some of you may be disappointed to learn that, in my opinion, the useful life of the NRU reactor should be extended for a longer period than currently planned. We are currently told that the NRU reactor's useful life will end in 2016, whereas its operating licence expires in 2011. So my conclusion is that the next operating licence will be good for five years, which is standard for the licences issued by the Canadian Nuclear Safety Commission. This five-year period is merely an administrative decision, not one based on the actual condition of the reactor.

Appropriate repairs could be made to the NRU reactor, especially given the current shutdown and the fact that the southern pump has been emptied. This would allow not only the most urgent repairs to be done, but also those required to prevent further corrosion. In these conditions, I believe that the useful life of this reactor could extend beyond 2016.

Moreover, I would like to point out that it is very difficult to build nuclear reactors quickly, regardless of the country. The announcement concerning the MAPLE reactors probably meant that other countries in the world shelved any plans they may have had to build reactors that could produce these radio-isotopes, given that the two MAPLE reactors were to supply 100% of world production.

● (1550)

Therefore, I believe that our country has the very great responsibility of keeping the NRU reactor operational, given that not only does it continue to produce radio-isotopes, but it also supports basic and applied research for the CANDU reactors.

This concludes my presentation.

[*English*]

The Chair: Thank you, Professor.

We'll now go to our second witness. From the University of Waterloo we have Professor Jatin Nathwani, Ontario research chair in public policy for sustainable energy management, and executive director of the Waterloo Institute for Sustainable Energy.

Go ahead, Professor, for around ten minutes.

● (1555)

Dr. Jatin Nathwani (Ontario Research Chair in Public Policy for Sustainable Energy Management, Executive Director, Waterloo Institute for Sustainable Energy, University of Waterloo): Mr. Chairman and members of the committee, I thank you for your invitation. It's my pleasure to be here, and I will stick to my ten minutes.

I will confine my remarks, in essence, to three aspects: the need for a reliable supply of isotopes, the technology choices and the future options, and suggestions on governance aspects and the public dialogue for acceptance.

In terms of the need for a reliable supply of isotopes, the shutdown of the NRU reactor at Chalk River has again brought into sharp focus the critical need for a reliable supply of isotopes to our hospitals. The most compelling and difficult issue, however, is the reliability and safe operation of a single aging reactor on which depends the well-being of so many, both Canadians and globally. To an outside observer and to those not associated with the isotope business, the realization of such extreme dependency and vulnerability on a single source is a matter of profound shock and incredulity. How did we get into this corner, and what's next for the path forward?.

Anything short of a revolutionary transition away from current practices in nuclear medicine that rely on the use of isotopes would suggest to me that a robust and a dependable supply will remain a critical need. The government's recent indication to exit from the supply side of isotope production by 2016 would make us dependent on sources outside Canada. For a resource this critical to the overall health and well-being of Canadians, the exit strategy does not appear to be prudent. The provision of a reliable supply of medical isotopes is far too important for the terms and conditions of supply and price to be determined by others.

If frustration with current costs is the primary driver for determining exit, what of the higher costs later, when we have conceded all control of any assurance of our own supply? Upon exit, we simply become a minor player with no influence. After a reasonable degree of success in the global markets, what is the compelling case for jeopardizing our own security of supply? As well, if we take the long view, could the exit strategy not compromise our ability to control health care costs if, over time, the use of isotopes continues to become more widespread in medical practice?

The fact that Canada has played a leadership role in the development and application of innovations in nuclear medicine and nuclear technology over the last 50 years is worth noting. That this has resulted in a significant positive contribution to quality of life and to health is again not to be dismissed lightly. That our global share of the business is respectable attests to some degree of success, and it has allowed us to enjoy relative stability for our own use. Why would we simply walk away? Is there not a case for nurturing our own strengths and for putting in place the solutions for realizing the benefits of this technology into the future?

Let me now turn to the question of technology choices and some suggestions for the way forward. One option is a combination of best-effort short-term fixes for the NRU reactor. That would allow us to muddle along until 2016 or so. Given the age of the reactor, this is the best that can be done in the short term, but this is not a credible or sustainable long-term solution. If we accept that the need for medical isotopes is not about to disappear, then a more robust solution is necessary. In light of our current difficulties, it makes sense to revisit the decision to cancel the MAPLE reactors.

I understand there are technical issues that need to be resolved, and there's a regulatory dimension to this as well. A strong recommendation by this committee to revisit the decision on the cancellation of the already built and partly commissioned MAPLE reactors is an option. If accepted by the government, this recommendation could pave the path for subsequent resolution of the technical issues.

● (1600)

Such a recommendation, coupled with a requirement on the agencies—whether AECL, industry, CNSC, or others—to develop an action plan with a formal quarterly progress report to this parliamentary committee, would provide a sufficient degree of focus, public accountability, and a high level of attention.

Whatever the business model—whether it is a public-private partnership, sole government ownership, or some other—the goal is to ensure that the national interest is taken into account, so we have to frame this problem as an important national problem, bring a sense of urgency to its resolution, and enlist the vast expertise within our regulatory bodies, industry, and the academy. However, in my view this will require an enormous amount of goodwill, a step-by-step problem-solving attitude, and vigorous measurement of progress against goals.

I believe this is the best path, and I remain confident that the technical aspects can be resolved.

Repairs to the NRU reactor, when completed, can only be viewed as short-term relief. It's an old reactor, and relying on it for too long would not be appropriate. A parallel path, followed with urgency, can bring the already-built MAPLE reactors to an operating state over perhaps the next six to 18 months, and such a strategy offers the best prospect for putting Canada on a firm footing for assurance of supply.

I will turn now to the problem that I characterized as that of governance and public acceptance.

How we set up the governance of institutions responsible for nuclear matters does have an impact on the quality of day-to-day decisions. In my appearance before this committee, I had indicated the need for an amendment to the Nuclear Safety and Control Act that includes a test of net benefit to Canada. If such a test were to be embedded in legislation, it would provide a stronger framework and guidance to the regulatory function, clarity of direction to industry, and broad public support for a coherent decision rationale in the public interest.

Again we are at a juncture that does not foster a meaningful discussion on how to do the balancing of trade-offs between real benefit now and what to make of low risks far into the future. We cannot allow ourselves to be stymied by perceived risks of reactor operation that place undue weight on hypothetical fears and end up denying patients the healing benefits of the reactor technology that yields large benefits for therapeutic and diagnostic use as part of medical treatment.

The costs are real, but not astronomical. The risk is not zero, but low, and the benefits are large and positive. The trade-off to serve the public interest is, to my mind, clear and simple.

Beyond specific aspects of governance and regulatory policies, there is a deeper and a more fundamental problem of public acceptance. Only you in the political arena can help with this problem.

In simple terms, there is a small but strong anti-nuclear sentiment that dominates public discourse on matters nuclear. Even though the safety risks are generally very low, social amplification of risk through the media gives rise to a political and cultural climate that makes it difficult for policy-makers to take a strictly rational approach. It reduces their comfort space of operation and forces the easier way out; witness the exit strategy proposed by the government.

Rather than taking the long view that emphasizes a balanced perspective, we run up against the problem of what I call the ugly duckling, the unpalatable pushed aside for yet another time. May I be so bold as to suggest that the time has come to shift the terms of debate around nuclear issues and help reduce the social friction, and that all parties will have to begin to articulate clearly the benefits of nuclear technologies? Over time, this would create sufficient space in the public sphere for a more informed dialogue.

