Canadian Nuclear Safety Commission

Public meeting

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Public Hearing Room
14th floor
280 Slater Street
Ottawa, Ontario

Commission Members present

Dr. Michael Binder
Mr. Dan Tolgyesi
Dr. Sandy McEwan
Ms Rumina Velshi
Mr. André Harvey

Secretary:

Mr. Marc Leblanc

General Counsel:

Ms Lisa Thiele

Commission canadienne de sûreté nucléaire

Réunion publique

Le 2 octobre 2014

Salle des audiences publiques
14e étage
280, rue Slater
Ottawa (Ontario)

Commissaires présents

M. Michael Binder
M. Dan Tolgyesi
Dr Sandy McEwan
Mme Rumina Velshi
M. André Harvey

Secrétaire:

M. Marc Leblanc

Avocate générale :

Me Lisa Thiele

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Ottawa, Ontario / Ottawa (Ontario)

--- Upon commencing on Thursday, October 2, 2014 at 9:01 a.m. / L'audience débute le jeudi 2 octobre 2014 à 9 h 01

M. LEBLANC : Bonjour, Mesdames et Messieurs. Bienvenue à la continuation de la réunion publique de la Commission canadienne de sûreté nucléaire.

We have simultaneous translation. Please keep the pace of speech relatively slow so that the translators have a chance to keep up.

Des appareils de traduction sont disponibles à la réception. La version française est au poste 3 and the English version is on channel 2.

I would ask that you please identify yourself before speaking so that the transcripts are as complete and clear as possible. Those transcripts will be available on the website of the Commission later next week.

I would also like to note that this proceeding is being video webcast live and that archives of these proceedings will be available on our website for a three-month period after the closure of the proceedings.

I would also ask you to please silence your cell phones and other electronic devices.

Monsieur Binder, président et premier dirigeant de la CCSN, va présider la réunion publique d'aujourd'hui.

President Binder...?

LE PRÉSIDENT : Merci, Marc, and good morning.

Good morning and welcome to the continuation of the meeting of the Canadian Nuclear Safety Commission.

Mon nom est Michael Binder. Je suis le président de la Commission canadienne de sûreté nucléaire.

Je vous souhaite la bienvenue and welcome to all of you joining us via the webcast.

I would like to introduce the Members of the Commission.

On my right is Monsieur Dan Tolgyesi; to my left is Dr. Sandy McEwan, Ms Rumina Velshi and Monsieur André Harvey.

We have heard from our Secretary Marc Leblanc and we also have with us here today at the podium Ms Lisa Thiele.

MR. LEBLANC: The *Nuclear Safety and*

Control Act authorizes the Commission to hold meetings for the conduct of its business.

The agenda was approved yesterday. Please refer to the agenda 14-M61A for the complete list of items to be presented today.

Mr. President...?

THE PRESIDENT: Okay. The first item for today is the status report on power reactors, which is under CMD 14-M63.

Dr. Rzentkowski, I think you are going to lead the charge here. Please proceed.

***CMD 14-M63**

Oral presentation by CNSC staff

DR. RZENTKOWSKI: That is correct. Thank you very much.

Good morning, Mr. President and Members of the Commission.

I have no further updates on the status report on power reactors presented as CMD 14-M63.

I would like, however, to emphasize that this report demonstrates that nuclear power plants in Canada continued stable full power operations throughout late summer. Please note that out of 19 reactor units, only Pickering Unit 7 is presently shut down for a plant maintenance outage.

Also, I would like to say that in response to the Commission's requests CNSC staff prepared a briefing note with a small information on issues related to fuelling machines.

CNSC staff concluded that the safe operation of the CANDU fleet is not significantly affected when fuelling machines become unavailable or unproductive. The units can be safely de-rated or shut down should fuelling be unable to be maintained -- operation of the reactors at high power. Lack of fuelling results in an economic penalty for the station, but it is not a safety concern.

This concludes our report. CNSC staff are now available to answer any questions the Commission may have. Thank you.

THE PRESIDENT: Thank you.

Questions...? Monsieur Harvey...?

MEMBER HARVEY: Just maybe a comment about the document on the fuelling machines. I wasn't sure at the beginning of the purpose of giving us a document, if it was to make us afraid or to help us. But just looking at the figures, so we see that it is very complex.

But thank you very much because it is a good presentation. And despite the fact that there are some black points, I have to work on it. That's a nice document. Thank you very much.

DR. RZENTKOWSKI: Thank you for this comment. And my apologies. We didn't have any better figures demonstrating the design of the fuelling machines, but we tried to explain, to the extent that we could, their operation and the impact on the safe reactor operation. So this was the intent behind this briefing note.

MEMBER HARVEY: The main point I was interested in, how you connect and disconnect the head, because you change the head from one place to another one. So there are so many cables and things like that it's not a simple switch.

DR. RZENTKOWSKI: No, it's an extremely complex piece of machinery and everything has to be done under the high pressure as well, because once connected the fuelling machine forms a part of the pressure boundary, at approximately 12 megapascals.

But if the Commission Members are interested, we have a Pickering Fuel Handling Senior Manager from OPG connected by phone and he can provide more information about the operational aspects of managing fuelling machines and managing fuelling of CANDU units.

MEMBER HARVEY: Yeah, that may be helpful to at least to have a broad presentation.

THE PRESIDENT: Go ahead. OPG online?

MR. JOHNSTON: Yes. For the record it's Chris Johnston, Senior Fuel Handling Manager at Pickering Nuclear online.

THE PRESIDENT: Okay. Do you want to give us a little overview of some of the issues associated with the machine?

MR. JOHNSTON: Well, so here at the Pickering site we do have -- we have had some issues around fuel handling reliability, so we have invested in that area for our site. We have a very comprehensive fuel handling reliability plant, improved reliability machines and we are currently executing that plan.

I know the issue came up previously with the issue we had on Unit 8 earlier this year. We did a root cause analysis on that and determined what the causes were of that failure and have fixed those problems.

So we currently state this week we have -- all fuel handling is available and all units are at high power, other than Unit 7 which is in a planned outage right now.

THE PRESIDENT: Ms Velshi...?

MEMBER VELSHI: So first of all, thank you and compliments on the reactor status report. Really great news.

So on the briefing note on fuel handling -- and I know this was prepared in 2011 -- I wondered if there were any changes in trends. There were some specific questions perhaps that you can clarify.

One was it said this was for a few of the stations, not all the stations, and I wondered if the trend was different from some of the other stations.

A challenge that had been presented was on the lack of qualified panel operators and I wondered how much of a role did they play on the unavailability or the unproductiveness of the fuelling machines.

And the third part was the briefing notes seem to imply that the target of 80 percent availability was met even though it was a challenge, and we have just heard from Pickering that they have completed the root cause. Maybe a bit more insight on what the root causes were that maybe didn't allow the 80 percent target to have been met?

MR. JOHNSTON: Okay. So it's Chris Johnston, Senior Fuel Handling Manager at Pickering.

So the first question around reliability issues from site to site, I guess each site has unique differences around fuel handling equipment. And what I can speak to is what we have identified at our site is the kind of common cause of fuel handling failures.

We have a list of the top five issues that causes fuel handling unreliability and that is part of our reliability plan that we are working down to improve beyond the 80 percent reliability. So that's all documented in that reliability plan and we are midway through executing that. We have about two years left to finish that plan off.

As far as the qualified resources, we have challenge in that area. We are adequately staffed and qualified right now.

We also have implemented a reactivity management planning meeting and every -- three times a week we sit down with fuel handling operations staff and look at the needs of the units for fuelling, their resources, as well as the critical work that needs to get executed where we can't fuel. So we kind of arrange all the fuelling, ongoing preventive maintenance, and make it a balance. We plan ahead and execute that plan.

So that's a new initiative at our site and it is going quite well where we talk about fuelling windows. We are hitting most of our fuelling windows to fuel when the unit needs the fuel and getting the preventive maintenance done when it needs to be done.

And then the third point around availability, we have met that 80 percent availability target and our reliability plans are focused on getting much higher than that. Just based on the needs of our units, and especially on the Pickering 1 and 4 units, there is not a lot of time we can leave a unit without fuelling it, so we are targeting close to 100 percent availability on those, on our units here at Pickering.

MEMBER VELSHI: Thank you.

THE PRESIDENT: You mentioned five. Can you give me the top three that caused you all the likely to stop operations?

MR. JOHNSTON: Okay. So the very top

issue we have is -- it's a fuelling machine ram it's called -- and that's the piece of fuelling machine that latches onto the channel and manipulates the fuel.

So that's the one thing, the first thing that will cause us to become unreliable. So we've got plans in place to get a significant amount of spare rams available, to be proactively replacing them before they get to their -- let's call it end-of-life. And a certain number of channels we know will start to see failure, so we want to plan replacements before they get there.

The next item that hurts us a lot is called separators. So we have fuelling machine separators that are also an integral part of the fuelling machine. And that's the top two.

The third one is basically a spare parts list of parts that we need to have readily available to be able to plan our preventative maintenance on the equipment.

So that would be the top three.

THE PRESIDENT: Okay, thank you.

Any other questions? Monsieur Tolgyesi...?

MEMBER TOLGYESI: You were talking about a spare parts list. What does it mean, that you don't have spare parts right close to the fuelling machine or you don't have spare parts in a warehouse, or what's the problem there?

MR. JOHNSTON: So obsolescence is a problem and what we have is -- yeah. So there's a lot of parts that go onto a fuelling machine and there are some that are hard to get.

So the parts initiative is looking at, say, a valve called a Marotta valve. They are not built anymore, so looking for a vendor out there that can provide us with the valve that meets the same specifications as the original and have adequate stock in the warehouse to replace those.

So lots of work going on in that area. Part of our reliability project focuses on that, getting those spare parts ready so we can be more preventative and maintain a better reliability of the fuelling machines.

THE PRESIDENT: Okay. Anything on the nuclear power plant itself? Any questions on that?

I have one. On Bruce B, the comment that they are now allowed to operate beyond 210,000 EFPH to 245,000, what I would like to know is what would be the number in February and April of 2015?

DR. RZENTKOWSKI: For the time being

we don't have the number clearly specified in the license application. So we will continue discussion with Bruce Power because, as you know, behind defining the acceptability target for the pressure tube operation is a very long and very complex research project.

So we are still awaiting further results from this research project which will confirm if in fact pressure tubes can operate beyond 245,000 effective full power hours. So this is still the matter under debate between the CNSC staff and the licensee. For the time being we are satisfied with the number of 245,000.

THE PRESIDENT: My question is different. What will be -- how many hours would they be over 210,000 in April 2015?

DR. RZENTKOWSKI: Sorry, I missed that. Let me calculate.

They operate at approximately 90 percent. There is 24 --

--- Pause

THE PRESIDENT: I can see a familiar face about to come and --

DR. RZENTKOWSKI: About 1,500 to 2,000. I think this would be the number.

THE PRESIDENT: Well, the first question, are they really going to be over 210,000 and, if so, what will it be?

MR. SAUNDERS: Yeah. Frank Saunders, for the record.

Unit 6 will actually just be approximately at 210,000. We included that one only because there is a period of time for you to make a decision and issue it. So it was just close enough to include in there.

Unit 5 will have about four months. You are typically in the 7,000 to 8,000 a year, so you will add a third of that, roughly, so another couple of thousand, so somewhere like 212,000 or that ballpark.

THE PRESIDENT: Is that the same Unit 5 that is celebrating this --

MR. SAUNDERS: The same Unit 5, yes.

THE PRESIDENT: What is so special about Unit 5? Why is it operating so efficiently?

MR. SAUNDERS: Well, I think, actually if you look at the Bruce B units, you will see that they all have operated in that range and they continue to do. Unit 5 is actually not the longest unit onsite. So the Bruce B units have a history of very long runs with error-free and it's just really just, I think, good solid maintenance programs and other things that support it.

You know, Bruce A coming from the layup and so forth, you are expecting that you are going to find more issues and more problems on Bruce A for a few years until you have worked through all of that. I expect Bruce A to get there fairly soon as well.

THE PRESIDENT: Okay. Thank you.

Any other?

Okay, thank you. Thank you very much.

The next item on the agenda is on the overview of the 6th Review Meeting of the Convention on Nuclear Safety, as outlined in CMD 14-M64 and 14-M64.A.

I understand that, Dr. Rzentkowski, you are going to do the presentation here?

***CMD 14-M64 / CMD 14-M64.A**

Oral presentation by CNSC staff

DR. RZENTKOWSKI: That's correct.

Mr. President and Members of the Commission, for the record I am Greg Rzentkowski, the Director General of the Directorate of Power Reactor

Regulation.

I am here today with Mr. Ramzi Jammal, Executive Vice President and Chief Regulatory Operations Officer and the Head of the Canadian Delegation to the Convention, to present an overview of Canada's and the CNSC's participation in the 6th Review Meeting of the Convention on Nuclear Safety.

I am also joined by CNSC staff who were members of the Canadian delegation to the 6th Review Meeting.

We don't have the slides up yet, sorry. I was very quick from the starting block, I see.

--- Pause

DR. RZENTKOWSKI: That's not the one. That's not the one.

That's the one. Okay, go to number two. Thank you.

So we are on slide number 2.

The Convention on Nuclear Safety was adopted in 1994 in response to the Chernobyl accident. Its aim is to legally commit participating states operating nuclear power plants to maintain a high level of safety by setting international benchmarks to which they would adhere. The CNS has three specific objectives:

First, to achieve and maintain a high level of nuclear safety worldwide through the enhancements of national measures and international cooperation, including safety-related technical cooperation.

Second, to establish and maintain effective defences in nuclear installations against potential radiological hazards in order to protect individuals, society and the environment from harmful effects of ionizing radiation from such installations.

Third, to prevent accidents with radiological consequences and should they occur to mitigate such consequences.

Seventy-five (75) states and one regional organization have become contracting parties to the CNS. Of the 76 contracting parties, 33 have nuclear power plants. Each of the contracting parties with NPPs is represented by the nuclear regulatory body of that country or organization.

The CNS was originally conceived as an incentive instrument. It is not designed to ensure fulfilment of obligations by contracting parties through control and sanctions. It is based on a commonly shared interest to achieve higher levels of safety which are developed and promoted through regular review meetings.

There is no inherent enforcement mechanism with the CNS to help ensure ongoing compliance of the contracting parties with its articles. Nevertheless, Canada is working hard with like-minded contracting parties to ensure that the CNS is a meaningful and effective peer review that aims to improve global nuclear safety.

The CNS obligations are detailed in the Articles of the Convention. The CNS sets down three main obligations on contracting parties.

First, they must prepare and submit a national report for peer review and to respond to the written questions submitted to them.

Second, every three years they must attend the review meetings.

Third, they must participate actively in the review process in order to allow other contracting parties to discuss the national report and seek further clarification.

The CNS leads Canada's work in collaboration with nuclear industry stakeholders and other federal agencies to meet the obligations of the CNS and encourages other contracting parties to do the same.

I would now like to call upon Mr. Peter Corcoran, Director, Licensing Support and Compliance Monitoring Divisions to continue this presentation.

Peter?

MR. CORCORAN: Good morning, Mr. President and Members of the Commission.

Participation on the in the Convention on Nuclear Safety's Sixth Review Cycle and attendance at the Review Meeting were adequate with a large number of contracting parties being actively engaged in the process and represented at the meetings and presentations.

Most countries submitted national reports, reviewed other countries' reports, submitted written questions and responded to those questions.

However, it is worth mentioning that 11 contracting parties did not submit a national report to the Sixth Review Meeting.

Twenty-two other contracting parties submitted a report after the deadline. And by the end of the Review Meeting only 19 contracting parties, including Canada, had posted their reports to the IAEA website.

Thirty-four contracting parties did not post any written questions on other national reports. And by the end of the Review Meeting only four contracting parties, including Canada, had posted their responses to written questions they had received on the IAEA website.

Seven contracting parties did not attend the Review Meeting, including emerging nuclear countries such as Bangladesh and Saudi Arabia.

This degree of non-compliance with the CNS obligations was indicated in the summary report, and contracting parties were reminded at the end of the Review Meeting of their obligations to the Convention on Nuclear Safety.

In preparation for the Sixth Review Meeting, Canada wrote its national report detailing how it implemented its obligations under the CNS Articles. The report was then submitted for peer review by other countries.

From the feedback provided by the other contracting parties and by members of the Canadian delegation, the report was considered both comprehensive and exemplary. To streamline the review work, the contracting parties were divided into six country groups. Canada reviewed all the submitted national reports in its country group.

In addition, Canada reviewed the reports of the G8 countries, the CANDU countries, and of other countries of special interest such as countries with ties to Canada or with a developing nuclear industry.

Based on those reviews, Canada posted a total of 235 written questions. Questions from Canada covered all the articles and general topics such as the status of response to lessons learned from Fukushima, the status of follow-up to peer review mission findings, and the public posting of event reports and CNS reports.

From the peer review Canada received 176 written questions and comments from 21 contracting parties. These covered all of the CNS articles.

Listed above on the slide, you can see that these were largely clustered in areas of regulatory framework, regulatory body, assessment in verification, emergency preparedness, as well as some more general areas concerning Fukushima follow-up, openness and transparency, as well as the closure of the G-2 Plant at Gentilly and the OPG new build.

The Sixth Review Meeting was held from March 24 to April 4, 2014 at the IAEA headquarters in Vienna. The CNSC lead the Canadian delegation with Executive Vice-President Ramzi Jammal as the Head of Delegation and Greg Rzentkowski as the Alternate Head.

Brian Gracie was an officer serving as the Coordinator for Country Group 4. Other CNSC Staff members in the delegation included Albert Thibert, Jean-Baptiste Robert, Phil Webster, Gary Schwarz, Luc Seguin and myself.

The Canadian delegation also included the following representatives of the Canadian nuclear industry.

And I might ask them just to identify themselves as their name comes out: Fred Dermarkar, Chief Executive Officer of the CANDU Owners Group; Maury Burton, Manager of the Regulatory Affairs representing Bruce Power; Robin Manley, Manager of Regulatory Affairs representing Ontario Power Generation; Nico Angelitas, Manager of the Licensing and Safety Concepts representing CANDU Energy; Dezi Yang, Vice-President of Engineering representing CANDU Energy Inc.; and John Froats, Resident Engineer at the University of Ontario Institute of Technology.

I will mention here that John Froats was also an officer of the Review Meeting serving as Chair for Country Group 2.

Industry representatives and CNSC Staff worked professionally and cooperatively to produce excellent results in all aspects of work associated with the Sixth Review Meeting.

During Canada's review session the presentation, which reflected the input and priorities of all stakeholders, addressed the highlights of Canada's national report.

The implementation of lessons learned from Fukushima, the engagement on the IAEA action plan on nuclear safety, the highlights of responses to written questions on Canada's report, planned activities for continuous improvement, as well as CNS challenges from the previous review meeting and good practices for Canada.

The presentation concluded with a list of recommendations that touched on how all contracting parties could better ensure that responsibilities for safety are upheld and seen to be upheld.

A robust discussion period followed in which interested contracting parties engaged Canada in a further review of its report. The responses to written questions and the presentation.

Overall, the assessment of Canada's presentation and response to questions was extremely positive based on observations shared by the members, officers and other observers.

Canadian delegation members participated actively in many other country review sessions and side events within Canada's group and in other groups where Canada had reviewed the reports of those contracting parties.

As well, Canadian delegation members encouraged other contracting parties to confirm that their convention reports and national reports had been made publicly available, if they had not been already.

In some cases, Canada challenged contracting parties to make publicly available the answers to the questions they had received and further challenged contracting parties to make their IRRS mission findings public and to reflect those findings as well as follow-up actions in their national reports.

Canada also met with representatives of CANDU countries during the first week of the review meeting and attended their presentations as a show of support.

Following Canada's presentation it was concluded that the main challenges for Canada from the previous review meeting had been addressed. Taking into account all observations of the reviewers, the end result for Canada for the Sixth Review Meeting was list of six new challenges.

These were: to complete the implementation of the integration action plan in response to Fukushima accident; to enhance the probabilistic safety analysis to consider multi-unit design structure and irradiated fuel bays; to establish guidelines for the return of evacuees post-accident and to confirm the public acceptability of those; to invite an IAEA emergency preparedness review or EPREV mission to

Canada; to update emergency operational interventional guidelines and protective measures for the public during and following major events and radiological events; and finally, to develop a transition approach to decommissioning.

The peer reviewers also identified two good practices for Canada. These were the degree of openness, transparency and stakeholder involvement in this country, and the level of review of all elements of the regulatory system performed after the Fukushima accident, including two independent external reviews of those activities and the extensive public consultation.

These were largely a reflection of the good practices that Canada had self-identified in its own presentation. However, the Canadian nuclear power plant licensees' declaration, "to practically eliminate potential for societal disruption due to a nuclear incident" was also incorporated in the good practices of all the other country group officers.

Canada's country group chair noted that although the licensees had taken action similar to those taken by other contracting parties, their voluntary declaration to aim for a higher safety bar represented an important advance for nuclear safety and was unique in the international community.

During the Sixth Review Meeting there was an additional meeting outside of the CNS where various organizations presented their progress on addressing lessons learned from the accident at Fukushima Daiichi.

The CNSC delivered a presentation covering two main topics; the inherent robustness of the CANDU design with respect to severe accidents, and the status of Fukushima follow-up actions in CANDU countries.

The presentation described various CANDU features such as natural circulation and ample and diverse supplies of cooling water. The presentation provided details on safety improvements that strengthen defence in-depth and enhance emergency response in order to respectively reduce the risk of a nuclear accident to as low as practicable and to effectively protect the public in the remote event that such an accident should occur.

To conclude the presentation, CNSC Staff told the audience that the measures put in place at CANDU stations worldwide following the Fukushima accident ensure significant enhanced public protection against potential severe accidents.

At the Sixth Review Meeting the contracting parties agreed to several improvements to IAEA guidance documents that will help promote better national reports, a more effective review process, greater openness and transparency and improved compliance with CNS obligations.

The contracting parties also proposed certain follow-up activities in support of these resolutions and agreed to a date for the Seventh Review Meeting in 2017.

In order to address noncompliance with the CNS obligations contracting parties were reminded in the President's summary report of their obligations, including attendance and active participate at the review meetings.

The President, Monsieur Lacoste of France, agreed to send a standard letter to each contracting party highlighting their duties and responsibilities to the CNS and inviting them to rededicate themselves to full participation in the review process.

At the Sixth Review Meeting Switzerland submitted a proposal to amend the convention. The amendment proposed adding a new paragraph to the CNS as follows:

"Nuclear power plants shall be designed and constructed with the objectives of preventing accidents. And, should an accident occur, mitigating its effects and avoiding releases of radionuclides causing long-term off-site contamination. In order to identify and implement appropriate safety improvements, these objectives shall also be applied at existing plants." (As Read)

This proposal was not adopted by consensus in the plenary. The contracting parties did, however, decide in a formal vote to hold a diplomatic conference to consider the proposed amendment and then requested the IAEA Director General to prepare a set of rules and procedures for organizing the diplomatic conference.

A consultation meeting open to all contracting parties will be held in October 2014 to exchange views and prepare for the adoption of the rules of procedure.

Canada supports the intent of the proposed amendment. The diplomatic conference is scheduled for February 9 to 13, 2015.

I will now return the presentation to Dr. Greg Rzentkowski to summarize and provide the path forward.

DR. RZENTKOWSKI: The activities leading up to the CNS Review Meeting provide valuable self-assessment and learning exercises.

The review meetings are good opportunities for the contracting parties to reflect on past achievements in the area of nuclear safety, learn from each other's experience and identify areas for improvement as well as emerging issues.

The identification of specific challenges for the next review meeting and good practices helps summarize the results, track progress and promote learning.

The contracting parties of the CNS

have embraced the resolutions to improve future review meetings by amending the CNS guidance documents, holding a diplomatic conference to consider the amendment to limit the consequences of a potential severe accident and helping address noncompliance with the CNS obligations among certain contracting parties.

For Canada specifically, the Sixth Review Meeting provided an opportunity to reinforce this country's commitments to global nuclear safety and to encourage other contracting parties to follow.

It was an occasion to demonstrate leadership in both CANDU nuclear safety and regulation of Canadian NPPs. It is important to note that Canada continues to lead among contracting parties, contributing significantly to the review process, and leading by example in terms of openness and transparency.

In preparation for the Seventh Review Meeting, and in the near-term for the diplomatic conference, CNSC has begun assembling a new team, which will include industry stakeholders.

CNSC will actively engage in

Canada's efforts to amend the CNS and will assist the permanent mission in Vienna for the Diplomatic Conference in February 2015.

Drafting of Canada's national report to the Seventh Review Meeting will follow the approved revised guidance for national reports.

CNSC staff will use the key messages approach to develop both the national report and the presentation and will focus on the progress related to the six new challenges for Canada and the CNSC.

Although we are at the beginning of the next CNS review cycle, nevertheless we can confidently provide the Commission a status update on the current challenges imposed on Canada by the CNS officers during the Sixth Review Meeting.

The current status of the work to address those challenges is as follows.

With respect to completing the implementation of the Fukushima integrated action plan, the plan is mostly completed and the remaining long-term actions are underway.

With respect to enhancing PSA to consider multi units and irradiated fuel bays, these enhancements have been completed and the new CNSC regulatory documents with updated requirements will be introduced in the NPP operating licences.

With respect to establishing guidelines for post-accident return and evacuees and confirming public acceptability, an early draft of these recommendations was prepared by CNSC Staff and will be presented to CNSC management later this year.

With respect to inviting an IAEA emergency preparedness mission, Health Canada is completing the current series of exercises to validate the Federal Nuclear Emergency Plan. A request for an emergency preparedness review mission will then be formally made to the IAEA.

With respect to updating emergency and operational interventional guidelines and protective measures for the public for major radiological events, a draft has been prepared by Health Canada to update the Canadian guidelines for protective actions during a nuclear emergency.

The draft addresses lessons learned from the Fukushima accident and aligns with new recommendations of the ICRP and IAEA.

The first round of consultation is complete and a second round, including public consultation, will start at the end of 2014.

With respect to developing the transition to decommissioning approach, efforts are underway to determine the path forward for the licensing of Gentilly-2, which is transitioning from operating units to decommissioning units.

In doing so, CNSC Staff considers lessons learned from safe storage of Pickering Unit 2 and Unit 3.

Mr. President and Members of the Commission, this concludes our presentation on the role of Canada and the CNSC in the Convention on Nuclear Safety and the Sixth Review Meeting.

I would like now to turn the presentation over to Mr. Ramzi Jammal for concluding remarks.

MR. JAMMAL: Thank you, Dr. Rzentkowski.

I would just like to inform the Commission that to date Canada is a contracting party and the CNSC is a regulator. We are the only regulator in the world that is publicly disclosing the outcome of the Convention on

Nuclear Safety and we are having the discussion in public.

So it is a demonstration of the CNSC's transparency through you, the Commission Members, and to the public.

Just before I close my remarks, just listening to my colleagues, it seems like we have to establish a glossary for the international lingo on treaty, Diplomatic Conference and guidelines and so on and so forth.

So just a brief Diplomatic Conference, that means techies like myself or Dr. Rzentkowski we will not be leading, we will be diplomats who will be having discussions and we will provide them support on the technical issues.

With this, I close my remarks and we are ready to take any questions. Thank you.

THE PRESIDENT: Thank you. Okay, let's start the questions from members. Monsieur Harvey?

MEMBER HARVEY: Merci, Monsieur le Président.

I will start with your sentence here, "Canada will continue to be a leader in the CNS peer review process."

Reading that, and I see that we are quite involved in the process. We believe there is benefit to come from the process and the stuff is positive and active. But at the moment, we read right at the beginning there is obligation, but not enforcement.

I would like to know how many countries are at the same level as Canada? There is 76 countries, different countries, some with nuclear activities, some others not. So what is the real picture? And what are they with years, have you noticed some positive results elsewhere than in Canada?

MR. JAMMAL: Ramzi Jammal, for the record.

I will try to be very very brief in my response to you. It is a very valid question.

The Convention on Nuclear Safety was set for, actually, countries who have operating power reactors or embarking countries who will have a nuclear power plant for the purpose of production of electricity.

You asked the question how engaged other countries are. Some countries actually did not bother to show up nor ask questions, nor make presentations. Approximately there are five countries that did not, quote unquote, conform to the CNS requirements.

So the President of the Convention on Nuclear Safety has written letters identifying these countries, and we're hoping right now that these letters will be sent to the head of states or individuals in power to inform the head of the countries that they have a contractual obligation that they have not fulfilled.

If you -- Mr. Peter Corcoran mentioned like-minded countries, so the engagement of the G8 countries, the engagement of mature countries that have mature nuclear power plant programs challenge each other quite extensively in reviewing the report and asking the questions and in the follow-up for closure of actions.

So the -- you've got -- I'm not a diplomat, but you've got emerging countries and you've got mature countries.

The challenge we're facing is the global safety is an international safety regime so, in other words, if an emerging country is mishandling or not capable of regulating and ensuring safety, as we learned from the Fukushima or other events, Chernobyl or 3-Mile Island impacts the global safety.

So this is where we're naming and shaming and trying to put in place a process by which to have a champion for safety at the global level.

So it's a long-winded answer to say some countries are very engaged, some countries are not very well engaged to the level Canada is engaged at, but the President of this Convention -- and this is unique to this Convention -- that he's pursuing the head of states or any individuals who are responsible for the -- at the government level to ensure that the regulator is acting in accordance with the contracting party.

MEMBER HARVEY: What is the nature of the reports coming from the countries not having nuclear activities, or not much?

MR. JAMMAL: It's Ramzi Jammal, for the record.

Most of the emerging countries, the reports -- some of the countries who I personally challenged myself in asking questions why didn't they bother to submit their report or make a presentation, they say they are in the steps of putting in place their regulatory regime steps, putting in place the capacity for assessment and so on and so forth.

On the other countries that they are contracting parties who have a bit more advanced regulatory structure in place presented their challenges in establishing a regulatory regime to ensure safety.

MEMBER HARVEY: Thank you.

Just a last question. It's about the -- you mentioned that CNSC leads Canada's work to meet the CNS obligation. Who else -- what other organizations are involved in the preparation of the report?

MR. JAMMAL: It's Ramzi Jammal, for the record.

From the beginning, the CNSC leads the report itself to the submission. We are the, quote unquote, designated body under the government of Canada to lead the Convention on Nuclear Safety.

But let me go back to say that, from the beginning, Canada was one of the very few

-- one of the first of the contracted parties to engage all of the industry in providing their updates in the report itself.

We have Health Canada as part of the contributor. As you can see from the actions, it's not just the CNSC, but it engulfs and encompasses other government agencies.

So we -- in the Convention, we had support from Foreign Affairs, we had support from Natural Resources Canada, we had support from Health Canada and the industry itself as a delegation.

MEMBER HARVEY: Thank you.

THE PRESIDENT: Ms Velshi?

MEMBER VELSHI: Thank you.

Thank you for that presentation. This is extremely interesting.

So this was the sixth meeting. And following up on Mr. Harvey's question, what's been the trend over the five previous meetings as far as engagement of the contributing parties?

And this is post-Fukushima, so I would expect there would be renewed commitment for this.

Has there been an improving trend?

MR. JAMMAL: It's Ramzi Jammal, for the record.

So I have to give you a long answer, but the fact is, the -- this was put in place right post-Chernobyl. The discussions at the time at the Convention were very hard-hitting with respect to safety and improvements and lessons learned.

Things became a bit more very diplomatic-like, patting each other on the back. Each country came with their own drums being -- or singing the song they're the best regulator.

And of course, the Fukushima event where, in fact, there was a discrepancy between the IRR's findings, which is the International Regulatory Review, mission and the contracting party reporting demonstrated there was a difference or conflicting, as a matter of fact, information being presented.

So you asked the question, how is this trend. There has been quite a hard-hitting at the early stages challenging the countries. It became more of a goody-goody, look how good we are.

Post-Fukushima, the seriousness

with respect to enhancement to safety has taken place and actually, as a matter of fact, Canada has taken the lead on a lot of fronts with respect to challenging questions, challenging contracting parties who are not submitting reports and requesting -- we formally requested in our presentation that the President of the Convention on Nuclear Safety name and shame the member states or contracting parties who did not present nor fulfilled obligations that was imposed on them from the previous reviews.

So again, a lot of the contracting parties and the like-minded to Canada did fulfil their obligation for closure of challenges -- they call them challenges under the treaty languages for the countries. And the trend of closure has been progressing, but there is still a lot more work to be done on the critique of the contracting parties.