● (1605)

The current crisis is but the simplest and clearest example of how we effectively ignore the enormous benefit of nuclear technology because the political comfort space is too narrow to allow for a more balanced and nuanced response. We create a cultural straitjacket that leads us directly to an exit strategy and an easier and quicker response to a problem; what it does not do is take into account the full consequences of the long term. For Canada, it would be truly unfortunate to walk away from having built and led a successful enterprise around the production of isotopes without a determined effort to fix the short-term problem.

I will now end with four simple recommendations to you.

First, confirm the need for a robust and dependable supply of medical isotopes for use in medical practice, and confirm whether the trend toward increased use is expected to continue.

Second, make a strong recommendation to revisit the decision on the cancellation of the MAPLE reactors. If accepted by government, a requirement to put in place an action plan for the agencies to establish clear timelines and implementation schedules to bring them to an operating state would be necessary. I think this is a credible path for a robust base for supply assurance long into the future.

Third, amend legislation to include a test of net benefit to Canada in the Nuclear Safety and Control Act. This would provide a strong foundation for balancing difficult trade-offs in regulatory decision-making.

Fourth and last, make a social and political commitment to frame a useful public dialogue on matters nuclear to help create a positive environment for policy-makers to make rational decisions.

Thank you for your time. I'll be happy to answer questions.

The Chair: Thank you, Professor Nathwani.

We go now to video conference from Atlanta. From the University of Ontario Institute of Technology, we have Dr. Daniel Meneley, acting dean, faculty of energy systems and nuclear science.

Go ahead, please, for about ten minutes.

Dr. Daniel Meneley (Acting Dean, Faculty of Energy Systems and Nuclear Science, University of Ontario Institute of Technology): Thank you, Mr. Chairman.

First I must say that what I say today are my own opinions, my own attitudes, my own convictions, and not those of the university at which I am employed.

The previous speakers have in fact eloquently described many of the situations I had intended to cover, so I will expect my brief to be even more brief than it is as written.

There is one point. The NRU reactor was and continues to be a vital part of the successful CANDU electric power system. As that power system has now reached maturity, the primary role of NRU is testing of design features aimed at upgrading plant performance and diagnosis of unexpected performance characteristics of various components and systems. Major plant developments, such as the current ACR-1000, also require extensive testing of novel design features, especially in the areas of fuels and materials.

But how about its age? How about its leaks and unplanned shutdowns? Of course, these are expected events in any similar facility. They are made critically important only by the lack of a backup system, as has been mentioned by previous speakers. AECL, to their credit, fully recognized this lack and planned early to install a large multi-purpose reactor as a replacement for NRU as soon as the imminent final shutdown of NRX became apparent. However, funding was not provided for this project.

Then, as a second-best approach to the problem of isotope production, the MAPLE project was initiated, with very tight funding and very tight schedule allowances. The results of this fundamental decision to proceed with MAPLE are well known.

However, in spite of the obvious weaknesses associated with the MAPLE facilities, I consider that start-up and operation of these facilities may well be the preferred route, as has been mentioned by both other speakers. It may well be the preferred route to solving the immediate shortage of radioisotopes. Yes, there will be problems; yes, this may not be possible until well after completion of the present repair processes at NRU; however, at the end of that sequence of events—that is, the repair of NRU—there still will be no backup supply of radioisotopes for a very long time to come. At the very least, MAPLE might help to fill this time gap.

I'm aware, from discussions here in Atlanta and in Vienna some time ago, that other countries are gearing up now to replace and augment the supply of molybdenum-99 from their own countries, so the gap-filling by MAPLE may well be the best thing we can do for both Canada and the world.

I come to the fundamental question to be answered, and I believe the committee is to be commended for investigating this question: if not MAPLE, then why not MAPLE?

Thank you very much, Mr. Chairman.

● (1610)

The Chair: Thank you, Dr. Meneley.

We go now to our last witness, who is here as an individual. He is Dr. Harold Smith, and he appears by teleconference from Toronto.

Go ahead, Dr. Smith.

Dr. Harold J. Smith (As an Individual): Thank you, Mr. Chairman, ladies and gentlemen of the committee.

I provided a brief biography to the committee. I would like to expand on that just a little, and I'd like to touch on two points: aspects of the production of moly-99 and the positive power coefficient of reactivity.

The positive power coefficient of reactivity is not a mystery. It is not an unsolvable engineering problem. It is a small thermal mechanical effect in a prototype design that requires a simple engineering fix. The power coefficient can be restored to a value of close to zero, and a safety case can be made for these conditions.

I'll come back to my biography. I started working at AECL in 1975. In 1981 I became section head of physics at the Whiteshell nuclear research establishment. In 1982, at the request of my branch head, I started to design the core for a new research reactor concept for the purpose of developing a new product. At that time, it had no name. The design concept was that it would be a multi-purpose research reactor, be based on low-enriched uranium, have competitively high thermal neutron flux levels, and not require development of any new technologies.

"Multi-purpose" meant at that time that it should be able to provide neutrons for fundamental nuclear materials research as well as produce a wide range of both medical and industrial isotopes.

During the next six years I led the development of the reactor concept, assembled and developed the computer codes, developed the various initial models required to simulate the reactor, and built an analysis group to support the effort.

By 1984 we felt that we had the basis for this new product. The group was asked to come up with a name and to make it Canadian in some way. In the next week or two, I coined the acronym “MAPLE” reactor. It stands for “Multipurpose Applied Physics Lattice Experiment” reactor.

In 1985 we hosted a team of ten Korean physicists and thermal hydraulics specialists to start the design of a MAPLE for Korea, which became known as the HANARO reactor. The HANARO reactor went critical in the early 1990s and functioned successfully at up to 30 megawatts, carrying out all of the described functions. It is mainly devoted to research, and production of moly-99 is not a priority. You cannot just throw out research programs that take years of implementation.

I left AECL at the end of 1988 to advance my career and experience by working for the CEA at Cadarache in France. I returned two years later to work in the nuclear safety group of Ontario Hydro. Three or four years later, I was offered the opportunity to work in Moscow on contract to AECL, consulting as an expert on western safety analysis methodology.

In 1997 I returned from Moscow to work as the head of the physics group on the newly revived MAPLE project. I led the physics effort in the preliminary and final safety reports, became a commissioning supervisor for MAPLE, and then became a nuclear commissioning manager.

I and my team took both MAPLE 1 and MAPLE 2 to criticality. We measured the positive PCR and we participated in the subsequent efforts on the positive power coefficient of reactivity.

I understand from the newspapers that there has been a team of experts who claim that MAPLE would never be functional. I now ask the rhetorical question: who are these people? If anybody qualifies as an expert on MAPLE, I think I'm it. Nobody has asked me or anybody else involved in the project what we think.

Let me talk briefly about the production of moly-99.

From the project's inception, we had focused attention on how to make sufficient quantities of fission product moly-99. If it were easy to do, everybody would be doing it. Working from the known demand at the time in the mid-1980s and using the estimated demand growth for a 30-year reactor lifetime, we built in the capacity to deliver double the world requirement at any time. This is achieved by high thermal flux levels, flexible target removal schedules, and the capability of the reactor to be shut down and started up every 24 hours. This is not an easy task.

● (1615)

I emphasize the word “deliver” since the reactor must produce at least twice the amount that has to be delivered, because you're going to essentially lose half of what you've produced by the time you've extracted it, purified it, and delivered it to where it's going. As was pointed out by Dr. Koclas, the half-life of moly is only 2.7 days. You have to work very quickly. Processing is almost a military-style operation. That is why you cannot store it.