MEMBER VELSHI: Thank you.

And as I look at your last three slides on the new challenges, was there anything new, really, for Canada in this? Was this not all part of your planned work anyways?

As I look at it, this all looks

familiar on what you were embarking on anyways.

MR. JAMMAL: It's Ramzi Jammal, for the record.

You're correct. It's -- globally, it's -- as you can see, the challenges arising from the review are literally arising both you, the Commission, directing us, staff, on -- take on engage, for example, the PSA, site-wide PSA.

The Commission is the only regulator in the world, actually, directed its staff to pursue and establish methodology for multi-unit PSA.

The -- in our report, we've identified these challenges in order for us to report against these challenges and key element, it's the return of evacuees and recovery post-accident because we want to establish the safe dose limit to the public and have that debate before and not during an accident with respect to what is the difference between a regulatory limit under the ALARA principle versus the health limits for the well-being of evacuees or the well-being of the society post an accident, if there is one.

So that what you see before you here is the public disclosure of the challenges, but they are arising from both a direction from the Commission to staff or challenges that we foresee as a regulator for the future.

MEMBER VELSHI: So maybe I'll ask the question a little differently.

With the questioning and the discussions you had with the other contracting parties, has your approach or the content of what you are going to do changed, or was it more a validation of what you were going to be doing anyways?

MR. JAMMAL: It's Ramzi Jammal, for the record.

It's a validation that what we're going to do anyway. The discussions of the country grouping, though, highlighted the fact that we are on the right path.

So in other words, we've got the multiple -- the Nordic countries who publish protective measures, the French experience of pre-distribution of potassium iodide, the cross-border emergency support in the -- in European countries.

So it literally showed and demonstrated to us that we are on the right path and definitely one of the elements is to have the public debate and public disclosure on what it means, a regulatory limit versus a safe limit.

So these challenges are not unique to us, but some of the other contracting parties are ahead in the debate than we are, so we are able to establish some lessons learned from them.

MEMBER VELSHI: And my last question for this round is on slide 11, this proposed addition to CNS Article 18.

As I look at it, this, to me, looks like a sacrosanct principle. Why would it not be accepted? Are there nuances that I'm missing?

MR. JAMMAL: It's Ramzi Jammal, for the record.

No, you're not missing anything. As a matter of fact, we support the principle behind this.

The key point here is the process, how to amend the Convention.

So we, as Canada, as CNSC, we were not against at all such principles, but the method how to achieve it.

So now, the danger is once you open up a Convention in the international scene and some regional political influences can be used to sabotage an existing Convention or we end up with no Convention or we end up with two Conventions. That's even worse.

But we're not against the principle. It's just how to achieve that principle.

THE PRESIDENT: It's a little bit more complicated than that.

If you look at the way the text is, the concern that -- nobody has any concern with the new build, new technologies. They have lots of concern with existing plants applying this.

So the problem is that -- and the European, in fact, passed on their law -- it's mandatory. They took this language and differentiated between the new build and on the old, it's -- there will be -- and I'm paraphrasing it. I don't remember the exact text.

But it says something like you will do the best you can to bring in to those new standards.

So all of a sudden, we are creating two types of nuclear power plants, new and old. So some of us are objecting to that, too, because it gets you down to the discussion of how safe is safe.

So if you have a new build that my favourite example is you must buy a new build with a coal catcher, some vendors like to suggest. So is that safer than existing CANDU plant?

So if it is, how much safer? Are we getting into the notion about whether people will argue you should shut down the old ones because they're not safe enough.

So that's the conversation we're going to have in the diplomatic conference, and there are going to be, already, counter -- how do you counter the European, which is already enshrined in law, with this new proposed amendment and some of us who believe you're better off without no amendment to the Convention but get into the guidelines and enforce the guidelines.

So all of this is going on.

I just want to make a point, also, that you're listening to all of us and you can think that the CNS is really a terrible kind of a thing. There's a lot of good stuff in there and just by comparing notes and comparing approaches of different regulators, what they're doing, et cetera, so there's a lot of good work, you know, sharing of information over the last six years. People learn from each other.

So what you're seeing in the step ahead is almost like a consensus post-Fukushima is what's important to do right now. And that's reflective of the community. And every one of those items has behind it a whole set of amendments, particularly post-Fukushima.

Post-Fukushima initiatives is a menu for many, many, many initiatives everywhere.

So I just wanted to clear the air, and you're going to hear some more about this diplomatic conference. And they -- like all diplomatic conferences, they need a rules of engagement conference to decide how the conference is going to be conducted. And that's going to be an interesting process all by itself.

So Ms Velshi, have you done?

So Mr. Tolgyesi.

MEMBER TOLGYESI: Merci, monsieur le président.

On slide 10 you are talking about CP's agreed to serve all CNS improvements. Does it mean that it's unanimous -- it should be unanimously agreed or it's a majority?

MR. JAMMAL: It's Ramzi Jammal, for the record.

It's -- the agreement is as each country grouping has the country group and there is the discussion with respect to closure of previous challenges, agreeing on the existing challenges, so the answer is yes, it's consensus.

So after Canada's presentation at the country grouping, Mr. Gracie was part of the reporter and, as you mentioned, Dr. Frotes was a chairman.

So the country groups, they go through the challenges and the grouping contracting parties will have the acceptance debate, modifications, clarity, so it is the country groupings that determines the challenges.

Is it a consensus? The answer is yes. And it's -- we make sure that it's clear to us, for example, on our challenges what it means and how the text reflects what are the challenges and how we're going to be able to close the challenges.

If I didn't answer your question,

let me know.

MEMBER TOLGYESI: So if a country group there is a country which do not agree with what you are saying, it will be pursued anyway as a -- so it's not unanimous.

MR. JAMMAL: Ramzi Jammal, for the record.

That's correct. For example, if we're presenting a closure for challenges on the fifth review or fourth review, then a country can object to our reasoning and the technical information we're presenting and declare it to be not closed.

So then we have to go back and then provide the confirmation that why we're declaring it closed and on what basis it's been closed.

But the end point is, it's got to be agreed upon by the Chairman so that the issue is closed.

But I will ask my colleagues if they have anything else to add on the procedure, but that's how the procedure runs.

MR. GRACIE: Thank you. Brian Gracie, for the record.

Just to go back to the original question, which was very general improvements on slide 10. Those improvements were, in fact, all achieved by consensus with all the contracting parties at the plenary.

Now, in terms of what happens at a country group session where there's debate about individual countries like Canada, in terms of the most important results, the good practices -- they're called good practices, challenges and suggestions.

And we've talked about good practices and challenges already. They are adopted by consensus.

The contracting party itself that's the subject of that particular review doesn't get a final say, so if there is a disagreement, the final wording is basically voted on by everyone else and sort of adjudicated by the Chair of that particular session.

The suggestions, though, which we haven't talked about here today is a third type of major result. And suggestions would have the agreement of the contracting party itself.

So talking about the major

results, good practices and challenges, they're almost always unanimous and everyone agrees, but there is occasion where the country receiving the challenge, for example, doesn't quite like it and might be a bit upset about the wording, but that is rare.

MEMBER TOLGYESI: So when the countries agreed on something and it's adopted, the expectation is that everybody will comply.

Does it happen or never, or some countries?

MR. JAMMAL: It's Ramzi Jammal, for the record.

Now I understand your question. You're talking about the open-ended session with respect to all the contracting parties. The vote is by consensus. They must obtain consensus.

And as a matter of fact, the reason there is a diplomatic conference due to the debate that occurred on the amendment of the Convention itself or the process.

So once the contracting parties agreed on a text and an article of the Convention itself, they should be in conformity and compliance with the Convention and its obstacles.

MEMBER TOLGYESI: And my last question, I was waiting gentleman from Bruce Power is coming back.

What's the industry participants' concerns, opinions, comments on this meeting and on the CNS in general?

OPG and Bruce, could you give comments?

MR. MANLEY: Robin Manley, for the record. I'm the Director of Nuclear Regulatory Affairs and Stakeholder Relations at Ontario Power Generation.

In response to your question, I consider that participation in the Convention on Nuclear Safety is a good practice for Canada and for other countries.

I especially would say that that would be true for emerging countries.

To the extent that Canada in the sharing of our experience and our knowledge can assist other countries and, in particular, those who are new to the use of nuclear power who haven't got a developed nuclear power program yet and should attempt to avoid the, you know, errors that might have been made by others in the past --

to the extent that we can help them in the safe operation of a nuclear power program, we should continue to support this Convention and the challenges, the questions that we pose and provide them with answers to their questions.

In addition, for ourselves, the challenging questions that are raised by other countries with a different perspective, perhaps different experiences, it's always good to have a critical review of your own program. And that gives us the potential to gain new insights that we can use to improve the safety of our own plants.

So I would support our continued participation in the program, for sure.

MEMBER TOLGYESI: So you accept these lengthy deliberations and discussions open-ended, whatever you were calling, because you consider that this is something -- in French you say "un mal pour un bien".

--- Laughter

MR. MANLEY: Oui. Yes. Sometimes it might seem a little bit painful to sit through the lengthy deliberations, and I was quite impressed with the stamina of the members of the

Canadian delegation, especially going to the open-ended working group sessions in the evening.

But certainly the group sessions where you heard the different countries making their presentations and the other countries had an opportunity to challenge and ask for more details, it unearthed certain, you know, weaknesses or opportunities for improvement, for sure. It's valuable.

MR. SAUNDERS: Frank Saunders, Bruce Power.

OPG has really presented the industry comments here. We did discuss them in advance. I think we're pretty well aligned.

The only thing further I would say is I think, you know, the nuclear industry has learned through its own past experience that errors that other people make impact us all, so we do take every opportunity, including this one, to try to influence the world.

Imperfect though some of those forums may be, we wouldn't dream of not participating, you know, for that reason.

THE PRESIDENT: I have a follow-up on this.

So are we unique or do all countries bring their industries to the table?

MR. JAMMAL: It's Ramzi Jammal, for the record.

We were the first to bring the industry. Some countries now are copying us. Not all of them. Most of them still the regulator or the government officials.

I would say I have got to look to Dr. Rzentkowski or Mr. Gracie to help me on this, but the French now bring their industry. The Russians brought their industry. Americans, actually the U.S. has brought its industry, so it is increasing over time, but it's not 100 percent yet.

THE PRESIDENT: What fascinates me about this, if it's true, then why is the industry not becoming more aggressive to try to block the governmental layers, because of the last statement that you made that we are all concerned about the same thing, about somewhere some accident happening?

And if you cannot get to the -- you know, to the decision-makers in a country to improve, then I think the industry has other venues. They can go the WANO way, they can go the press way, things that bureaucrats can't do. And I am still surprised that you are not being more aggressive to extract accountability.

MR. SAUNDERS: Yeah, a difficult question to answer. But I think I would say we are being quite aggressive there, right.

And both OPG and Bruce Power occupy very senior positions in WANO and have been pushing, as we have had, you know, discussions with you in the past about trying to at least highlight and communicate different performances in a public way. But, you know, as the IEA has issues, so do we all in trying to bring different cultures and different things together.

THE PRESIDENT: But I know that. But what I meant, to be absolutely precise, and this is really heresy for the private sector to point where the regulator is ineffective in a country. It's not the WANO looking at operator to operator. I'm talking about -- and I know this is heresy for you to point that a regulator is ineffective.

It may be counterintuitive, but I think if we all believe that we all have to be in the same safety culture, if there is a country where the regulator is ineffective -- we are pushing the CNS and the IEA level -- I think you should push from your own side.

MR. SAUNDERS: Yeah, I'm not sure I know how to answer that, but I understand your point.

THE PRESIDENT: We will leave it hanging then.

Dr. McEwan...?

--- Off microphone / Sans microphone

--- Laughter / Rires

MEMBER McEWAN: Thank you, Mr. President.

A couple of questions. As I look at the challenges you have, one of them relates to emergency preparedness and the pre and post planning, and there is a very clear statement of the expectations to Canada from this.

It strikes me that this is made very much more complex -- I'm basing this on a previous Commission meeting where we discussed potassium iodide -- where you were dealing with multiple other jurisdictions, the provincial jurisdiction and the regional jurisdictions. How do you incorporate them into this conversation, because it was very clear that I don't think we were in different libraries, but we certainly weren't on the same page with the provincial jurisdiction in something as simple as potassium iodide pre-distribution.

MR. JAMMAL: It's Ramzi Jammal, for the record.

That's an excellent question. We will start -- first of all, my answer is, yes, we will be engaging all of the stakeholders who will be involved in the post-recovery emergency management and you got it bang on with respect to the potassium iodide.

The intent of this is to establish our regulatory requirements. So in other words, we will put in place the regulatory requirements, just like we did for the potassium iodide and say they shall be distributed -- I believe the decision is out so I can speak freely now -- that they should be distributed at minimum a 10 km radius or to a 10 km radius.

So we are working towards establishing our regulatory requirements that the stakeholders, let it be the operators, but the licensee has the ultimate responsibility under the Act, and they must fulfil that requirement. So the key point here is we establish the regulatory requirements. We establish what the Commission wants and is satisfied with, in response to an event and then we make sure that the stakeholders are executing accordingly. But it's going to take a lot of work. It's not an easy challenge.

And the international experience to date has not been easy, from responding to an emergency to post-recovery and for the well-being to return of the public. And, in specific, the biggest confusion is what is safe and what can I eat, what I cannot eat, and everybody sticks to the regulatory levels of 1 mSv or literally the 1 mSv, which is the regulatory limit, not the health limit.

So in conclusion, it's going to take a lot of work but the endpoint here is establishing the regulatory requirements for the licensees and stakeholders to fulfil the needs of the Commission and the safety of the public.

MEMBER McEWAN: So coming out of the meeting is there any sense of a consensus around the world -- and again I'm going to use potassium iodide, but you could pick any of 20 endpoints -- on best practices?

MR. JAMMAL: It's Ramzi Jammal, for the record.

Is there a consensus? The answer is briefly yes and that is what we search ourselves to look at the best practices that currently exist. Is there an agreement with respect to what Canada is doing can be fitted into another contracting party, the answer is probably not because uniqueness of Canadian requirements or the environment is not identical to the rest of the world.

But there is definitely consensus and that's why the good practices are published so the other countries or contracting parties will pursue with their counterparts in order to establish what is the best practice and how it can be implemented.

THE PRESIDENT: Just to add to this, I think that you remember that in the Convention they are nuclear regulators and practically everywhere in the world many of the recovery in food are regulated by another set of regulators; from Health Canada, the Food Agency. So they don't necessarily -- they cannot come up with a very precise consensus, just a general consensus that post-Fukushima you need to review it. I think that is a consensus everybody agreed to.

But then it's getting involved with medical, not only domestic medical authorities, but international. If ICRP comes up with guidance, it's going to be very difficult to a domestic authority to overrule this. And the same thing with the World Health Organization, et cetera, et cetera.

So as Mr. Jammal is saying, it has been a challenge to get everybody engaged and to be in the same -- you know, it's fascinating in post-Fukushima, if you wanted to ask -- to answer the question, "Can I drink the milk?" it depends where you were. The answer may be "Maybe" because every country has its own kind of rules about when it's safe to drink the milk.

So it goes.

THE PRESIDENT: Dr. McEwan...?

MEMBER McEWAN: So again, if I go to the amendment to the CNS, to me it seems very narrow. I mean it's relating -- so I guess the question is, is there coverage in the rest of the Convention?

It seems to me that you are saying you have to design this well. It's not saying anything about a continuous review, continuous improvement, building a review framework that enables you to ensure that that initial perfect construction that this bullet asks for is actually improved going forward or actually monitored going forward.

So is there phrasing in the rest of the Convention that covers that or is this really just a standalone related only to building?

MR. JAMMAL: It's Ramzi Jammal, for the record.

I will start with the easy answer

first, is yes, the continuous enhancement and reviews is part of the other articles of the -- and guidelines of the Convention itself. In specific this amendment was triggered by the Swiss, in specific, as a communication tool, if I might say, to show the public that post-Fukushima there has been lessons learned and that we are attempting to do something to enhance things.

However, as you know, in our Canadian practice, and the CNSC practices, we are always achieving so that the existing facilities are always approaching or equal to the best standards and that's why we have the integrated safety review and the priority of the integrated safety review. So post -- before refurbishment starts there is a self-assessment and a review of meeting the new standards or approaching to meet these new standards.

So even though the Convention calls for continuous enhancement and reviews, some regulators are bound by their own national requirements that sometimes cannot meet the Convention. And that's where the debate occur on -- for example, the convention calls for periodic safety review as a good practice. Some member contracting parties do not practice periodic safety review, and that is always a challenge.

So to answer your question, from our perspective the continuous enhancement is embedded in our raison d'être at the CNSC and the Convention itself recommends continuous enhancements through periodic reviews of the safety and defence-in-depth mechanism pertaining to either new build or existing facilities.

MEMBER McEWAN: So you have six challenges defined for you by the meeting. If you were being self-reflective, were any missed? Is there a seventh or an eighth that we should be concerned about?

MR. JAMMAL: Ramzi Jammal, for the record.

From our report itself and all of the other peer reviews we have had, we feel those are first of all enough and they are adequate. With respect to anything that is being missed, I don't believe so. When I say I don't believe so, we have all sorts of missions coming up that will give us again regulatory perspective on operating safety of reactors.

But I will call onto my colleagues if -- anything I missed or anything they would like to say that this challenge we are missing or we need to add to it.

DR. RZENTKOWSKI: Greg Rzentkowski, for the record.

Just to complement this answer, we are operating here in this spirit of continuous improvements. So the continuous improvement can be driven only by thinking about the things which can go wrong and doing something about it. So you will always have challenges. Is this an all-inclusive list? No, absolutely not.

And coming back to the OSART missions, for example the first OSART mission will be conducted at the Bruce site in the fall of 2015. Particular attention will be paid to the long term operation of the units there. So this is the main focus of the mission.

The second mission was also already scheduled for Pickering in the fall of 2016. The focus of that mission will be the end of commercial operation.

So here you have already two additional challenges which personally I consider to be probably near the top of our list. But definitely the long term operation and maintaining fitness of service of the critical components is the key challenge which is not on the list.

THE PRESIDENT: I'm surprised you didn't mention IPAs and the emergency also mission. So those, I'm sure every one of those peer-reviewed and will raise all kinds of other challenges.

MR. JAMMAL: It's Ramzi Jammal, for the record.

That's why I mentioned peer reviews in general. So we are -- in our transparency, the OSART in order for us to fulfil the requirements of the IEA action plan for post-Fukushima is the IEA would come and look at the OSART or the operation safety review and to include the IPAs, which is a peer review of our security, and then of course the emergency preparedness review. Again, that is another peer review mentioned by an international group.

Actually, international experts will, and -- actually, we have several. To include seismic review with respect to our regulatory oversight of seismicity. The name escapes me right now, but there is a title for it, there is a seismic review, SEED. Okay. Don't worry about the acronyms.

But again, we are calling on international reviews to throw challenges at us and to enhance our capacity as a regulator.

THE PRESIDENT: Anything else?

Ms Velshi...?

MEMBER VELSHI: You tweaked my

curiosity when you said there were discrepancies in the IRRS reports. I don't know whether there were country reports or CP outcomes. Can you comment a bit more on why that would be and what that means, really?

MR. JAMMAL: It's Ramzi Jammal, for the record.

Boy, that's a diplomatic loaded question, but I will answer it in a non-diplomatic manner.

No, very -- a very good point is the peer review IRRS missions will highlight challenges to the receiving regulator and -- I mean, I find out, when I'm reading certain reports. You read the contracting part of the report, you think it's -- there is no self-assessment associated with the contracting party report. So they are saying how good things are in their country. Is it to please the minister or the government who is going to sign off on this report? Is it for all publicity purposes? I cannot answer that question.

But I raised the flag, as a matter of fact, post-Fukushima immediately, because we were going through the extraordinary meeting for the CNS post-Fukushima. And Canada, and we personally, did take the lead on the fact to start to highlight that the contracting party report should include the IRRS finding.

As a matter of fact, I can say it on the record that I drove my colleagues crazy against the wishes of the IEA and the contracting parties of the Convention, to include the findings of the IRRS mission of 2009, the follow-up mission of 2011 and, in our own report in Canada, the closure of the follow-up mission.

So you can see the trend on transparency and that's where right now the culture has changed to start to put in place the IRRS finding and part of the review, that the questioners now review the IRRS findings against the contracting party reports and through these challenges. So it's a self-assessment and some countries do not go back and highlight the challenges.

So that is a discrepancy between and IRRS finding and the contracting party report.

THE PRESIDENT: Just to add, I don't know if it's known that Mr. Jammal is going to lead an IRRS to India. We have agreed that we will not invest our expert resources in IRRS missions unless the country will sign an agreement that there will be a follow-up to that IRRS mission, because what is the point of doing and IRRS mission with all kinds of recommendations if there is no follow-up and execution on it? We refuse to waste our resources for something that does not generate any action.

So this is slowly percolating through the international community. The only reason we have accepted for Mr. Jammal to lead this, is that India actually signed up on this. And they did, so it is starting to occur. It is a slow process. Not everybody still adheres to this, but that's our contribution to this.

Anybody else?

I have only one slight observation question on your slide 14. I thought we had agreed that we will discontinue the relationship between when our regulatory document applies and license renewal. Particularly when we get into 10-year licenses now, there should be no relationship between the two. Do I understand it right or not?

MR. JAMMAL: It's Ramzi Jammal, for the record. Yes.

THE PRESIDENT: Thank you.

MR. JAMMAL: No debate.

--- Laughter / Rires

THE PRESIDENT: Anything else?

--- Pause

THE PRESIDENT: Because we know we cannot do NOP in 10 minutes, we're going to take a 10-minute break right now.

--- Upon recessing at 10:31 a.m. /
Suspension à 10 h 31

--- Upon resuming at 10:45 a.m. /
Reprise à 10 h 45

THE PRESIDENT: Okay. We are back and moving into something really simple now. It's the Fifth Progress Report on CNSC Staff Review of a New Neutron Overpower Protection (NOP) Methodology As Outlined in CMD 14-M50 and 14-M50.A.

I understand that Mr. Frappier will make the presentation. Please proceed.

***CMD 14-M50 / 14-M50.A**

Oral presentation by CNSC staff

MR. FRAPPIER: Thank you and good morning, Mr. President and Commission Members.

For the record, my name is Gerry Frappier and I am the Director General of Assessment and Analysis here at the CNSC.

With me today is Dr. Greg Rzentkowski, who is the Director General of Power Reactor Regulations; Dr. Michel Couture, the Director of Physics and Fuel; and Dr. Dumitru Serghiuta, CNSC's Lead Physicist.

Today we are going to provide the Commission with the fifth progress report on the CNSC review of the new neutron overpower protection methodology.

Before we get to some of the technical details, I would like to be clear about the overall message so we don't lose sight of that overall message as we get into the discussion on some important details. So on this slide I would like to provide a bit of a summary on some key points.

First, the installed neutron overpower protection trip setpoints are important to ensure adequate reactor operation and adequate reactor protection. Industry is interested in using a new methodology for the establishment of these trip setpoints and CNSC staff has been undertaking detailed assessments of the potential impact on safety of using this new methodology. However, what we have today is installed trip setpoints that are very acceptable, ensuring the safety of the reactors and we believe that is the case until at least August 2017.

So now to move to the main presentation, in the first part of the presentation I will provide a quick recap of the NOP system along with the effects of aging of the heat transport system and how the two are intertwined. I will then briefly recall why OPG and Bruce Power developed a new NOP methodology and what are its main elements.

And after giving a brief history of the CNSC's staff review of this new methodology, I will provide a summary of our main conclusions as of April 2013 and the current status of CNSC staff review activities.

And then we will pass it on to Dr. Rzentkowski for the current licensing situation.

So between July 2005 and December 2007, OPG and Bruce Power submitted updated licensing NOP analysis based on this new methodology. There were progress reports that were done and that we presented here before. The purpose of the progress reports was to fulfil a commitment made by staff to provide the Commission high level progress updates regarding the staff review of the NOP methodology. We have done previous reports in 2009, 2010, '11 and '12.

So some of the keys concepts before

we can go forward -- I would like to expand upon -- are associated with the control of the reactor power level within a CANDU reactor, what the loss of regulation as an event means and the role of safety analysis in that; the protection against loss of regulation and fuel sheath dry out and the NOP system's effectiveness.

So concept number one, the control of the power reactor. Neutron-induced fission is the operating principle of a fission reactor. Neutrons released by one fission causes fission in another nuclei, creating the potential with sustained chain reaction. This chain reaction will increase or decrease in intensity or remain steady, depending on whether the number of neutrons increases, decreases or remains constant. So in normal operation the objective of the operator is to have a steady-state situation, the reactor operating at full power.

The fission chain reaction can be externally controlled by controlling the amount of neutron absorbing material in the reactor core. I will explain that in a couple of minutes.

The CANDU unit possesses several types of vertically operated neutron absorbing devices which can be either inserted or removed from the core and which provide fine and coarse tuning of the fission chain reaction. They are part of what is known as the reactor regulating system. The reactor regulating system maintains a steady operating reactor power level and is the main way that operators control the reactivity.

The next slide provides a picture, if you like, of this reactor regulating system, the main components of which are the control room computers, which are not shown on this diagram, but obviously are quite key in providing the computer control of the various mechanisms.

The liquid zone controllers: These are compartments partially filled with ordinary water and the main design function is the fine bulk and spatial control achieved by continuously changing this ordinary water level.

There is adjuster rods and these are rods that are inserted into the core during normal operation and contribute to this broader or gross control of power distribution.

There are mechanical controller absorbers and these rods are outside the core during normal operation, but they are inserted into the core in abnormal or unplanned power increases and they can be inserted gradually or dropped into the core depending on the rate of unplanned power increases. These modes of operation using the mechanical controller absorbers are what you have heard before as a step back or a setback.

There is also a capability to inject a neutron absorbing poison, which is not shown on this slide, which can also moderate the situation.

In all of these types of control mechanisms when they are used, we would consider that normal operations. So this is day-to-day the operators are making adjustments to ensure the reactor is always under control. But if, for whatever reason, there is a malfunction with this RS, then it could result in an unplanned power increase which should be prevented to ensure there is no progress to an undesirable situation like an accident or damage to the core.

So of course the designers have thought about the fact that there might be a problem with the regulating system itself, and so that brings us to key concept number two, which is the loss of regulation event. A fault or malfunction or failure of the reactor regulating system could lead to an unplanned increase in power level. This type of event is called the loss of regulation event, in our jargon, if you like.

By design, the frequency of a loss of a reactivity event or an LOR event is less than one event in 100 years per reactor. While not frequent, this type of event has occurred and is the type of event that we would consider a design-based event as opposed to, over the past little while, we have been talking about Fukushima-type events which are very extreme events. This is an event that, as you can see, suggests that a 10^{-2} or a 1 in 100 years type activity.

The safety objective in case of an LOR event is to ensure that the appropriate dose limits are not exceeded and that there is not extreme damage. The safety objective is achieved by having the shutdown system timely actuate so that fuel and fuel channel integrity throughout the core is assured with high confidence. When I say the shutdown system, I am talking about another system that we are going to be talking about right now.

So the selection of trip setpoints; that is, at what point are we going to activate that shutdown system to ensure timely actuation and effectiveness of the shutdown systems in case of such an LOR event, is based on specific safety analyses. And, therefore, it is important that the methodology employed in these safety analyses is correct and conservative. So for the LOR event, the effectiveness of the shutdown system is demonstrated through the safety analysis.

So key concept number three is the protection against such an event. So the NOP system in CANDU reactors is designed to provide the protection against such an LOR event. The NOP system is composed of a number of fast response in-core detectors which monitor the neutron flux throughout the core.

In the event of an LOR, protection of the fuel and fuel channels is achieved by initiating reactor shutdown system before the overpower reaches a pre-established level, which is called the NOP trip setpoint. The analysis methodology which determines the highest possible NOP trip setpoint is known as the calculated trip setpoint or calculated NOP trip setpoint. This is what this new methodology that we are talking about, the NOP methodology, provides is that calculated trip setpoint.

So key concept number three continued, the overpower at which the shutdown system will in fact be actuated is known as the installed trip setpoint. So again, so you do your calculation. You say there is a certain trip setpoint that is the highest that you are allowed to be and still demonstrate that the system will react safely. And then you install in your machine a trip setpoint that must be at that level or lower so that it in fact will shut down as predicted in the analysis.

So the term install refers to the fact that this value is fixed in the operating software of the reactor NOP system and fixed is a term here we mean it can be -- it is something that can be modified in software, but it is day to day in the machine operating and is not something that has to be done by the operator or anything like that. It is already fixed in the system. The installed NOP trip setpoint must always be lower or equal than the calculated trip setpoint and the installed NOP trip setpoints are very important to ensure adequate reactor protection.

So again, if we now look at a diagram of the shutdown system separate from the reactor control system that we talked about earlier, the CANDU reactors are equipped with two independent automated fast acting shutdown systems of diverse design.

The first shutdown system consists of spring activated, gravity driven neutron absorbing shutoff rods which dropped into the core. That is shutdown system number one and, as you can see from the top, the sort of brownish devices there that drop the rods into the core.

The second shutdown system is based on injection of a neutron absorbing liquid into the moderator. This is shown on the left side of the diagram. You see the tanks. They are called poison tanks. The neutron absorbing liquid, in technical parlance we call it the poisoning, the neutron poisoning.

Either one of these two shutdown systems which operate completely independently from each other, are capable of shutting down the reactor in the case of an LOR event. The actuation component of the NOP is independent and separated between the two shutdown systems. One system uses vertical, gravity-based devices separated from the horizontal devices used in the other shutdown system.

To get a bit deeper understanding of the problem we are trying to ensure does not occur, it is important to understand the key concept of fuel sheath dry out. So under normal operating conditions, the heat transfer from the fuel itself, the fuel bundles -- and I think we have all seen the fuel bundles before. They have these little pencils within the fuel bundle and the coated -- the metal around those pencils is what we call the fuel sheath.

So under normal operating conditions, the heat transfer from the fuel to the coolant is high and the sheath temperature is only a few degrees, or a few tens of degrees higher than the coolant temperature. However, under certain accident conditions leading to abnormally high channel power such as an LOR event, the rate of heat transfer to the coolant can deteriorate due to the development of a vapour film, which I will explain in a minute, at the fuel surface, thus reducing fuel cooling effectiveness. This condition is called fuel sheath dry out.

So as the energy within the bundle gets a bit too high, you all of a sudden start disrupting how effective the heat transfer is between the fuel and the coolant that is going through. So this dry out power is the elevated fuel channel power at fixed thermal hydraulic conditions at which the fuel sheath starts experiencing dry out.

So this dry out power is an important parameter. That is the spot at which you are now having a little bit too much power coming out of your fuel bundle for the ability of the coolant and you are going to start now disrupting the effectiveness of the heat transfer.

So continuing on with fuel sheath dry

out for the LOR event, the prevention of the onset of intermittent fuel sheath dry out is conservatively used as an acceptance criteria for demonstrating the effectiveness of the NOP system and ensuring fuel and fuel channel integrity. That is, that we know that if we prevent dry out from occurring the fuel has not had any damage to it.

So as a criteria for whether the shutdown system is effective enough, we use the idea that if it prevents dry out on the fuel, then we know the fuel has been protected and therefore the pressure tube has also been protected and we consider the shutdown system effective. So for LOR events, prevention of fuel sheath dry out is the measure by which the effectiveness of the NOP system is demonstrated through safety analysis.

We were asked to try -- and this is a bit of an experiment here in illustrations, if you like. You see the bottom circle, the bottom right-hand big circle is a look at the fuel bundle with all its little pencils inside it. We have circled in on the blue one and we have tried to bring it horizontally across the top of the slide to demonstrate. That's one fuel pencil, if you like, and that's the sheath that we are looking at. What we are seeing is there is a good flow in the direction of the arrow there which is keeping the fuel sheath nice and wet. So it has not achieved dry out.

On the right-hand side you see there are a few little bubbles that are perhaps presenting themselves but, again, the bubbles are wet and so we would not consider that dry out yet. So this figure mimics one sub channel of the fuel bundle surrounded by three or four fuel elements as shown in the blue circle.

The wall represents the heated fuel sheath. During normal operation the bundle and channel powers are relatively low. Thus, the bundle channel flows through with water only in one phase. It's all liquid and no gas in it. Some small bubbles may be present in a few hotter fuel channels, as we have shown there, but they are not of concern.