But to make sufficient quantities to meet these demands, the reactor needs to have high flux levels. Without delivering a nuclear theory course, please accept that it is the nature of the production and decay processes.

You cannot make more in a low power reactor by operating for longer periods, because what you have made will be destroyed by neutron absorption and decay. You cannot arbitrarily raise the maximum power level of an existing reactor to increase flux levels to produce more moly-99. You could produce more in this manner, but reactors are designed for a certain maximum power level. Raising that maximum value involves redesign to provide additional cooling and compensate for whatever safety margins have been eroded, and possibly fuel redesign.

These changes would be increments of 5%, 10%, and 15% on their current capability, as you've already heard in the press. When people talk about how they're going to work on their reactors, they're talking about 5%, 10%, and 15%.

It's the compactness of the MAPLE core that permits the required flux levels at a relatively low power of 10 megawatts. Having said that, I note that MAPLE 1 operated at 80% full power and is capable of making the world requirement for moly-99 at that power level. MAPLE 1 was producing moly-99. We did not extract it because we're still commissioning the reactor and we did not want to destruct the continuity of the process.

Let me just speak briefly, then, about the power coefficient of reactivity. When the positive PCR was measured during commissioning, further tests were put on hold until it could be investigated. We reviewed our calculations. We've re-performed the calculations using the latest tools and data libraries. The design tools that we had used were in the original tool kit developed in the eighties. We contracted external expert groups to review our test analyses and calculations, and another group, as was pointed out, to recalculate the PCR.

Nobody came up with a result that was significantly different from the original results. From this, we concluded that there must be an unmodelled effect taking place. The regulator required that we understand it.

We executed a PIRT study for a phenomenon, importance, and ranking table, in which every component of the reactor is examined by a group of specialists on each system against a list of physical phenomena to decide if a particular phenomenon can contribute to the observed effect. This systematic approach led to the identification of 20 possible candidates, but only three stood out: bowing at the targets, bowing of the fuel elements, and possible heat-up of water between the reflector wall and the flow tubes, because there was some recirculation.

A test program was planned for the execution of these tests that focused on each candidate to the maximum extent possible. However, in each case it was not possible to completely isolate the factors in each test; i.e., there was some interdependence of each of the three different effects. So the end result needed the answers from all three tests to determine each individual contribution uniquely.

By taking out the targets and replacing them with fuel bundles, test one showed a reduction of a positive PCR by about one-third. Test two straightened out the recirculating water, but did not change the value of the PCR. That's been called failure. That was a measurement of what we intended to measure.

That left the third test, on the fuel bundles, to be executed, which was to use the simple engineering fix, which is to restrain the bowing of the elements—and it's a very tiny amount—when the project was suddenly terminated. The contribution from the targets and the contribution from the fuel both depend upon the same physical effect.

● (1620)

This same effect will happen to any material that expands when heated. If one side is hot and the other side is cool, there's a temperature asymmetry from side to side.

The fuel assemblies in MAPLE and HANARO reactors are very similar. HANARO is a larger MAPLE. I personally worked on the transfer of the technology. The fuel assemblies are made by the same people. HANARO has a negative PCR of a value we calculate for MAPLE. It is mostly a property of the fuel constituents.

The temperature asymmetry results from a high-flux gradient across the outer elements of a fuel bundle making one side hotter and the other side cooler. The fuel element will bow as one side tries to expand more than the other due to the temperature difference. This bowing movement moves the fissile material in the fuel element up the flux gradient in such a manner. This makes it more important to the core. This is the source of the positive reactivity coefficient.

This last statement could be labelled as speculation, since we did not have the opportunity to perform that test. In fact, the project was terminated in May, and the test was scheduled for October.

While the PCR would be negative for a core fuelled without moly-99 targets, we see that they do make a positive contribution, so putting the same number of targets back in the core would bring the net effect to approximately zero PCR—perhaps slightly positive, perhaps slightly negative—unless the targets were also modified to resist bowing. So you cut off the effect in both types of assemblies.

In conclusion, I'd like to repeat that if making moly-99 was easy to do everybody would be doing it. Other reactors may be upgraded, but will only be able to contribute small fractions of the demand. Other proposed methodologies are still in the experimental stage, and there are two MAPLE reactors, each with the capacity to deliver more than the current world requirement. Positive PCR requires a relatively simple engineering fix to restrain the bowing of the elements and reduce the PCR to approximately zero.

I thank you for your attention, and I hope this doesn't turn into another Avro Arrow.

The Chair: Thank you, Dr. Smith.

We'll now go to questions, starting with the official opposition.

Mr. Regan, go ahead.

Hon. Geoff Regan (Halifax West, Lib.): Thank you, Mr. Chairman.

It's unfortunate we weren't able to secure a room to have a televised meeting today, particularly in view of what we've heard from these four witnesses. They are witnesses who were proposed by all the parties—in fact two of them were proposed by the minister's parliamentary secretary—and they're all agreeing. They're all saying that the government has made a mistake and should reconsider its decision to cancel the MAPLE project. It's a remarkable confluence of expert opinion we're hearing today, and it's very disappointing that the public is not able to see this.

I really appreciate the witnesses appearing today. It has been very interesting and raises lots of questions. Unfortunately, we only have limited time.

Dr. Smith, did I hear you say that the reactor produced moly-99, that it produced the isotopes, but they were not extracted? Is that right?

● (1625)

Dr. Harold J. Smith: That is correct. We operated first at one megawatt, then at two megawatts, five megawatts, and eight megawatts, as we did tests at different power levels. The targets were in the core, and moly-99 was being generated in those targets.

Hon. Geoff Regan: Was the testing of the MAPLE reactors complete last year when the government abandoned the project?

Dr. Harold J. Smith: No. We terminated at 80% because we were required to explain the positive PCR before we could carry on. Then the project was terminated before we got to that point. We were probably four months away from putting the final test in. That test would have contained the engineering fix.

Hon. Geoff Regan: Have you heard anything that gives you an opinion on why that decision was taken by the government?

Dr. Harold J. Smith: No, and it's an area that I don't care to step into, because it becomes political and I don't want to deal with that.

Hon. Geoff Regan: Okay. In your view—

Dr. Harold J. Smith: I will say there's no technical basis.

Hon. Geoff Regan: I think what we've heard today from witnesses is basically that we should get the NRU back up and operating, which of course is what AECL is attempting to do as quickly as possible, no doubt.

We've also heard that the government should go back to the MAPLEs so we have a secure supply of medical isotopes for Canada for the future and so we can supply them to other countries. But let me ask you this: how long, Dr. Smith, do you think it would take to get it going?

Dr. Harold J. Smith: The last time I saw MAPLE was a year ago. It had the fuel removed at that point. It was sitting in pristine condition. I do not know what has happened to it in the last year, because I have not been working for AECL. But if you decided to do it and the machine had not been otherwise dismantled, you still have to recover the teams. In particular, the operators will take about one year to re-certify; they have not run the machine. We could be putting it together and they could be re-certifying, but you're still going to have a year's delay getting on track.

Hon. Geoff Regan: The minister and I believe the Prime Minister both said that MAPLE never produced isotopes. Is that the truth?

Dr. Harold J. Smith: No, absolutely not. Of course it was there. You can't avoid it if the targets are in the core.