In an event leading to an increase in bundle power, more bubbles start being generated and some of them start collapsing into larger bubbles or a vapour core surrounded by a liquid film attached to the fuel sheath. In this case again the fuel sheath temperature still remains low because the bubbles are wet, if you like. So there is still a liquid contact with the fuel sheath, But when the bundle power is further elevated such that the liquid film can no longer be maintained on the fuel sheath, then dry out is then initiated and portions of the fuel sheath is exposed to a vapour environment leading to a quick rise in sheath temperature. So as you can see, at this point now, all of a sudden it's not little bubbles anymore that you see at the right of that pencil. You are starting to have a big area which is not wet anymore. There is no liquid there, and that is going to change the temperature properties or the temperature transfer properties of that sheath and that is where the potential for that sheath to melt is going to start appearing.

So with that as a bit of a lesson, we can take a look at the impact of the heat transport system aging on the NOP. So the heat transport system operating conditions; that is, the cooling flow, temperatures, pressures of a CANDU reactor are affected by the aging of the heat transport system components. In the absence of compensatory action, this requires the reactor to be tripped at lower over power levels.

The adverse impact of aging increases with time and eventually will lead to a reduction of the operating power level and therefore to a reduction of the electric output of the reactor called derating. Adequacy of reactor protection and safe operations under aging conditions is strongly dependent on the NOP trip setpoints and their trend with time. So that is, aging of the heat transport system components requires us to review the trip setpoints, the NOP trip setpoints, on a regular basis and make adjustments.

I would point out that derating is not the only thing that an operator can do and is in fact usually the last thing they want to do. So they could also do other compensatory actions such as mechanical or chemical cleaning of the heat transport system, but eventually all of those will result in an aging plant that requires us to review the trip setpoints. Because the key point is we have to ensure that the shutdown system is always effective whatever the age the plant is.

Which brings us to OPG and Bruce Power's position. It is OPG and Bruce Power's position that the methodology used in the design of the NOP system in the past, originally, was overly conservative and would have led to earlier than required plant deratings under aging conditions. The OPG and Bruce Power position is that the proposed enhanced NOP, or the ENOP methodology, is superior and based on its results, trip setpoint adjustments to address the impact of heat transport system aging on the safety margins can be delayed. The introduction of the ENOP methodology is part of OPG's and Bruce Power's aging management strategy and the CNSC's role is to confirm the acceptability of such an approach.

So let's talk a bit about what this new ENOP methodology is. The ENOP methodology is a new computational framework developed to solve the NOP equations which determine the NOP trip setpoints. The ENOP methodology has essentially three components.

First, a module which calculates the thermal hydraulic variables which appear in the NOP equations and their associated uncertainty and this module takes into account the effect of heat transport system aging.

There is another module which calculates the reactor physics variables which appear in the ENOP equations and their associated uncertainties.

And then finally the data from the above two modules are transmitted to a module which solves the NOP equations using a statistical procedure which they call EVS 2010.

Now, the use of EVS 2010 constitutes

a very significant departure from the statistical procedure that was used in the previous NOP methodology. And this has been the main center, if you like, of our attention. However, the licensees have concluded that the new methodology demonstrates that more safety margin is available than originally assumed and thus higher trip setpoints are possible. That is the main conclusion of their analysis, if you like.

So what has staff been doing with respect to this? So given its complexity, and I can assure you it is very complex, and impact on the licensing aging management strategy, the ENOP methodology required close scrutiny and CNSC staff undertook an in-depth review of this.

Since 2007 the new NOP methodology has been subject to a thorough multidisciplinary review by CNSC staff; both the screening review which was done in '07, interim reports in '09 and a summary review report in 2013.

I would like at this point to acknowledge that throughout all this, both OPG and Bruce Power have been excellent at providing us technical input and supporting us in our review and making sure that we are in the best position to understand the innovative approach they are using. And this is including some of the research projects that we have undertaken that again would not have been a success without OPG and Bruce Power making data available to us and to our contractors that we had working on it.

CNSC staff reviews were supported by two third-party expert reviews. First was a five-member independent technical panel led by Dr. Apostolakis. This was before he was nominated by the US President as the Commissioner of the U.S. NRC -- created in 2008 as a joint industry COG-CNSC joint project. That final report was issued in 2009.

We also had a Professor O'Hagan, who is a statistical expert from the University of Sheffield, in 2011 under a research contract, to focus on the statistical aspects and in particular EVS 2010. His final report was made available in March of 2013. So there has been thorough review of this new methodology to ensure that there is no decrease in safety.

So where is staff with respect to our main conclusions?

Overall, the method by which the impact on heat transport system aging is incorporated into the NOP trip setpoint calculations is acceptable.

There are, however, a number of important issues regarding the treatment of uncertainties that remain to be addressed.

The EVS 2010 theory is mathematically and statistically correct and has the potential to provide a practical solution to the NOP trip setpoints. However, there are a number of findings from the CNSC staff technical evaluation that make it clear that at present there are several obstacles to its use for determining NOP trip setpoints in practice, and I would suggest, on its own. So as an overall computational framework for calculation of NOP trip setpoints for plant aging conditions, the ENOP methodology presented for regulatory review and acceptance needs more developmental work, testing and qualification to ensure and confirm it produces reliable results for the real application.

At the present time, and although OPG and Bruce power remain very confident in the adequacy of the ENOP methodology, the CNSC staff do not consent to rely solely on the current ENOP methodology with 2010 EVS model implementation in setting the values of the trip setpoint. CNSC staff will only consent to the use of the current ENOP methodology if additional supporting information is provided, and I would point out it has been by the licensees.

So the ENOP methodology presented for regulatory review and acceptance needs more developmental testing and qualification work to ensure that it produces reliable results for the intended application.

I would now like to turn the presentation over to Greg Rzentkowski for the current licensing status associated with all this.

DR. RZENTKOWSKI: Thank you very much, Gerry.

As Mr. Gerry Frappier explained, many technical details related to the development of the new NOP methodology are extremely complex, and it takes a long time to get the regulatory consent for the use of ENOP.

In closing, I would like to attempt to answer a couple of fundamental questions. First, what does it mean for operating reactors and; second, how do we assure the effectiveness of the installed trip setpoints?

In responding to these questions I will describe the current status of a regulatory assessment of the installed trip setpoints and required future steps.

Given the relatively little progress over the past two years in validation of the new ENOP methodology, in April 2013 CNSC staff requested licensees to develop a practical method for derivation of NOP trip setpoints. The objective was to confirm adequacy of installed trip setpoints considering aging of the primary heat transport system, by demonstrating fuel and fuel channel integrity with high confidence should a loss of regulation event occur.

In response to this request, licensees assessed and confirmed the values of installed NOP trip setpoints until August 2017 based on the previous NOP methodology, which was modified to incorporate the aging effects.

Licensees confirmed also the defence in-depth in the NOP trip coverage by demonstrating the effectiveness of high heat transport pressure and low heat transport flow trips in stopping progression of loss of regulation events. These trips are normally accredited in loss of flow events only.

Although the new E-NOP methodology, based on extreme value statistics, was used to establish the initial value of the trip set points as an input parameter, the actual calculation is independent of this methodology.

Following the detailed review, CNSC Staff accepted the values for installed NOP trip set points based on: first, understanding that the currently installed trip set points are more conservative than those predicted by the new methodology; second, application of the risk-informed decision making process to assess the risk of operation associated with intermittent dryout of fuel under highly unlikely neutron flux conditions and implementation of the main control room procedure to avoid reactor operation under these conditions; finally, implementation of additional monitoring and confirmatory actions.

With regard to future actions, CNSC Staff requested licensees to perform a number of monitoring and confirmatory actions, including submission of an annual NOP compliance report with results of surveillance and monitoring for impact of aging and an update of the NOP analysis by January 2017.

CNSC Staff also requested licensees to complete the development of a new NOP methodology, not necessarily based on EVS, by January 2016 or propose other compensatory measures to deal with reactor aging effects by January 2017.

CNSC Staff confirmed adequacy of the installed NOP trip set points for the next three years. CNSC Staff will provide further progress reports to the Commission on the installed trip set points and the development of an NOP methodology in the annual NPP status report.

It is important to note in closing that based on the current understanding of the impact of primary heat transport system aging on the NOP trip setpoints, derating of the reactors in the future years cannot be precluded if the new ENOP methodology, or any other methodology proposed by licensees, has been found to be inadequate for licensing applications.

Mr. President and Members of the Commission, this concludes the CNSC Staff Progress Report on the new NOP methodology based on extreme value statistics. CNSC Staff are now available to answer any questions the Commission members may have.

Thank you.

THE PRESIDENT: Thank you.

So let's jump right into the question session with Ms Velshi.

MEMBER VELSHI: Thank you, Mr. President.

So this is extremely complex and this is first update, so forgive me if the questions are really basic. But I notice this is just OPG and Bruce Power, so is this not an issues for Lepreau as well?

MR. FRAPPIER: It is not an issue for Lepreau because of course they have been through refurbishment, so they don't have the aging issue to the extent that some of the facilities, OPG and Bruce, have.

So they use a different methodology which is more the original methodology, if you like, that the designer used.

DR. RZENTKOWSKI: If I may add a little bit to it?

However, before the refurbishment, Point Lepreau Station was derated because of the NOP trip coverage.

MEMBER VELSHI: Yes. So that was my next question. What has been the deratings of the different units as a result of this issue?

MR. COUTURE: Towards the end of the -- just before refurbishment, they were done at one point at 90 per cent full power. And then they did several things to bring it up to perhaps 92-93 per cent. But there were significant deratings for a number of years at Point Lepreau and G-2.

MEMBER VELSHI: And for Pickering, Bruce and Darlington, are they currently derated as a result of this?

MR. COUTURE: No, they are not derated. What they have to do, however, is to adjust as aging. But for now, they are not derated.

MEMBER VELSHI: And then I got lost towards the end because I thought we were going through this E-NOP methodology, but now CNSC has gone back to the licensees and said, well, you could come up with an alternative methodology.

But you have been reviewing this for the past seven or whatever years, so is it because you see little potential in the E-NOP methodology or you have some concerns that this may not deliver what you were hoping it will.

DR. RZENTKOWSKI: Greg

Rzentkowski, for the record.

The development of this methodology has been initiated about 10 to 12 years ago. And we are still not converging in terms of the acceptance of this methodology for the licensing application.

So that is the reason why, personally, I was concerned that we will have to start derating the reactors and there could be some other methods by which we can demonstrate the effectiveness of the installed trip set points, taking the aging impact into account.

And as a matter of fact, the licensees went back to the existing NOP methodology which is referenced in the safety analysis reports, including effects of aging and demonstrates that actually the trip set points are still effective.

However, the aging manifests itself in reducing the safety margin by approximately 1 per cent per year. If we projected three years ahead, we still have sufficient safety margin. But beyond that point, we don't know currently.

MEMBER VELSHI: I would like to

hear from the licensees on what their thoughts are on where this is at and where it is going please.

MR. MANLEY: Robin Manley, for Ontario Power Generation.

First off, I would say that, as Gerry Frappier said, the current operation of our stations, using the existing methodology, is safe, that the existing trip set points provide a good safety margin.

As was already pointed out, the old NOP methodology is very conservative. The new methodology, the improved methodology that we and our partners have developed over the last number of years, this E-NOP, has been extensively reviewed, independently reviewed, it is technically sound and in many ways it is superior to the old methodology. And it also will provide for safe operation of the plants.

Perhaps I am quibbling slightly with the language. I would say that we have in fact been converging, but we aren't completely converged. There is, as pointed out, still work to be done.

Many of the questions that have been raised over those years of independent review have been addressed and further, what I guess I would call enhancements, have been made in the methodology. So that what is on the table today is not the original E-NOP. Changes were made partly as a result of CNSC input, partly as a result of input of the independent technical panel, Dr. O'Hagan and others.

We understand CNSC Staff continue to have questions about application of the methodology, and we continue to work with the CNSC Staff to resolve those. In fact, you know, there is a meeting scheduled for around the end of October to go through in detail the last round of Staff comments.

We expect that we can answer many of those already. And it is likely that there will still be some further questions to answer after that, and we will do so.

So we are confident that we can come to a resolution of those questions and that we will satisfactorily address the remaining questions and that we will be able to implement this methodology more fully in the future.

Frank, do you want to add anything to that?

MR. SAUNDERS: Yes. Frank Saunders, for the record.

It is our view that this methodology is in fact ready to use. We have been using it at Bruce since 2005 with modifications as we go along.

And we fully expect at the next meeting to actually provide the justification and the safety criteria to support official use of this approach.

It is just important to note that when you change philosophies and change approach, it does take some time to get everybody on the same page and understanding it. But our experience with this is it is very accurate, it actually predicts very well what to expect. And in fact, it has been a helpful/useful tool as we have gone through it.

For example, it did show us that certain flux shapes -- and when I talk about flux shapes I am really talking about the distribution of nuclear power across the core, that they are more prone to problems with this and others. And we took actions three or four years ago to actually limit the flux shapes in which we operate the reactors to make sure that we don't get into areas where there is possibility of problems.

Likewise, both with us and OPG have developed through 37M fuel which in fact is intended to improve the cooling capacity of the fuel bundles in the aging conditions that were discussed. And these two factors also need to get wrapped into this in terms of the safety case.

So it has been a very long journey. We think it is time to conclude this one and we believe we are in a position to do that. We will present that evidence when we have this next meeting.

We were asked to provide some additional field measurements versus actual calculations, and we are going to do that. But we think we have really reached a point where we need to make a decision on this particular approach.

MEMBER VELSHI: So my sense is that maybe after your meeting at the end of October it may be clearer, is the E-NOP methodology something that the CNSC feel confident in and that it just needs some fine tweaking or should you be embarking on a parallel path?

I am sure we will betting more

updates on this issue. So I will wait for the next round for follow-up questions.

THE PRESIDENT: But somewhere along the line I would like to have a little bit more definitive answer. You have been looking at this now for 12 years. Do you fundamentally believe that this is a no-go? It is eventually -- you should cut the cord and move on to a new approach, or do you believe it is still doable, as we have just heard from the licensees?

MR. FRAPPIER: Gerry Frappier, for the record.

So certainly the one that was presented 12 years ago wasn't a no-go. As industry has indicated, through the review stages that we have gone through they have made some changes, they have made some improvements, they have another set of improvements that they have made.

So can this methodology be put into good enough shape to be used as the primary methodology for determining trip set points? Myself personally, I am still unsure, but it is quite possible.

The way it is being used right now

from a regulating perspective might show part of what the end gain might be, which is it is very useful to give us an indication what the trip set points might be. And then we can use other methods to say if those were the trip set points, do we guarantee things are going to be safe and the shutdown system is going to be effective?

So we might still need to have that add-on sort of certainty. But we are very anxious to hear what industry has done with respect to the last round of comments we have had.

But I don't want people to think that this has been the same thing stagnant for 12 years and we are just arguing back and forth, as was indicated.

Based on the better understanding that everybody is getting with respect to this methodology, changes have been made to the methodology itself, some of them significant, some of them less significant. And that process will probably continue no matter what.

THE PRESIDENT: Let me ask you, I don't know if it is a reasonable question. What is the gap between the way the set points are set now and what we predicted? How far apart are you?

Is that a reasonable question to ask?

MR. FRAPPIER: No, that is a very reasonable question to ask.

I think if I can paraphrase what you are saying, what is the installed trip set points currently versus the predicted E-NOP trip set points?

THE PRESIDENT: Right.

MR. FRAPPIER: Michel, I don't know if you have those numbers with you?

MR. COUTURE: Michel Couture, for the record.

If you are talking about what the E-NOP is predicting and what is currently installed and has been approved for the next three years. In the case of Pickering there is significant margins between the predicted E-NOP and what has been installed. For the Darlington case, the Unit 2 is very close to the predicted -- the installed and the predicted.

What adds some margin is the new fuel, it adds about 2 or 3 per cent above the installed.

In the case of Bruce Power, similar situation for Units 3 and 4; what is being predicted and what has been installed is very close, but they also have the new fuel coming in at 3 and 4, and they are not taking credit for it, so that adds some margin.

For Bruce B Unit, well, the Bruce B Unit still has some margin, significant margin between the calculated and the installed.

THE PRESIDENT: Okay, thank you.