Hon. Geoff Regan: Explain to us why it is that you feel that the MAPLEs could use the same fuel type as HANARO in South Korea—without getting too technical about it.

Dr. Harold J. Smith: It is essentially the same fuel. Yes, it's the same fuel made by the same people at AECL.

Hon. Geoff Regan: But the type—

Dr. Harold J. Smith: There are subtle differences in the design, and I may get into trouble by specifying those details.

Hon. Geoff Regan: Okay. It's highly sensitive information, I suppose, and that's why you're cautious.

Dr. Harold J. Smith: I have to be.

Hon. Geoff Regan: I understand. That's your responsibility. I appreciate that. I'm sure we all do.

Dr. Koclas, in your remarks in the document you distributed, you say:

> We see in these events the typical problem of first of series design. This sort of difficulties happen also in the domain of large power reactors, even when only a change in dimensions can bring unforeseen engineering problems, the Darlington reactors in Canada being a case in point.

You're saying that it is not unusual when you have the first of a new design type to have a series of problems. Would you like to elaborate on that?

Dr. Jean Koclas: I've given the example of the Darlington reactor. The Darlington reactor is a standard CANDU reactor with essentially more and longer pressure tubes, but basically the same technology. Yet when it was put into service, there were unforeseen vibrations in the primary circuit, which produced long delays in starting up the reactor and commercial service.

The European power reactor of Areva, for example, has its first series built in Finland. It is way behind schedule and way behind budget. For me, it's not actually a law that it is like this, but you can just infer it from many such things that have happened. Also, in the United States, in the early eighties or so, I think some things like that happened.

I've never had the design of the MAPLE in my hands, but consider that one MAPLE was already working, and that is the HANARO reactor in Korea. It's a 30-megawatt reactor, which tells me that it has more fuel bundles, maybe longer ones, but certainly a larger number, so the dimensions of the core are different. So to have surprises when you go to similar technology but just have a reduction in size is not really surprising.

● (1630)

The Chair: Thank you, Doctor.

We go now to Madame Brunelle. You have up to seven minutes.

[*Translation*]

Ms. Paule Brunelle (Trois-Rivières, BQ): Good afternoon, gentlemen. Thank you for being here today. My first question is addressed to all of you.

I have heard from your presentations as well as from other witnesses that to cease our production of isotopes would not be a good idea, because of medical needs, among others. This is an urgent problem that affects many areas. We have also been told that it is important not to lose our scientific expertise, that we in Canada have a significant advantage, and that our country's reputation, in the eyes of the world, is an important consideration. So we need isotopes and, as some of you have said, we will need them in greater and greater quantity. So we need to look to the future.

We have two choices: temporarily extend the life of the NRU reactor, which appears to be a temporary solution; or go back to the MAPLE reactors. Several witnesses have said that AECL should seek international assistance to complete the development of the MAPLE reactors. Representatives of AECL, as well as other witnesses, have said that this has already been done, that experts have already been consulted. What is your opinion on that?

Some witnesses also mentioned the HANARO reactor. If I understand correctly, the technology on which it is based is the same as that used for the MAPLE reactor. I would like to know why the authorization required for its startup was issued, whereas in the case of the MAPLE reactors, AECL did not give its authorization.

Mr. Jean Koclas: There are several facets to your question. I believe that the HANARO reactor experienced a few problems during startup, but that mechanical modifications to its fuel solved these problems. In addition, this reactor has a negative power coefficient, which is not the case for the MAPLE reactors at this time.

Ms. Paule Brunelle: But we can say that the technology is fairly similar.

Mr. Jean Koclas: Without having studied them in detail, I would say—and even Mr. Smith confirmed this—that the technologies are essentially the same, except for their dimension.

Ms. Paule Brunelle: Mr. Nathwani.

[*English*]

Dr. Jatin Nathwani: If I may comment on your question, my opinion is that we have a relatively small technical problem in terms of resolving some of the issues around the power coefficient of reactivity.

When I alluded to what I call the regulatory dimension to this problem, that related to a degree of inflexibility in acceptance of the notion of how one deals with a positive power coefficient in a reactor. When that regulatory inflexibility became a big issue, it left a lot of people in a situation of being under the threat of not being able to license this reactor. That downstream consequence set in motion a whole series of decisions, which may well have led the policy-makers to come to the conclusion that they would pull the plug on the MAPLE. It's an unfortunate set of historical circumstances around what is partly a technical problem and also a degree of inflexibility in being able to say it's something we can solve in time.

That said, I would go on to insist that there is sufficient capacity in the nuclear science and technology community within Canada to resolve this problem, but we still have to take a more flexible attitude, and it may turn out that we need to draw in expertise from outside Canada to resolve this specific technical issue around the power coefficient and so on. Dr. Harold Smith is indeed an expert and can speak to the point better than I can.

I consider it an entirely resolvable issue. Whether it's six months, twelve months, or eighteen months until you actually get into it, time will tell. I'm fully confident that this problem can be resolved, but it will require clear direction.

● (1635)

Ms. Paule Brunelle: Mr. Meneley or Mr. Smith.

Dr. Daniel Meneley: On the point of why HANARO was licensed and MAPLE had difficulties licensing, HANARO is a larger reactor, so following Dr. Smith's comment, flux gradients in the bigger reactor are less important to the reactivity. So it's quite possible, even with identical fuel, that one coefficient could be positive in MAPLE and the other coefficient could be negative in HANARO. But both of them are relatively small, and small coefficients, whether positive or negative, really are not important to safety.

I referenced the first comment on this point to W.B. Lewis, the father of CANDU, who said in 1960 that the important thing was to have small coefficients so that they were easily controllable, and whether the coefficient was positive or negative was relatively unimportant. That's an extremely important point to make. So the positive power coefficient in MAPLE is not really a safety issue; it's a regulatory issue.

I think it was Dr. Nathwani who mentioned that regulatory inflexibility—in fact, extreme inflexibility—on this point was counter to both operation and to safety.

The Chair: You have time for a very short question.

[*Translation*]

Ms. Paule Brunelle: Perhaps Mr. Smith could answer my question.

[*English*]

The Chair: Dr. Smith, you have 53 seconds.

Dr. Harold J. Smith: Thank you.

I support the comments on the regulator made by Dr. Meneley and Dr. Nathwani. It would be dangerous for me to say more. But yes, Dr. Meneley's point is very correct.

Do we need external help? I don't think so. I think we had the answer. We've used external contractors, and they didn't come up with any new ideas. We deciphered what the solution was ourselves.

The Chair: Thank you, Doctor.

We go now to the New Democrat Party, to Mr. Cullen.

Mr. Nathan Cullen (Skeena—Bulkley Valley, NDP): Thank you, Chair, and thank you to our witnesses.

I have to say we've been sitting through a number of days of this testimony, and I don't think any of us on this committee are nuclear scientists. I don't have a degree anywhere close to nuclear level. I'm shocked by the testimony I'm hearing today concerning what the reality was around the MAPLE project.

Let me start with you, Dr. Smith. This is obviously—I don't know if personal is the right word—a personal issue for you. You spent a great deal of your career around this project. Is that correct?

● (1640)

Dr. Harold J. Smith: That's correct—about 25 years of my life.

I was asked if I was bitter, and I said no. I'm sad and disappointed with what's happened. I did my grieving when they terminated the project. But if somebody wanted to restart it, I know many of the team members who would jump back on to get this thing on the road.

Mr. Nathan Cullen: I have a question for you then. Does anyone know more about the MAPLE reactors and how they work than you do? Would you consider yourself one of the most informed people about this?

Dr. Harold J. Smith: I consider myself one of the most informed. There are aspects in which I'm not expert. There are certain engineering aspects. I'm a physicist, and I know how the neutrons are supposed to behave, but if you want me to do thermohydraulics then I call in a specialist for that. There is one other physicist—but unfortunately he wouldn't be accessible to you—who I consider knows as much as I do. Maybe he even knows a little more from the theoretical point.

Mr. Nathan Cullen: The reason I ask this is you mentioned earlier in your testimony that no one phoned you before this decision was made by government, and I'm curious why. The Prime Minister and the Minister of Natural Resources both said that MAPLE had to be cancelled because of cost overruns and said that it had never produced an isotope and was unlikely to ever produce an isotope.

Mr. David Anderson (Cypress Hills—Grasslands, CPC): Point of order, Mr. Chairman.

The Chair: Point of order, Mr. Anderson.

Mr. David Anderson: Maybe Mr. Cullen should understand it was AECL that cancelled the project and shut it down. It was not the government.

The Chair: Okay, Mr. Anderson. Point of debate.

Go ahead, Mr. Cullen.

Mr. Nathan Cullen: Mr. Smith, did anyone call you from the federal Government of Canada, the Prime Minister's Office, or the natural resources minister's office to ask you what your opinions were as to this project or whether the technical problems...?

And that statement that the Prime Minister and the natural resources minister made, that it had to be shut down because it had never produced an isotope and was unlikely to ever produce an isotope—is that a factually correct statement?

Dr. Harold J. Smith: No, it is not. Nobody tried to contact me. It was making isotopes at the time.

And there was another statement that it was not designed to be functional, which of course is not true.

Mr. Nathan Cullen: Over to you, Dr. Nathwani. You mentioned the public aspect of this. There seems to be a political aspect as well, not so much in the politics that we deal with but within the very small community that is nuclear scientists. It doesn't seem to be a large community. Within the public sphere there's a certain level of concern and skepticism towards nuclear power in general, whether it was cost overruns or safety considerations from the public. Have the last 18 months improved that public perception of nuclear power, or lessened what people feel towards this technology?

Dr. Jatin Nathwani: I'm not a pollster, so I read what's available. But if you were to ask me where people stand on this question of nuclear—certainly people in Ontario, and Canada in general—there seems to have been a reversal, if you wish, or a near acceptance of nuclear as one option in the larger mix. I'm thinking more of the power systems. Partly, all this is driven by issues around climate change and the carbon question. There is a large number of people who otherwise would not be entirely supportive of nuclear who are saying that maybe this is not as bad as we have made it out to be.

So there's a shift. And certainly you see in the Ontario situation that there's a government policy commitment to go down nuclear that's very open, very public, and there's not been much of a debate on that particular question.

Mr. Nathan Cullen: Doctor, if I can, I wanted to get to the point that you made about Canada abandoning its position in the making of isotopes, because that's what we're here for. You talked about a national interest and that this question had to be framed in terms of the national interest. Why does it matter that the Prime Minister got up and said at the end of a press conference that, by the way, we're out of the isotope business? Why should Canadians be at all concerned about that? What's the big deal? We can just go on the open market and buy isotopes. Why should anyone be concerned?

Dr. Jatin Nathwani: Well, as I said in my statement, this is not like buying any other commodity. It is such a critical resource and links so directly into the health and well-being of Canadians. This is through its need in the medical practice.

I shake my head when you say that it doesn't seem to make a business case, or you don't like the cost overruns, or it just doesn't look very pleasant, and it's causing nothing but political problems, and therefore we're out of it. It doesn't seem to take the very long-term view of the benefit that this particular technology delivers today and has the potential to deliver to our health system.

● (1645)

Mr. Nathan Cullen: This is my question then. You seem to have inferred or connected the political problems to the technical decision to get out of isotopes, that this was causing the government some grief so it's best to push it aside. You've talked about short-term thinking, as opposed to long-term national interest. I don't want to mischaracterize your words. Is this the connection you're making?

Dr. Jatin Nathwani: I am, and again, it's my opinion. It's an observation I make. I have some sympathy for, in this case, policy-makers, the Prime Minister, politicians. When you have a situation where the broader climate is essentially anti-nuclear and you have a problem that people say they don't like to see in front of them, there is a natural tendency to ask why we don't just close the door and move on.

Mr. Nathan Cullen: Back to you, Dr. Smith. Just to clarify, there were technical problems being faced at MAPLE that had been addressed by the regulator. You had a test scheduled for some months just after that. In between the time the technical problems were pointed out and the test was meant to be conducted, the entire project was cancelled. Am I getting my timeline correct?

Dr. Harold J. Smith: Almost. We had the test program, which involved three tests, because the issue had arisen. We were trying to explain it and understand it. The first two tests had been executed in that series, and in fact we were being driven to work very hard to get the preparations ready for the third test. It was the middle or end of May, and the program was cut. The test was scheduled for October. So most of the preparations were already well under way.

The Chair: Thank you, Dr. Smith.

We go now to the government side. Mr. Allen, for up to seven minutes.

Mr. Mike Allen (Tobique—Mactaquac, CPC): Thank you, Chair, and thanks to our witnesses for being here today with some interesting comments.

Dr. Smith, I'd like to start with you. I found your comment kind of interesting that you don't know who these people were who suggested MAPLEs couldn't work. Between 2003 and 2008 there was plenty of testing done on this, and what seems strange to me is we had.... I agree with your factors; you get down to the 3 to 5 factors from 200. We had the Idaho National Laboratory involved, we had Brookhaven involved, we had international people involved for five years, yet all of a sudden it's now only a little mechanical thing that we can fix. I'm surprised, given your involvement in the MAPLEs project up to the commissioning time, that this testing program wasn't done a long time ago. What happened between 2003 and 2005, and how is it that we're saying right now that we can have this thing up and running in a matter of months?

You have to square that circle for me, because that was in some of the testimony we heard from Mr. Waddington, who has credible experience in this, although probably not the MAPLEs experience you have. At the same time, I would like to understand how you can square that circle for me. If this is fixable, maybe you should come up on a plane tomorrow.

Dr. Harold J. Smith: Between 2003 and 2008, there was no testing. There was a lot of calculating. This is a fixation of the regulator, that you can calculate everything. Unfortunately, there becomes a limit beyond which you cannot calculate.

I could give technical details of why the calculations are very difficult, but I'm afraid that might entail too much technical detail.

We used BNL to be independent reviewers of what we had done, and then we asked BNL to do it independently. Again, this was to try to satisfy the regulator's request that it be demonstrated by calculation. In the end, we needed to do the tests, because you couldn't calculate some of these effects. You already have to know the answer to get the code to tell you the answer. That's the way it works with thermomechanical codes; that's the way it works with thermohydraulics codes. Neutronics is probably the closest to getting an independent answer, but with the thermohydraulics and the thermomechanical, you have to tell them the answer before the code will give you the right answer. So you already have to know what the answer is.

This fixation on a calculated solution—

● (1650)

Mr. Mike Allen: The ability to predict, though.... Some of the issue is how the reactor function is part of how the control systems functioned as well. In your view, and I guess the view of all the folks here, is that an acceptable way to relax a regulatory and safety standard, that we would have a situation where a reactor is behaving differently from the control processes and mechanisms?