MR. FRAPPIER: Gerry Frappier.

If I could just add, because a couple of times we mentioned new fuel. And just to again provide some comfort to the Commission. So we have been talking about E-NOP, and it is an important aspect of the aging management strategy for the utilities. But it is not the only thing they are doing.

And over the past few years they have designed some new fuel that I think we have briefed you on as well, the 37M fuel, and that does provide, absolutely guarantees some improvements with respect to the subject area, if you like, that we are talking about, cooling.

The industry, you know, as part of their safety culture and being conservative, at this point in time they haven't -- when it comes time and installation of these trip set points, they are using the E-NOP methodology as if they had the old fuel. Whereas in fact the new fuel is in place or at certain reactors, and that is improving the situation for sure, we all agree on that.

So again, there is some margin there that allows us to be confident about the safety of the reactors right now.

THE PRESIDENT: Okay, thank you.

Dr. McEwan?

MEMBER McEWAN: Thank you, Mr. President.

So this was largely going to be the direction of my question too. But can you help me understand a bullet on slide 27?

Because, I mean, what I read in the CMD is that E-NOP is sound, has the potential to provide a practical solution, no fundamental flaws, some concerns.

And then I read this second main bullet on slide 27 which says, "Complete the development of a new NOP methodology."

So are you asking for an N-NOP or is this a confirmation of the E-NOP? Because it seems to me unreasonable in 15 months to develop an entirely new methodology that is still not complete for this one over 15 years.

DR. RZENTKOWSKI: The objective behind this bullet was to open the door for maybe more innovative thinking. It is because it appears that we are in the impasse situation right now.

And even going back to the old methodology, one can still improve the existing methodology, using the aging calculation as well, in order to demonstrate the effectiveness of the installed trip set points. This is one way to go.

The second way to go of course is to complete the development of the EVS methodology. But the question is can we do it on time? Can we do it by 2016? So "A" could be eventually replaced by "The". To manifest that this is in fact related strictly to ENOP.

But I wanted really to open up the door for more thinking, more innovative approaches, because not necessarily -- the development of a new methodology has to be very long, as long as this new methodology is based on the existing one, which is referenced for years in the safety analysis report.

MEMBER McEWAN: I think that makes sense. But to me, this is a shell, not a possible path.

So does industry have any comment on that?

MR. SAUNDERS: Yes. Frank Saunders.

We do not intend to develop the new methodology. We have the one we like and we are going to go with it, and we believe we can justify the safety case based on that.

There may be some methodology in terms of how you use it that gets adjusted, and I think this is probably more what we are referring to, is how you actually use the E-NOP, and the set points may have -- there may be some variability in how we do that.

But it is too late to come up with a new methodology in terms of anything as comprehensive as what we currently have. It is not a possible task.

But there may be ways that we can build some conservatism into how we do the set points that will satisfy everybody, and that we will consider of course.

THE PRESIDENT: Too late? So that raises another question. Is that if you proceed to refurbish both Darlington and Bruce, and Pickering is on its way to a shutdown, are we not talking about a theoretical debate here? Because by the time you do the refurbishment aging is not a big issue.

MR. SAUNDERS: Well, that would be true. But that wasn't exactly the point I was trying to make. I guess what I am trying to say is it took us 10 years to get to this point. To do it again in a year and a half is very unlikely.

But eventually, as you refurbish, this becomes a less significant issue obviously.

MR. FRAPPIER: Gerry Frappier for the record.

As you were just mentioning, if you refurbish of course this problem goes back to time zero sort of thing, and so there is other aging issues perhaps with the rest of the plant. But this particular problem would be resolved.

However, whatever the refurbishment plan ends up being, the actual sort of delivery of that refurbishment is going to take several years, you know, like 10 years.

And with the current aging that is occurring in the reactors, it is going to be pretty close. Like I said, right now we know they are good until August 2017 with the current trip set points installed.

What happens after that, as Dr. Rzentkowski said, is that trip set points start getting lower and lower, and at some point it is going to no longer be acceptable to be running at full power. And whether you can get your plant refurbished before that time comes is a question mark.

But at the same time, from a regulator's perspective, there is obvious courses of action here that can be taken to keep the reactors safe, perhaps producing less power than before.

THE PRESIDENT: Okay, thank you.

Monsieur Harvey?

MEMBER HARVEY: Merci Monsieur le Président.

Having been here four years, so it is not the first time I see that, and I will not ask the same questions that I probably asked the other times.

But I had the same concern, and this about the no less protection. You are developing something and saying no less protection. And I don't like too much that concept, no less protection.

I agree that with time we have got to take advantage of new technology and use it. I mean, it is okay with time, it is correct.

But the benefit coming from those technologies should as well come on the safety side and on the economic side. So how, in your study, you can evaluate that and coming to the end and saying we have got some benefit on the security, on the safety side?

Is it possible or you just have to say no less protection? Which is a concept that -- we had the same thing on the St. Lawrence River when we got the study on the Great Lakes for the high levels. We were trying to find a new plan to operate the damns and the initial concept was we tried to find benefit with no less protection downstream, and we were downstream in Montreal.

So this is why I don't like that term here.

MR. FRAPPIER: Gerry Frappier, for the record.

So perhaps the term could be improved, but the concept here is that the shutdown system must be effective. That's the safety criteria, if you like, and we are not going to move from that criteria.

So I think the language that we're using there maybe could be improved, but basically, the idea is we know what we need for safety, we know what we need for that shutdown system to be effective. We want it to be prevention of dry-out, as we were talking about.

If you are preventing dry-out, you are going to maintain the integrity of your fuel and the integrity of the pressure tubes, so that would be our definition, if you like, of the criteria of safe.

I don't think there's any intent to try to be safer than that because that is safe. You're not going to damage your fuel.

So what we mean in the presentation here is that, from our perspective, what we're looking at is if there's some new innovative analytical methods, if there is some improvements in things like fuel design, you know, we're very supportive of innovation as long as safety has not been compromised at all.

Sometimes it makes for improvements in safety. For instance, the new fuel is an improvement in safety. And sometimes it just maintains that level of safety.

And as long as we're still preventing dry-out, then we're confident that the shutdown system is effective of doing that, then that's sort of where we stop, if you like, as far as saying then, as far as we're concerned, the approach is satisfactory.

MEMBER HARVEY: Okay. Thank you.

But right at the beginning when you mentioned over-conservative, when it's over-conservative we've got over-protection, so just the point that if you abandon that over-conservative, you do it -- I don't want you to do it to be -- au prix de la sécurité.

DR. RZENTKOWSKI: But over-protective in this particular case is not a good thing because during normal operation, the reactors will trip during standard refueling operations because the refueling would cause a flux spike, and the flux spike would trigger the shutdown system or regulating system actions, so that's something that needs to be avoided.

That's the reason why having a good tool which can precisely predict where the trip set point should be is very important not only for safety, but also for operation.

Operational safety is also important to us because we don't want to have those reactors tripped. This puts a lot of stress on the system and, as a result, the safety is being compromised.

So we have to be aware of that.

MEMBER HARVEY: Merci.

THE PRESIDENT: Thank you.

Mr. Tolgyesi.

MEMBER TOLGYESI: Mr. Frappier, you were saying that with refurbishment trip set points are not of concern once it's refurbished. Am I right?

MR. FRAPPIER: Gerry Frappier.

Yes, that's correct, in the sense there's not concern -- they're still important to understand, but there's so much margin to the trip set point that it's very easy to have installed trip set points that are below the NOP calculated trip set point.

MEMBER TOLGYESI: So at what point of the reactor life these trip set points are coming on stream, one, the importance getting high that we should consider that we cannot, you know, go by?

MR. FRAPPIER: Gerry Frappier, for the record.

So the aging, of course, starts immediately, but with the -- with a new set of pressure tubes, if you like, the calculated trip set point is far away from what the operators have in practice in the field.

So you're starting your aging process and, eventually, it's going to become something that is an operational concern, if I could use that word. But that takes decades.

So as you see right now, we're starting to get into the problem in a significant way with respect to Pickering, Darlington, Bruce, but they've been operating for a long time.

So there are things that you can do along the way, as I mentioned, that rejuvenate key parts of the heat transport system so that this delays the effect.

There's also a slight difference between different reactors designs, different properties of the metal, so it's something that has to be watched all the time. But it's -- once it's refurbished, it's years and years before you have this sort of problem again.

MEMBER TOLGYESI: So --

DR. RZENTKOWSKI: If I may add a little bit to this response. Greg Rzentkowski, for the record.

I want to make sure that we understand that we are not flying in the dark because by monitoring the changes in the inlet header temperature and outlet header pressure, we know exactly what is the impact on the trip coverage. With the aging of the heat transport system the inlet header temperature and outlet header pressure will go up, and we know what is the limiting value when those two parameters will start affecting the trip coverage.

MEMBER TOLGYESI: So could we say that these trip set points concerned could eventually shorten the life of reactor and probably consider earlier refurbishment?

MR. FRAPPIER: Gerry Frappier, for the record.

So that's a business decision that business has to make.

So what we can do is ensure that the reactor is always going to be safe, and that's going to be -- that's the requirements, if you like, of the regulator.

Whether industry decides to do refurbishment earlier or later, as I mentioned, there's other operational things they can do to ensure that all the safety requirements are met, both from a maintenance perspective or from an operational constraints perspective up to and including de-rating sort of solution.

So there's lots of solutions available. Which one a particular licensee wants to take is -- really becomes a business decision of theirs.

MEMBER TOLGYESI: Do you have any comments, Mr. Bruce?

MR. SAUNDERS: Yeah, Frank Saunders.

Yeah, this issue is not likely to be a life-limiting issue in reactors. I mean, what we're talking about here is essentially the pressure tubes get a little larger in diameter with age and so a little -- you get a little bit more water going around the fuel rather than through it.

And that's really -- and that reduces the cooling of the fuel, obviously, slightly. And that's really the effect that we're talking about here, is that there's a little less cooling as reactors get older and, therefore, you know, an increase in power starts to have an impact sooner.

The new fuel design is intended to offset that, right, so that, in fact, it doesn't have an issue. But -- so this issue is not likely to be the life-limiting issue in reactors. Many things which will eventually cause you to refurbish your reactor and -- you know, but this one is not likely to be that.

I think I should point out as well because we haven't talked much about it and I'm just worried we're leaving a perception here that may not be correct.

In all of these parameters that trip on the reactor, there's multiple coverages, so typically, for any trip parameter, any trip situation or safety case, we'll have two parameters on the shutdown system one and two parameters on shutdown system two which will actually protect against that.

And that is the case here, too, for mostly all of it. So if you talk about increase in reactor power, you will see that in pressure and temperature and in the steam drum temperature and pressure.

So anything that causes a bulk increase in reactor power, whether it's a slow loss of regulation or a fast loss of regulation, will show up and has coverage in many places.

The issue we talk about here, the one that is kind of -- you know, makes this one a little bit more important, is, really, this notion that within our larger cores you can have higher power in one area and lower power in another and, therefore, your bulk reactor power may look pretty much the same but you've got an area of the core that's operating at higher power and the like.

So the kind of concern or damage that we're talking about here is relatively limited, so we're not really talking about, you know, major disassembly of reactors and so forth. We're talking about protecting damage to fuel, essentially.

So this is the area where most of this discussion is really happening, and it's why we did things like change the operating parameters of the reactors so they can't operate in certain flux conditions and so forth, so to keep you out of those kind of circumstances.

So I didn't want to leave the impression with people that, you know, this is the one and only thing that protects you in a reactor. There are many trip parameters that actually achieve that.

But of course, you want all your trip parameters to work, so that's why this discussion is going on.

THE PRESIDENT: Okay. Any other questions?

Dr. McEwan.

MEMBER McEWAN: Sorry. Could I ask just maybe two more questions?

On page 9, item number 3, you say:

> "The inherent limitations of generic benchmarking mean

> that encouraging performance and benchmarking in tests may not hold."

So -- no, sorry. Page 9 of the CMD. I'm sorry. Item 3.

So what I read that to say is although we do benchmarking, there are limitations with that ,and the results of the benchmarking aren't helpful.

Is that a correct reading of that, or overly simplistic?

MR. FRAPPIER: I'll ask Michel to provide some additional things, but I think it's important to understand that the benchmarking concept here and a lot of the analysis here, we're really in what I would call mathematical space, if you like. So we're taking a look at statistical analysis, ability for certain statistics to handle different kinds of uncertainties and that.

So it's not like a physical benchmarking in the sense of a hard test.

So one of the key concerns we have is you can be very mathematically self-consistent with all your -- with all your rules and all this stuff, but it doesn't represent the reality of a reactor. And that's one of the key things that we're looking for.

So what we're trying to say here is you can do benchmarking and the benchmarking can come out looking very, very good, but you're still going to have to make sure that your -- that that mathematical application works in real life because it's got to work for the reality of an actual reactor.

But maybe, Michel, you can add to that.

MR. COUTURE: Yes. Michel Couture, for the record.

The benchmarking tests that were conducted had two components to it. One was we used very simple cases for which we knew the solution, so these were not NOP -- the real application.

So we started the very simple where we actually know the answer and we -- and there was a number of criteria that had to be met by these tests. And most of them were met.

They did provide some indication, perhaps, of some problems. And then we graduated to further tests that started to be more physical.

But the final one was a so-called NOP, but reduced in complexity because there was no way we could do the full NOP problem.

So what our consultant informed -- or told us, and that's the -- one of his conclusions is that you would have to do further tests, try to figure out tests that would test more and more the real problem.

So maybe your simple cases meet all the criteria, but it's possible that when you go to the real problem, you will realize that certain criteria are not met.

So we haven't figured out what could be those tests, and we'd probably need some input from our -- from experts for that.

But that's what it was meant. It's not sure that the good result that you get for these simple cases will remain for the more complex.

MEMBER McEWAN: Thank you.

And then just --

THE PRESIDENT: Before you leave, on the same page on the same benchmarking, I always get stuck when somebody said to me that we did the modelling and we found some counterintuitive results.

So this is a more fundamental question.

This is a statistical analysis, and you know with statistical analysis we always have those plus or minus. I don't care if it's one percent or .01 percent, you've still got the outlier.

So is that where you guys are really struggling with the uncertainty of the statistical approach? Because I don't know if they're deterministic kind of counter to this.

You'll never take away the, you know, statistical methodology, some of the plus or minuses.

Is that the showstopper that's preventing us from moving forward on this?

MR. COUTURE: Okay. On the -- what you mentioned, we refer to them as paradoxes.

For instance --

THE PRESIDENT: Don't like paradoxes.

MR. COUTURE: And yes, these are -- these could be -- if we have identified some paradoxes where the more uncertainty you have, for instance, about a certain parameter, whether it's a detector reading, you end up having higher trip set points.

There were cases like that.

These need to be further discussed, and these could be a showstopper because this is from the engineering point of view if it doesn't make sense. We don't care about all the sophisticated mathematics because -- and there's a point that is important to mention.

The fact that it is statistically and mathematically correct is absolutely necessary, but it's not sufficient because your mathematics may not capture parts of the reality.

So your -- the mathematicians will always make sure it's consistent, and our consultant and the previous report consultants or the independent panel did confirm consistency of the mathematics and the statistics.

But these examples that you mention has triggered further discussions, and they will continue to try to resolve and find a root cause.

And there may be an explanation to this related to when they're combining uncertainties because your NOP equations have a number of parameters.

Each parameter, if you knew it with certainty, you would have certainty about your trip set points, but each parameter comes with uncertainties. And that's why you need a statistical approach, to cover all these uncertainties.

And the -- while they're combining the uncertainties, we finally understood that there was a correction being made because they're combining the uncertainties and it's seen as overly conservative in combining.

So there's a correction going on, and there may be a reason why the problem that you mentioned, the ones that don't -- that are paradoxes maybe are rooted in this correction that is being made. Could be in the wrong direction in some cases, which would give you sort of an answer that doesn't make sense.

But this is still under review and this part we really fully understood it, relatively recently, that there was actually corrections going on.

From the statistics point of view,

we were told -- they call this noise reduction. From the statistics point of view, we were told that this is perfectly correct. They do this all the time.

Then the question is, fine, if you do it from the statistics, that is statistically correct. The question is, is it suited for the application, the application being NOP trip set points.

So that's one area that we will be looking into which may, actually, explain some of these paradoxes that you're mentioning.