Dr. Harold J. Smith: I don't agree with your statement. I stood in that control room for every test of the commissioning, through the low power and the high power tests. The reactor behaved extremely well. It was very stable. As Dr. Meneley pointed out, when a coefficient is small, it doesn't really matter.

The thing is, we have extremely conservative safety cases that say there isn't a problem. And when I say "extremely conservative", we have essentially three shut-down systems. Two of them are fast, less than one second for insertion, and the other one takes two and a half seconds. We are forced by the regulatory process to credit only the very slow one. That's a point of difference between MAPLE and HANARO. HANARO does not have the slow system. Their regulator did not require them to put it in. They have only the two fast ones. When you can credit one of the fast systems, there is no safety issue. In fact, even with the slow system we can still make the safety case.

Mr. Mike Allen: One of the things we have heard here today— and I think it is pretty consistent in the testimony we've heard—is the importance of getting the NRU back running again, because that represents our best short-term case. I've had discussions with some folks, and I'd like you to comment. If you need to take that tack, do we have the resources within AECL, and within the right technical competencies, to be able to tackle that and be able to divert resources to the project when it has already been proven, after five years, that we're not sure how long it's going to take to bring it on? I don't think you can give me a definitive answer as to how long it will take us to bring MAPLEs back, so do we have the resources to chase two rabbits and get neither one?

Dr. Harold J. Smith: I think it was in 2007 that AECL went on a very large hiring spree. It brought on board a lot of young people. I know that all the members of my commissioning team are still at Chalk River, and there's one down here at Sheridan Park. So we have the people to staff the requirements for MAPLE, and they have been bringing on new people, as I say, who could be used on the NRU.

Having said that, I'm not AECL, and whether they regard themselves as having the resources, I don't know. I just say that I think the people are there.

Mr. Mike Allen: You've all said you think we should look at the MAPLEs again. Can anybody here today give me an answer as to how long they think it would take to bring MAPLEs back on, considering what we've got? We've had some say it could be up to 2015 or 2018 to bring this back on. Can anybody give us some kind of indication as to what that is, including the licensing? And given that situation, does it make sense to pursue other technologies? For example, we could have home-grown regional solutions, like accelerators, which we could have up within two years.

● (1655)

The Chair: Mr. Allen, your time is up. Do you want to choose maybe one witness to give a short answer?

Mr. Mike Allen: I guess we'll go with Dr. Smith.

The Chair: Dr. Smith.

Dr. Harold J. Smith: Excuse me for a second while I gather my thoughts. I thought it was over.

Okay. With MAPLE you have to put things back together and you have to certify the operators. You're probably looking at a year or a year and a half for that. But you could have your people getting all the tests and whatever ready at the same time, in parallel.

The other technologies you're talking about—accelerators—are experimental. They don't have a demonstrated capability to produce the vast quantities that are required.

I can't give you any guarantees. Having dealt with the regulator for a long time, there's just no estimating what is going to happen.

The Chair: Thank you, Dr. Smith. I appreciate your answer.

We go now to Mr. Bains, for up to five minutes, in the five-minute second round.

Hon. Navdeep Bains (Mississauga—Brampton South, Lib.): Thank you very much, Chair.

First of all, thank you very much for your testimony. It's very informative.

I want to say that the core issue we're dealing with and discussing here today is really the reliable and secure source of medical isotopes. There are many converging issues that come into play. This issue has been described as a matter of life and death, in certain instances.

I'm very glad to hear today, from all of you, that the MAPLE reactors are a viable option that the government should seriously consider. Even though the government, on numerous occasions, has put the onus back on AECL, saying it was their decision, the buck really stops with the government. It has a responsibility, in light of the crisis we're dealing with.

The question I have—and it's really a continuation of some of the questions that have been posed in the past, just for further clarification—is with respect to the Prime Minister's comments about the fact that he thinks we should no longer be in the isotope business, basically that we should walk away from this.

Why would we walk away? Why would Canada walk away from this? Why would we want to walk away from this? From what I've heard today, clearly, I don't see any upside to this. Specifically, this question is directed at Mr. Nathwani, because you talked about this in your presentation. Could you elaborate on what you think, what feedback you're getting, what you're reading, what you're hearing? Why would the government walk away from such an important critical component of the production of isotopes in relation to our health care system?

Dr. Jatin Nathwani: It remains a puzzle, in my mind—unsolvable, in that sense. It doesn't make sense to me that we would take a position to walk away.

It's not because we just somehow were late in this business and found that it wasn't successful. This has been 50 to 60 years of fantastic achievement in Canada in both nuclear medicine and nuclear engineering technology. Yes, there is a problem here around NRU, obviously, and MAPLE, with some technical issues and problems, but the depth of expertise exists within Canada.

In response to the earlier question, if we were at the stage where we said, “Okay, NRU is a problem, and now we're beginning to think of designing some new reactor and hope that will work”, if that were the MAPLE, that would be one thing. But MAPLE has been thought through, built, and commissioned. Results have been obtainable, but some problems exist. You are into the last 20% of the resolution of the problem, if you wish. As to whether it is 20%, 15%, or 30%, the people who work on it should be able to tell you that. But we are not that far away.

So it is a question of some cost, first, but also, in my view, the expertise is available to be able to bring it on. If that is the case, it just makes no sense to walk away from this phenomenal achievement.

Whether you accept the fact that the achievement is good or not, think of it as a national strategic perspective. Would you really want the prescription in price of these isotopes to be left to world markets, whether it's the Australians, the Dutch, or the South Africans, or wherever they come from? What would be our situation in that scenario, if you assume that isotopes will continue to be required in medical treatment?

It's too critical a resource, and we have the expertise within the country to be able to bring it home. As well, we're not starting from ground base, with just about 80% of it done. It makes eminent sense to revisit this question.

● (1700)

Hon. Navdeep Bains: I believe there's another witness who wants to speak to this.

The Chair: Mr. Meneley, go ahead with a short answer, please.

Dr. Daniel Meneley: Thank you, Mr. Chairman.

I'd just like to close off a point about the time taken for a start-up of MAPLE.

It is my firm opinion that both NRU and MAPLE should be restarted, and as quickly as possible. I believe the time schedule for NRU is some three months. At the end of that three months, we will still be on a very tender point in isotope production. We need MAPLE.

We will be able to hopefully get through the short period between NRU start-up and MAPLE start-up without another NRU shutdown. MAPLE must come in addition to NRU; both of them must be.

On the point of resources, NRU resources are in place. They're the operating and maintenance crew. They are quite different people from the people who would be involved in restarting MAPLE.

So yes, we have the resources.

The Chair: Thank you, Mr. Bains.

Ms. Gallant, you have up to five minutes.

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

Who was the head of the CNSC at the time you were required by the regulator to stop commissioning the MAPLEs?

Dr. Harold J. Smith: Linda Keen was the chairman.

Mrs. Cheryl Gallant: At what point in time, which year, was the positive power coefficient of reactivity first observed?

Dr. Harold J. Smith: I think it was back around 2002 or 2003.

Mrs. Cheryl Gallant: Now, there were about 200 potential factors identified as contributing to the positive coefficient. It was mentioned previously that the Idaho National Laboratory in the U.S. also observed this, and came out with the exact calculations.

We were told that the last set of tests was in April of 2008. That was the last set. We were told of no future set, in September of that year, being tested, and that last set of tests showed that the factor was not contributing at all to the anomaly that had been seen. There's where things really ground to a halt.

Now, to solve the problem, it would likely need the development of a new fuel, which would have to be designed. How long would it take to design a new fuel for the MAPLEs? We were going to have to go to that anyhow, as the international community wants us to use something other than highly enriched uranium.

Dr. Harold J. Smith: I realize that.

Could I correct a couple of points? Did I hear you say 200 factors? It's only 20. We identified about 20 possible contributors, but some were very small.

We finished the main body of our commissioning in 2002. Then it was five years of calculate, calculate, calculate, before we could get approval to do a test that we could as easily have done in 2004, quite right, if we had not been pushed into this path of calculation.

When it comes to new fuel development, if you're talking about starting the search for brand-new fuel and qualification thereof, I think you're looking at ten years. The modification to the MAPLE fuel bundle can be done in a matter of months. There's nothing wrong with it; it's the same kind of fuel that is in HANARO. It has been working fine since the mid-nineties.

Mrs. Cheryl Gallant: Has the processing facility for the MAPLEs, the moly extraction equipment, been used and known to function properly at the MAPLE site?

● (1705)

Dr. Harold J. Smith: I wasn't in charge of commissioning the NPF. Perhaps Dr. Meneley knows more about it.

Mr. Daniel Meneley: I don't know much more. It's somewhat speculative on my part, but I've heard from senior people at Chalk River that the original design, which was defective, had been fixed by Chalk River staff and could now be operated. That's only a speculative statement, I'm sure you understand.

On the second point, even if the material were produced in MAPLE, it could still be processed in the old NRU processing facility, temporarily, until the MAPLE thing was finished. It's quite possible to do that.

That's all I know.

Mrs. Cheryl Gallant: If everything went perfectly, with zero further technical difficulty, how long would it take to produce the amount of medical radioisotopes required to supply Canada?

Dr. Harold J. Smith: It would take 15 days, if given approval to start operating. That's how long it takes to breed in what you need. It takes about 15 days.

Mrs. Cheryl Gallant: But how long before we get it commissioned?

Dr. Harold J. Smith: That is a strong function of the regulator. I'm saying that from personal efforts you could put the people and the required behaviour back in in a year or a year and a half. But will the regulator let you go? I don't know. I have no control over that, no idea.

Mrs. Cheryl Gallant: That's a fair statement.

The Chair: Thank you, Ms. Gallant. Your time is up.

We'll go to Madame Brunelle, for up to five minutes.

[*Translation*]

Ms. Paule Brunelle: As concerns the MAPLE reactors, there is the issue of cost. We have been told that there are minor technical problems. There are also time and money problems. As a citizen, I wonder whether we can afford to do without isotopes, given the problems we will be experiencing as a result of the aging population. Do we have the means to cover costs that may balloon out of control if we do indeed opt for the international solution? Can we be sure of the supply?

It would seem to me, according to what I have observed, that the decision to go ahead or not with the MAPLE reactors is a political one. In the end, it is up to us, the politicians—and this is not a question I am asking you, it is a statement—to determine whether these reactors can be recommissioned.

Mr. Nathwani, you said that you suggested amending the Nuclear Safety and Control Act. According to what Mr. Smith has just said, it would appear that nuclear safety authorization is complex. And you say that this must provide a net benefit for Canada. What do you mean by that?

Mr. Koclas, do you have an opinion on that as well?

[*English*]

Dr. Jean Koclas: Maybe to answer so everyone understands, since we are the producers of molybdenum-99 and technetium-99m, we can serve ourselves first. When we are no longer producers, we will have to go on the international market.

Our neighbours, the Americans, rely on us to feed them with technetium. They will no longer have us to supply them, so what can you expect? You will probably be faced with a spot market on technetium, and our American friends will take everything at prices we will probably not be able to afford—or very few of us will be able to afford—and our health system will collapse, essentially. This is one aspect.

The other aspect I would like to comment on is the regulator. It is a fact that throughout the world the research reactors are subjected to the same regulations as the large power reactors. Canada is not different from other countries in that respect.

It is also my point of view that certainly we can operate a reactor with a positive coefficient of reactivitiy. Certainly the safety of the installation relies not on performing accidents in the core and establishing the failure probabilities; the safety case is based on simulations and is consigned in a safety report. If you cannot predict how a simple coefficient is behaving, you probably cannot assure the public that your installation is working as it should. And you are saying to the public, “Here is the risk; it is consigned in my safety report”. But I cannot be certain my power coefficient is right, so can I be sure my complex safety analysis is right or not? These are all done on a calculation basis. They are not done on commissioning tests.

So I concur with the point of view of the safety commission that it is not too rigid to operate the MAPLE. I think the regulator is concerned that because you cannot correctly predict these coefficients, you cannot properly predict how the reactor is going to behave in even more complicated situations involving the coupling together of all these effects.

I do not think in this case we were facing too rigid a regulator. We are facing the simple fact that there are physical effects we are not able to predict at this time, so there are probably other effects we cannot be sure we will be simulating for the safety analysis, which has an impact on how the safety systems work and how the regulating systems also work.

● (1710)

The Chair: Merci, Madame Brunelle. Your time is up.

We'll go now to Mr. Anderson for up to five minutes.

Mr. David Anderson: I actually would like to follow up on that point, then, because earlier you had talked about wanting regulatory inflexibility removed. Did I hear that wrong? I think both you and Mr. Nathwani said you wanted the regulatory inflexibility removed. Mr. Nathwani said the only thing holding us up is a small technical problem. But what you've just said seems to me to be the opposite side, and I would say a more reasonable opinion to take: if you can't get reliable predictions at one area, how do you know you have them at any other area?

Dr. Jean Koclas: I have not taken the position that we are facing rigid regulatory authority.

There are many different issues. Perhaps the regulatory authority is following very closely what is happening with the operation of the MAPLE reactor. Perhaps it is a little bit more than what AECL has been used to. I think if we have a positive coefficient of reactivity, fine. If we can predict that positive value, we can do the safety analysis and be happy with it, because we can predict these coefficients.

It is not the fact that the coefficient is positive or negative that is a problem. The problem is that you cannot calculate it. As long as you're able to calculate it, calculate its positive value, if you want, or modify it to force it to have a negative value that you can also predict, then you can go and make your safety case and have a full reactor operating under the normal regulations that all operators have to face in this country.

● (1715)

Mr. David Anderson: The issue, as far as you're concerned, is the lack of predictability between the calculations and what was actually happening. That's what we need to be concerned about.

Dr. Jean Koclas: Yes.

Mr. David Anderson: Thank you.

While we're talking about the regulator, do any of you know when the regulator would have known that there were problems, particularly between those calculations and the reality? What year did they step in and say that there were issues there that needed to be addressed?

Dr. Harold J. Smith: The regulator was present at almost every test we did. They were in the control room. There was no delay.

Mr. David Anderson: Would that have started back in the early 2000s, before 2003, when you said that the positive coefficient rose?

Dr. Harold J. Smith: It was in 2000. We started commissioning in February 2000, and the regulator was present for almost every test we did in the next two years.

Mr. David Anderson: That's interesting, because in testimony the other day I think the head of the CNSC said that she wasn't aware of any issues until 2006. She was unaware of any issues other than some construction and maintenance issues and those kinds of things. So that's very interesting.