But the paradoxes themselves could be a showstopper. If we cannot make sense of them, that's where it stops because then you can have something concrete.

THE PRESIDENT: I just assume that your paradoxes should be the same paradoxes that the industry will be facing, so presumably you have something to discuss and try to understand. They should have the same concern as you do about solving some of those equations.

MR. COUTURE: I can assure you that the meetings that are coming up, paradoxes will be fully discussed. That's one of the points we'll be looking into.

THE PRESIDENT: Thank you.

I interrupted you, Dr. McEwan.

MEMBER McEWAN: So this is just a use of English.

The last sentence of the CMD, the implication of that sentence is that industry have, up until now, been dragging their feet. And is that, in fact, the intent of this sentence, and have they?

MR. MANLEY: If I may respond to that. Robin Manley, for the record.

No, we wouldn't say that that's the case. I think we've been attempting to address the CNSC's questions expeditiously and we've been putting a lot of resources into it.

MR. FRAPPIER: Gerry Frappier, for the record.

That was certainly not the intent of the paragraph. Now that you mention it, I can see how it could be read that way.

We've had a good working relationship with industry. They've provided us timely responses both to the questions and, as I mentioned earlier, to our requirement for data so that we could do our own analysis and research.

I think it's -- the intent there was more lining up to that we're getting down to a few difficult problems that I think once they're resolved one way or the other, either resolved or not resolved, we'll be able to come to a conclusion.

MEMBER McEWAN: So maybe modulate it slightly as a final version.

THE PRESIDENT: M. Harvey?

MEMBER HARVEY: One quick question.

My question is how and how often are tested those shutdown systems?

MR. SAUNDERS: Yeah. It varies on -- the shutdown system is not one system, as you might expect. The rods and the SDS 2, the poison, are one piece, but the shutdown system is activated from many, many parameters, everything from pressure to flow to temperature differential to steam. I mean, it goes on and on. And there is an actual very rigorous testing program that tests.

It's also built on a three or four channel concept, depending on which parameter you're talking about, so you can actually take a channel out, fail it safe and test it. And we call these safety system tests, and in your annual report, you list all these in there about, you know, any times we're late or any of that sort of stuff.

So there's a very rigorous program that tests it all the time, and there are reliability targets that need to be met, so if, in testing, it fails and the reliability starts to drift, there's also a quarterly reliability report that comes to CNSC that demonstrates that we continue to meet the licence requirements for reliability on that system.

MEMBER HARVEY: So you can test the system while in operation.

MR. SAUNDERS: Yes, that's correct.

MEMBER HARVEY: Okay. Thank you.

MR. FRAPPIER: Gerry Frappier, for the record.

Just to add to what was said, so it's not just one test. There are many, many tests that take out different components. And as Mr. Saunders was saying, there is a pretty rigidly controlled set of inspection routines.

Some of them are very often, and some of them are a little bit longer. All of those get reported to us both from the perspective of the results of tests, but more importantly as to the fact they demonstrate the reliability of the shutdown system as meeting targets.

THE PRESIDENT: I just have one question.

You mentioned that we have read historically there was loss of regulation. You're talking about in Canada. When and where, how often? What's the history of this?

MR. FRAPPIER: Gerry Frappier, for the record.

I'll have Dumitru give you the details, but yes, there has been both LOR type events -- and, again, not that they wouldn't have been predicted. That was the entire purpose of these systems.

And of course, shutdown system trips for -- sometimes it's a little bit difficult to decide did you have an LOR event or was there something else that caused the trip. As Mr. Saunders says, there's lots of things that can result in a trip.

But Dumitru, maybe you could provide us some detail.

MR. SERGHIUTA: Dumitru Serghiuta, for the record.

First of all, I'd like to clarify that the concept of LOR is a postulated scenario for analysis of design basis and also for safety analysis. Such is quite stylized and may be significantly different from what may happen in the real life.

Looking to the real life, we are typically talking about potentially initiating events, which are the malfunctions or failures in the system and components. In this particular case, it is about failures of the reactor regulating system.

Now, the reactor regulating system is designed with redundancies such that it can detect by itself if there are failures to certain components and the system itself can take care of that. That is the purpose of the function of setback and step back which were already mentioned.

Now, historically by the time of Pickering A, and that would be in the early 70s, there have been a significant number of LORs, a couple per year, and that was because of the limitations of the initial design of the reactor regulating system. The lessons learned from that experience led to significant improvements to the reactor regulating system. So those occurrences have been significantly reduced. And that was what led to the requirements in the CSA standards on requirements for a reactor regulating system which says the target of 10 to minus 2, for that means 1 in 100 years, for a total failure of the reactor regulating system.

Now, as it was already mentioned, in real life operation there have been a couple of events, including in Canada, that led to the activation of the shutdown systems and the potential initiating event was related to failures to the reactor regulating system. One that I am aware of it happened in 2005 at Bruce. It was a failure of the leaking zone controller system leading to erratic draining and floating of the compartments, which eventually led to a reactor shut down in about 15 seconds.

However, it was clear that that event could have been safely terminated also by the setback, which however was relatively slow. So that is why what came first was the shutdown system. So concerning the definition of a serious process failure in the LOR, it is something that is subject in that case to potential confusion, whether it was an LOR, or it was just an initiator that hadn't progressed to that point where you had a clear failure of the entire RRS.

The most recent event that I'm aware of, I think it was in 2012 -- 2011 at Darlington, Unit 2, when an adjuster went out of the core inadvertently. In that case the event was terminated by operator action so there was no need for the shutdown system action. But, again, it is a type of failure related to the components of the reactor regulating system so they may fit to the generic definition of loss of regulation event.

THE PRESIDENT: Okay, thank you. Anything else?

Okay, thank you. Thank you very much.

MR. SAUNDERS: I just want to say we don't agree. There was no failure in 2005. It was clearly determined not to be that.

THE PRESIDENT: I'm sorry, I missed it. So what was the --

MR. SAUNDERS: It wasn't a loss of regulation failure. Certainly we had a problem with the liquid zones, but the regulating system was still operating. So it depends on how you want to define it.

The only one we have actually had at Bruce was back in '92 and that was actually on operator error where they inadvertently forgot to take a dumping signal out so the regulating system wasn't actually on, so to speak. So yeah, that was a failure of the regulating system, but it was an operator error on start-up which was detected.

The system actually operates quite reliably. You know, occasionally you will have component failures in the system, but that is not the same thing as a complete failure of the regulating system to control the reactor.

THE PRESIDENT: What I take away from this is regardless of whether it was loss of regulation or something else, the defence-in-depth worked and the machine shut down so we hadn't had a catastrophic result in Canada as a result of that. So that may give some more flexibility in terms of the risk design, if you like.

MR. FRAPPIER: Gerry Frappier, for the record, and maybe just to wrap up the comments here.

So as Dumitru was saying, loss of --

an LOR event is part of the design toolbox and the current review from a safety analysis, so we just assume the whole thing is gone.

So that's -- yeah, we don't care if it's partially gone or not, just assume the whole regulating system is no longer functioning; show that the reactor is still going to be safe. That is sort of the analytical part.

In reality you don't actually get that other than perhaps if you have a human operator who doesn't turn it on. But you have different bits and pieces that fail. I think the point is that it is maybe a bit of semantics whether it's an LOR or not. The key point here is that the shutdown system is available -- two shutdown systems, I would remind us.

There are lots of different trip parameters that can trip either the shutdown system or the regulating system, including the operator can take action. And so there is quite a bit of defence-in-depth here, a lot of defence-in-depth.

And we can argue for a long time as to what we want to call that event, but the key point here is within Canada we have had initiating events that required NOP to activate, and certainly shutdown systems activate, but they have proven themselves that the design is sound and that it can handle these sort of events without causing any concern from a safety perspective.

MR. MANLEY: Robin Manley, for the record.

Just to respond briefly to that, we would agree that plenty of defence-in-depth; multiple ways to make sure that the reactor remains safe. And I would hesitate to say that it is semantics to say whether or not this is an LOR event or not. I mean an LOR event is, you know, a significant event. We would certainly treat it seriously.

And certain initiating events that may occur that don't require an NOP trip, you know, whether one would say it is an LOR event, I'm not sure that I would agree with that. But certainly the fundamental point of we have multiple ways of ensuring the reactor is maintained safe and we do maintain it safe, that is true.

THE PRESIDENT: Okay. Thank you. Thank you very much.

The next item on the agenda is a technical briefing on seismic safety of the Canadian nuclear power plants and the national research Universal reactor, better known as NRU, as outlined in

CMD 14-M65.

I understand, Mr. Frappier, you are still with us on this one.

***CMD 14-M65**

Oral presentation by CNSC Staff

MR. FRAPPIER: Okay. I think we are ready there.

So again, thank you, Mr. President and the Commission for allowing us to provide some update and some technical perspective on an item that has come before the Commission many, many times and that is seismic safety with respect to our reactors.

So for the record my name is Gerry Frappier. I am the Director General of Assessment and Analysis and with me is Mr. Andrei Blahoianu, who is the Director of Engineering Design Division and George Stoyanov, who is a specialist within the division.

As a common cause initiator the seismic hazard is one of the most significant external hazards contributors to the overall risk of nuclear facilities. This became evident after recent occurrences in Japan, the Fukushima one which we all know about in 2011, and I would remind people of the

Kashiwazaki-Kariwa in 2007 which was also a major earthquake incident in Japan. The latter one, Fukushima, as we all know, culminated in a severe nuclear accident. The first one did not.

Subsequently the whole international community decided to initiate, among other things, a comprehensive review of all aspects related to seismic safety of nuclear installations and to provide guidance with regard to the improvement of the performance of existing as well as the new nuclear installations with respect to seismicity.

This presentation aims to provide insight on how the CNSC staff overview and assess the licensed major Canadian nuclear facilities such as CANDU nuclear reactors and the NRU with regards to seismic safety.

So just as a quick overview, we are going to talk a little bit about seismic engineering and some of the fundamental aspects of it. The evolution of the seismic safety requirements in Canada, and I would say in the world -- I think that peace is very important for some of the confusion that sometimes comes up with respect to the Commission because there is a time evolution issue here that needs to be understood -- the earthquake-related Fukushima action items that we have undertaken, the new initiatives envisioned to improve the seismic safety of Canadian nuclear power plants and staff outreach and international cooperation that is very important to this overall field. Then we are going to have a few summaries and conclusions.

So first, what are the fundamental questions regarding seismic engineering? We keep talking about seismic and certainly one of the first items and most important is: Are the nuclear power plants safe against earthquakes stronger than they were designed for? So we can all sort of take the stab that says they were designed for a certain level of earthquake. We know they are safe for those ones, but now of course evolution happens; questions, comments. So the questions we are getting more and more is: Are they safe against earthquakes that are bigger than the ones we were thinking of? What are the seismic safety objectives that we are trying to do? What does staff assess the seismic -- how does staff assess seismic safety, what is the basis for the seismic design and when do we need to do seismic re-evaluation -- and I will explain that in a minute -- and what methodologies are used for this type of re-evaluation?

So existing Canadian nuclear power

plants are prepared for beyond design based accidents or beyond design based earthquakes -- pardon me -- is an important concept.

The seismic design for CANDU nuclear power plants is very robust with a large margin. Design based earthquakes is defined with a high return period. Conservative assumptions regarding the seismic hazard are considered. Design construction manufacturing installations are all performed on a strict QA. That has been the case since the first designs were going on. It is still the case today.

The seismic hazard and its impact on the safety of nuclear power plants and the NRU are reviewed, assessed and addressed periodically as part of relicensing, as part of refurbishment and in compliance with REGDOC 2.4.2, which was formerly S-294. The existing plants -- all CANDU nuclear power plants and NRU have demonstrated the safety functions are performed for beyond design based earthquakes which are at least greater than or equal to 1.5 times the original design based earthquakes.

So if I could just stop there for one second and say -- so when these plants are designed we understand earthquakes as something we have to handle. So there is a designed based earthquake and that is very conservative at the time of the design. And as we mentioned, you create a very robust design around that.

We then -- as time goes on, people are more and more interested in what is going to happen for an earthquake beyond that. We have some engineering criteria that we use to demonstrate that plants are safe beyond the design based earthquake. You will see in a couple of lines that there is different criteria that we can use. But in general in all the cases one and a half times the original design based earthquake is the CSA standard that we should have.

If I take an example of Darlington, the site-specific peak ground acceleration, which is the measurement that the engineers are interested in, if you like, from what an earthquake does, is for the one in 1000 years, which was the original design, was .053. However, the actual facility -- if we go to the next slide -- the level earthquake below which core damage is extremely unlikely is .26 Gs, which is greater than the 1.5 times the design based earthquake.

You will notice we have changed the wording a little bit here. So a design based earthquake is one that the facility can handle and continue or restart operations, no problem. When we look at beyond design based earthquakes, what we are really looking at is getting a high confidence that there is a low probability of failure of the key safety functions. I will explain that in a few seconds.

The reason it's important to understand these differences is because often before the Commission you have intervenors that are talking as if the design based earthquake is the only thing that's important. I would argue that from a safety perspective the Heathcliff, as we call it, the HCLPF, is actually the more important thing, it is what is really going to talk to you about what size of earthquake can you handle without a safety concern. You may have a very, very big operational concern and, in fact, your plant may never operate again, but from a safety perspective you have demonstrated that you have a very high confidence, you are not going to have a safety issue.

Furthermore, I would like to point out that with respect to seismic there is a lot of defence-in-depth measures that are in place. There is an improved capability to withstand prolonged loss of heat sinks, improved capability for power supply and multiple sources of it, improved containment performance. There are added safety features that have been put into place for spent fuel bays.

We now have the whole concept of severe accident management and so we have severe accident management guides that are in place, onsite and offsite emergency mitigating equipment and a whole emergency preparedness that I know the Commission has -- a lot of attention has been paid to it over the past few months.

So from a seismic safety perspective what is the objective that we are trying to ensure? So to ensure that those structures, systems, and components important to safety are able to fulfil the following safety functions over all the lifecycles, and that is shut down the reactor and maintain it in a safe shutdown state, remove the decay heat during the shutdown and maintain fuel cooling, maintain the containment boundaries, control and monitor the plant. So that is what we are expecting when we are taking a look at seismic safety.

The steps in order to assess this:

We need to first of all assess the site-specific geological and seismic hazard. We will talk about that in a second.

We have to assess the adequacy of the seismic design, so the design itself.

We performed systematic seismic re-evaluation.

We use competent and continually trained staff and we use third-party reviews as needed.

We have also established a CNSC research program associated with seismic safety.

So first off the geotechnical aspects, if you like. So staff assessed the data and information within the site, local and regional areas related to the geological history and physical, chemical and mechanical characteristics of the geological formations, the structural geology and tectonics settings, the geotechnical properties of overburden materials and bedrock, the coastal geology, the erosion mechanisms and characteristics, the natural or human induced geotechnical hazards, natural or human induced seismic hazards, seismic induced hazards that are caused by -- the biggest one that people are talking about now being tsunamis and then other natural geological hazards that may be there.

So that's the starting point, which is you have to know what your hazard is. Then you can start looking at seismic design.

There are basically two design site-specific earth -- pardon me -- two design site-specific earthquakes are used for seismic design as follows. For structures, systems and components that are important to safety, you use the design based earthquake that we talked about a little bit earlier, which is an earthquake that has been estimated to have annual probabilities of occurrence of 1 in 1,000 years for existing nuclear power plants and for any new builds that would be built we would require one in 10,000 years.

For all the other SSCs, or structures, systems, and components, we use the National Building Code for a reference earthquake, and an earthquake that has been estimated annual probability of one in 500 years for existing buildings and one in 2,500 years for new buildings.

However, for seismic re-evaluation -- and I think this is one of the key components of the confusion that has perhaps been brought in by some of the discussions at licensing and whatnot on seismic safety -- re-evaluation is typically triggered when there is evidence that the seismic hazard out of sight is greater than the design based earthquake. You can't go back and change the design based earthquake, but if we find out that the actual geology of the area might produce a seismic event that is greater than the design based earthquake, then we would go through one of these re-evaluations to see what the consequence of that is.

We also require re-evaluation if a facility applies for refurbishment or if there is operating experience that shows some components need improvement, whether there is a need to address performance of the nuclear power plants for beyond design based earthquake, which could be something the Commission requires, or a new experience gained from occurrences of strong earthquakes elsewhere in the world and the effects it has had on buildings.