I really want to address this issue of the fact that we have one thing that's supposed to happen and something else that actually does happen. It's easy for everybody to say that we need to get these things up and running and we need everything to be operating here, but somebody has to take responsibility for that, and that is the regulator. It would certainly be put back to the government by the opposition, I'm sure, if there were a problem. All four of you today have said that we need to get the MAPLEs up and running, but nobody is willing to address the fact that we have the issue of unpredictability and the fact that what this regulator has suggested needs to happen isn't the same thing that's happening when it's actually operating. If anybody has any suggestions about that, I'd be glad to listen to them.

The Chair: Dr. Nathwani.

Dr. Jatin Nathwani: If I might, I'll comment on the question of regulatory inflexibility and net benefit, which was the question raised, and I'll help answer what you've just raised as well.

Let me make the point that the question of regulatory inflexibility is a bit of a historical thing. It happened then. Things have certainly changed in recent times with the way CNSC operates, as best as I'm able to tell.

What we got cornered into in the 2002 to 2006-08 timeframe was trying to prove a philosophical negative: Tell me something doesn't exist; I don't like positive reactivity, so try to prove to me that it doesn't exist. That's where the whole simulation question got stuck.

Mr. David Anderson: It just seems that our information has been that actually it was predicted that there wouldn't be one, and then there was one. That was really the issue, not the fact that there could or couldn't be, although that may be an issue with the regulator, as well. The real issue was the divergence of the two things.

I would like to go to something else.

Dr. Smith, you talked about the HANARO fuel being similar and about being able to switch over, basically, that reactor to the MAPLE. We had testimony earlier that the main driver fuel is similar, but it certainly would not be a simple process to change a reactor like that over to create the isotopes. You would have to do a new analysis of fuel and those kinds of things. I'm just wondering whether you have any comment on that. Dr. Waddington seemed to think that this would be a long process. There would have to be a lot of analysis done in order to switch that over. Is that accurate?

The Chair: Just give us a short answer, please.

Dr. Harold J. Smith: You have to do a safety case with the HANARO fuel. I don't see any impediment at the moment to sticking HANARO bundles in there. They're about ten centimetres longer than the MAPLE bundles. But you'd have to produce a safety case with that fuel.

Mr. David Anderson: How long does that take? Is it years or months? I would assume it would be years.

Dr. Harold J. Smith: I would say a year. You have people who are pretty experienced. It's a different fuel, and we'd have to start at the beginning, but I'd guess it could be done in a year.

The Chair: We have Mr. Tonks, and then we have to have a brief discussion: Mr. Cullen has indicated he wants to bring up an issue.

Mr. Alan Tonks (York South—Weston, Lib.): Thank you.

You all seem to be in agreement that our strategic technology decision to occupy the international market was correct. You all seem to say that we should ramp up the NRU and try to fill a void that would be in place for the reactivation of the MAPLEs. And you all seem to be in agreement that the technology and the resources, with some tuning of the statutory legislative regime, would produce some value-added results.

At the last meeting we were told by the people at McMaster University that when fully activated the McMaster system could fill four times the Canadian need for isotopes. Do you think the fourth part of the strategy should be to accelerate that option while we do the other things you've suggested? Is this a viable strategy, given that we want to continue to meet our international responsibilities but that we may have to make some temporary adjustments to satisfy Canadian medical needs?

● (1720)

Dr. Jatin Nathwani: Given how critical the situation is, the multi-pronged strategy is perhaps the best and most defensible approach.

Mr. Alan Tonks: Would anyone else like to take a crack at it?

The Chair: Is there someone else who'd like to answer that?

Dr. Harold J. Smith: I agree with the multi-pronged approach. Don't cherry pick—give it buckshot.

Mr. Alan Tonks: Do any of you have additional information about McMaster and the TRIUMF, with emphasis on the McMaster technology?

Dr. Daniel Meneley: With respect to the statements made by Dr. Smith and McMaster, I think they are coincident. With a ten-megawatt MAPLE you could do this much, and with a five-megawatt McMaster reactor you could do that much. I think that fits pretty well.

I'd like to sneak in a point on predictability. Dr. Koclas was comparing apples and oranges. The extremely difficult power coefficient prediction is way beyond—

Mr. Alan Tonks: I'm sorry to interrupt you, but I really want Dr. Nathwani. He was going to reply to the McMaster question. That's another factor in resolving a crisis.

The Chair: Your time is more than up, Mr. Tonks. I'd love to hear both answers, but we have to go.

Mr. Calandra.

Mr. Paul Calandra (Oak Ridges—Markham, CPC): Mr. Smith, are you saying that if AECL were to call you tomorrow, within 15 days you could have enough medical isotopes for Canada?

Dr. Harold J. Smith: No, that's not what I said.

Mr. Paul Calandra: Sorry, I thought that's what I heard you say.

How long would it take, then?

Dr. Harold J. Smith: No, it's 15 days to—

Mr. Paul Calandra: How long would it take, roughly, to meet the current regulatory demand to have the MAPLEs up and running?

Dr. Harold J. Smith: As I said, I think we'd need a year to get the people back. I mean, it's not just putting the machine back; the people have to be re-certified to run it. You're looking at about a year for the timeframe.

Mr. Paul Calandra: About a year to meet the current regulatory framework?

Dr. Harold J. Smith: Yes. We could put in place any plans while the operators are being re-certified. That assumes that you can get them to come back to the project.

Mr. Paul Calandra: So it would take a year to get everybody back, and then it would take you a certain amount of time to make the calculations and to make sure the reactor actually worked. Then you'd have to start producing medical isotopes after that. Would it be two years, then, presumably?

Dr. Harold J. Smith: Yes. There's some parallelism here. Some things can be done at the same time—

Mr. Paul Calandra: But ultimately—

Dr. Harold J. Smith: —and two years, I think, is an outside—

● (1725)

Mr. Paul Calandra: I'm sorry for interrupting. I just have three minutes, so that's why I'm going fast. I apologize. I'm not trying to be rude.

Dr. Harold J. Smith: Okay.

Mr. Paul Calandra: So we're talking about two years for that.

Tell me, what is meant by “some of the emergency shut-off rods failed to deploy”?

Dr. Harold J. Smith: It meant that they couldn't poise them. It didn't mean that these couldn't fall in; they had some friction that was stopping it from being poised. It was a fail-safe situation.

Mr. Paul Calandra: What's the ultimate danger of a reactor not working, of all the safety features not working?

Dr. Harold J. Smith: That's not a 25-words-or-less kind of answer. Sorry. There are many different scenarios. It depends on what your accident is.

Mr. Paul Calandra: In essence, it's not good.

Dr. Harold J. Smith: It's not what you want, for sure, but that's why there are three systems in MAPLE.

Mr. Paul Calandra: Let me ask you another question.

The Chair: Mr. Calandra, you have about 15 seconds left.

Mr. Paul Calandra: I would assume that none of you are suggesting, then, that we reduce the safety. As somebody who lives quite close to Darlington, I remind some of the people that there is a $38 billion unfunded liability with Ontario Hydro. None of you are suggesting that we reduce safety in order to get this project to work.

Dr. Harold J. Smith: Absolutely not.

Dr. Daniel Meneley: Absolutely not.

Mr. Paul Calandra: I appreciate your time. Thank you.

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

Thank you all very much for appearing here today. It's been a very interesting discussion with interesting information.

If I may, I will just ask the two of you who are here to leave the table. We will suspend for 30 seconds, and then Mr. Cullen has some business he'd like to bring before the committee, which we'll have to deal with very briefly in camera.

[*Proceedings continue in camera*]

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