Next slide. So this methodology for re-evaluation I think is of key, and I would like to spend a few minutes on what that means, because there is a lot of terminology here that seems the same but actually is not and it is important to understand some of the differences.

So there are two major methodologies used for seismic re-evaluation and both are accepted by the CNSC and both are in the standards.

One is what's called seismic margin assessment. Within the seismic margin assessments there are actually two ways you can do it. One is the deterministic approach, sometimes referred to as the EPRI approach, or EPRI methodology and another one is using your probabilistic safety analysis, using that as a basis to undertake your seismic margin assessment.

So an SMA methodology requires a review level earthquake. So you decide, okay, it's no longer the design based earthquake. You say let's pick another earthquake value and you use it to be, of course, stronger than the design based earthquake. You can think of that as being a stress test, if you like, that we want to put the facility through.

This review level earthquake is used solely for benchmarking purposes. It is neither a new design level nor an acceptance criteria and this is one of the areas that I would suggest the public often gets wrong. The review level earthquake is not a new design requirement. It's not a new criteria. It is a level we have put way above the design based earthquake for testing purposes to see how the building is going to react under the analysis.

Now, the separate methodology that can be used is a seismic probabilistic safety analysis, which again terminology is quite different than saying a PSA-based SMA, which is the second one of the seismic margin assessment. The seismic probability safety analysis, which is what we are moving all of our licensees onto now, or all of our nuclear power plant licensees, is a much more complicated one and I've got some additional technical information on that, if you are interested in as one of the attachments.

So for example of the improvements of implementing and the increase in seismic safety, Pickering -- because I want to try to make this real for you as to some of the things that happen -- so at Pickering A the SMA was -- seismic margin assessment was undertaken, and based on that there was anchorages that were upgraded to prevent shifting, reinforcement of concrete masonry adjacent to safety-related equipment so that they wouldn't fall or hit or cause the safety-related equipment to malfunction, and the replacement of a number of components were done at the Pickering station.

If you take Bruce A, Unit 1 and 2 after the seismic margin assessment, there were design modifications to prevent seismic interactions between adjacent valves on flexible pipings that, since based on the analysis, those pipings could touch each other and cause a valve to mis-operate.

Some electrical equipment items and control panels required Anchorage upgrades. Several tanks and heat exchanger supports were upgraded to prevent sliding or overturning. So those are some practical examples of how you could have a design-based earthquake. You can then do your re-evaluation and determine that I can improve the performance of the building beyond what it's design based earthquake was, by doing not necessarily inexpensive, but doing some very practical things.

So the evolution of seismic safety requirements in Canada: Early builds used the rules of conventional buildings, basically the National Building Code with additional conservatism put into them because we didn't have standards for nuclear power plants. So NRU, Pickering A and Bruce A all were done under that regime. Their seismic margin adequacy was checked, however, late in 1990s and again early in 2000s, using the internationally-accepted methodologies of seismic margin assessment that we were just talking about.

Later builds used in-house seismic design guides that were developed by then, which were the seed documents that were used to become future CSA standards. So Pickering B, Bruce B, G2 and Point Lepreau came out of that approach.

The Darlington facility was seismically designed following CSA standards. So by the time of Darlington we have actual CSA standards for seismic engineering for nuclear power plants and they were used. So seismic safety requirements in Canada are revolving in order to account for new information on site-specific geological and seismic hazard methodologies and experience acquired from strong earthquakes. And as time moves on, as you can see just in here, the design standards can evolve. That does not mean, however, that the ones that were designed to an earlier standard are no longer safe.

So changing subjects now and talking quickly about the Fukushima action items, the earthquake Fukushima action items went through three broad areas, one on strengthening the reactor designs -- excuse me -- defence-in-depth.

Licensees should review site-specific seismic hazards, so all facilities are required to take a look at the geology of their ground in a more site-specific way.

Licensees are to re-evaluate if the current site-specific design protection for each external event assessed as required above is sufficient and if there is gaps produce a corrective plan. So we have required all the licensees to take a site-specific most modern view of what the hazard is and compare it to what you have decided you were accepted to and if there is any gaps we expect some kind of plan to reduce that.

We have also improved the regulatory framework processes. We have done revisions and amendments to specific regulatory documents with direct links to seismic qualifications and NPPs and brought them up to standards or up to modern requirements, and we have worked with the CSA to improve the CSA standards and, in fact, to develop the new N1600 that I know you are familiar with for emergency management at nuclear facilities and it also has a seismic component to it. So I was saying it was being developed. In fact, Andrei has just reminded me it was published in May of this year.

So new initiatives envisioned to continue with the improvement of seismic safety in Canada: Both my directorate and Greg Rzentkowski's directorates are currently working on developing explicit licensing requirements for the maintenance of seismic qualification of nuclear power plants we have.

Completed procedures for type II inspections for verification of nuclear generating stations seismic design basis. We are going to be starting that with Darlington, March 2015. There are new license conditions requiring the maintenance of seismic qualifications of SSCs as per the requirements of the CSA Standards addressing this topic and those we are expecting will be implemented in the second quarter of 2014.

Of course Canada, and certainly the eastern part of Canada is not the hotbed of earthquake research or earthquake engineering even and so it is very important for us to maintain our out links or outreaches to the international community associated with this very technical area. However, CSA technical committees are an important piece as well, bringing home some of the information we acquire internationally and ensure that the Canadian Standards Association technical committees are as up-to-date as possible.

We were recognized for leadership within the NEA working group where we have been dealing with a lot of seismic aspects and the technical contribution to the IAEA's Seismic Safety Centre that is a fairly recent centre within the IAEA that has been created to look at external events, in particular seismic.

We continue to disseminate state-of-the-art-based information to staff, industry and the public, both through having lecturers come to provide staff with information, and also with respect to publishing results of the research that we have been involved in on our website.

So in summary, CANDU nuclear power plants and NRU were designed using state-of-the-art codes and standards and best international practices that existed at the time of construction. The seismic adequacy is continuously reviewed against updated seismic hazards.

The lessons learned from Fukushima accidents are being implemented at all nuclear power plants and at NRU and are incorporated within the CNSC regulatory framework in order to address extreme events and their combination well beyond the original design basis.

Staff participate in a leadership position in national and international fora established to address various aspects of protection against earthquakes, and staff ensure the dissemination of the state-of-the-art science-based information to Canadian stakeholders through various means.

Just before I move to conclusions, we have two attachments as I mentioned, that I'm not going to go through as part of the presentation. The first one is to provide more details on the engineering approach. Again, I don't want to put everybody to sleep with what all us engineers do, but with respect to seismic safety there is some more detailed information there.

And the second attachment, again to try to make this thing feel real is a series of pictures that I think are self-evident, but the pictures do help understanding how there are practical solutions that are used if analysis indicates that there is a need. So although we might have been designed to an older standard, we are continuously reviewing it. We are analyzing what the new standards would require and updating -- our industry is updating their plants and there are some pictures in there that I will show you some of the stuff that can be done.

So in conclusion, the Canadian nuclear power plants and NRU are safe with respect to seismic due to a robust plant design at the time of construction, extensive upgrades resulting from seismic re-evaluation of the seismic hazard, as well as the need to withstand earthquakes much stronger than the original design based earthquake and implementation of the lessons learned from the Fukushima accident.

So with that we are available for any questions that the Commission might have on this subject.

Thank you.

--- Pause

THE PRESIDENT: Okay. Thank you. Maybe we will jump right into the question period with Mr. Tolgyesi.

MEMBRE TOLGYESI : Merci, Monsieur le Président.

I will go to the part that you are not talking about, Attachment 1. You are comparing the three methods which is the PSA-based; SMA and they are deterministic and probabilistic, and the last one which is the SMA -- how do we call that -- SMA, the last one. Just a second.

So you are talking about seismic margin assessment which could be deterministic or probabilistic and you are talking about seismic probabilistic safety analysis. Now, in Attachment 1 you are talking about what is a strength and a weakness or a limitation of deterministic seismic margin analysis, but you don't talk about was that probabilistic also. It's a big difference between those two, because you are moving from deterministic to probabilistic and eventually to the SMAs, you know.

So what is the weakness and why are you moving? Because in the first case, as I said, you have strengths and weaknesses are limitations. You don't talk about the probabilistic and you don't talk about PSA either, what is the strength and are there some weaknesses, what we should consider.

MR. FRAPPIER: So, Gerry Frappier. I will give you a quick thing and I will ask Andrei to add

But you are right. One of the reasons is the deterministic seismic margin assessment is perhaps the oldest one and has been used a lot. It is still in the standards and it is the EPRI methodology that has been used lots of different places. We view that there is significant weaknesses to it and we are trying to move people away from it even though it is still acceptable within the standards. So that's, I guess, maybe one of the reasons we wanted to put some of its limitations that are actually very important from modern regulations, or certainly modern regulations like we have in Canada where we talk a lot about core damage frequency and some of these other parameters that you cannot get from that type of analysis.

With respect to what are some of the weaknesses on the other two, perhaps Andrei, I can ask you or George, whichever.

MR. BLAHOIANU: For the record, it's

Andrei Blahoianu.

I guess the slide 26 about the weaknesses or the strengths of limitation between the deterministic and probabilistic safety margin assessments are clear at this point. If not I can elaborate on this.

So the traditional or deterministic SMA has a so-called success past in which you look -- you select the number of components that are essential to ensure that you safely shut down the plant and would be able to ensure the cooling for 72 hours. This is the request. Meantime, assuming that another source of water will be connected to ensure the cooling.

Practically, you look at the capacity of each component and the weakest component, so the component with the smaller HCLPF, no capacity, dictates the HCLPF of the plant. So this is how the work is done.

But from a deterministic point of view it's yes or no. You assume that beyond this it will fail. The weakness of this is that you don't get an insight how an accident progresses and you look only at the very limited number of components.

Evolutionarily, it's the oldest method for assessment and it could be easily explained also, the use, because the computer capabilities 20 years ago, they were very limited and to perform a PSA-based SMA or a full seismic PSA was quite impossible.

Also, this is one methodology that engineers prefer to use because, as you know, engineers are still designing in the deterministic domain. So this is the thing.

Another other two limitations are the fact that you don't get -- you cannot quantify the safety goals in there, so core damage frequency and large early release frequency produced by earthquakes. You cannot get -- the method itself has limitation, you cannot get these important numbers. And it's not also -- that cannot coincide with simultaneous failures because, as I said, you have only an earthquake and you look at how components will fail and which is the weakest one, which gives the HCLPF.

So this I showed. I guess it's clear now the difference between the two methodologies. I will add another one, that recently the U.S. NRC provided indication that SMA are not to be used when we tried to address beyond design earthquake following the events in an accident like Fukushima, exactly because of this particular important LRF that I just mentioned that is not able to provide the sequence of the events.

You don't see how accidents progresses and because of this you don't know what we have to do to ensure that the components are operating.

Now, if it's about the difference between the PSA-based SMA and the seismic and the full PSA, seismic PSA, as we see on slide 29 the second bullet says that it, "Produces a quantification of the plant CDF and LRF through integration of the fragility curve with the seismic hazard curve."

When you do this seismic PSA you have curves for both. When you do the PSA-based SMA you have the full -- you have the seismic hazard as a curve.

But in terms of the fragility you look only -- you don't have a curve, you have just the number, which is the LCLPF of the components. So you have just a point of the curve. You don't have the full curve. Otherwise both methods are valid, are acceptable and, as Mr. Frappier mentioned, the old plants performed PSA-based SMA, or now they are required to move to the PSA or SPSA.

MR. FRAPPIER: Gerry Frappier, If I can just sort of wrap up a little bit.

So that's sort of the benefits, if you like, of going to a seismic PSA. Of course the main limitation, if you like, or CON against the seismic PSA is its level of complexity. So you now have a very good PSA around, you better have your computer systems that can handle that level of complexity, you better have your reliability data for your various components and whatnot so you can determine your fragility curves.

So from that perspective that is one of the problems with, let's say, a seismic PSA. We believe we have that information now with -- or the licensees have that sort of information and we can move forward with that kind of analysis.

MEMBER TOLGYESI: So did you compare for one site all three methods which will give you, you know, what is the confidence or credibility of one or another method?

MR. FRAPPIER: Gerry Frappier, for the record.

I wouldn't say we have done a comparison, because these are very extensive, very labour-intensive analyses, however, as we mentioned, we have had deterministic seismic margin assessments that have been done which are now being supplemented with seismic PSAs. But I don't know that we have done an actual comparison of the results. We view it more as a continuum of a continuous improvement, if you like.

THE PRESIDENT: But I assume it's not either/or. No matter what happened post-Fukushima you do the quick walkabout and do the deterministic look out and see the obvious situation where you probably need to beef up. So you will always do it deterministic on all analysis and then augment it with some of the safety analysis. Right?

MR. FRAPPIER: Gerry Frappier. That's correct. That's the approach.

THE PRESIDENT: Monsieur Tolgyesi, next one?

MEMBER TOLGYESI: The last one this round. When you go to your slide 10 you are talking about, "Staff assess the data and information within the site, local and regional areas..."

MR. FRAPPIER: I'm sorry, where?

MEMBER TOLGYESI: Slide 10 --

MR. FRAPPIER: Thank you.

MEMBER TOLGYESI: -- when you are saying that, "Staff assess the data and information within the site, local and regional areas..." you are talking about geology, morphology and whatnot. All these factors are influencing the site-specific peak ground acceleration, I suppose.

Also, they are influencing the design based earthquake factor, okay, and they influence also the high confidence in low probability of failure, because these calculations will depend -- or these factors will depend on what is the geology, what is the morphology, what is the location and the risks.

So they are related to the same basics and eventually you will come with different sets because you are saying I used that for design based earthquake or high confidence or you have another one which is in between, which I think is moving from this review level earthquake, review level earthquake. Minimum is a DBA, I will say, and it's going up to the high confidence, okay, so it is moving between those. And you do iterations when you calculate how the risk decreases as I'm going higher or increases when I'm getting close to design based earthquake.

MR. FRAPPIER: Gerry Frappier, for the record.

You said a lot of things there and mostly I would say correct.

So yes, as we explained on slide 10, it is very important to understand the nature of the hazard. The nature of the hazard, the geotechnical site-specific hazard assessment, if you like, it's very important to get what we on the engineering side really want, which is what is the peak ground acceleration that we need to be working for. You get a little bit more complicated than that because it's not just a point, you can actually get a spectrum.

Definitely that would be very important in determining the design based earthquake if we were going to go back to, you know, for a new build, for instance. That would be the basis upon which we would determine here is the design based earthquake that we must be using.

Once you move into the re-evaluations it's as you mentioned.   You are going to use that to ensure that your relative level earthquake is high enough to make sure that it's much higher than what the geologists are telling us is possible from an earthquake perspective. But the HCLPF, as we are talking about there, the maximum level, that will come out of your analysis. So it's not so much from this. It's going to be a little bit independent.

However, that review level that you have picked is going to have a big effect on what your HCLPF is going to be. But as you mentioned -- and the rest is exactly as you said. So when you are first building you are using design based earthquakes.

As time goes on you are going to be using various re-evaluation methods and that review level earthquake is what you really want to watch for, that it's always above what the geologists are saying is a potential because of course they have their own science that is evolving and learning all the time and you want to stay up to date with it.

I don't know if that answered your question.

THE PRESIDENT: Monsieur Harvey..?

MEMBRE HARVEY : Merci, Monsieur le Président.

Well, first I want to thank you for the presentation. I really appreciated mainly the attachment with the photo and everything. I think it would be very useful to put it on the internet and on our site because it helps to understand how a plant that has been built years ago could be brought to new standards.

My question would be, here in Canada I suppose those photos have been taken here in Canada in our plants and all those different equipment, those connectors, those valves and everything, what percentage of all that was there at the beginning and has been installed since?

MR. FRAPPIER: Gerry Frappier, for the record. That is a very specific thing, and I'm not sure if George or Andrei know the answer.

I want to comment on your first piece. So thank you very much for the comment on the presentation and we are in the process of putting it on the website. The CNSC Management Committee also came to that conclusion, that it would be worthwhile to make sure that it is more available so we are doing that.

The pictures are from CANDU sites. I don't know if we know the percentage of seismic equipment that would have been originally put in versus what has been done, so George, I think you --

MR. STOYANOV: For the record, George Stoyanov, Engineering Design Assessment Division.

So the majority of the equipment has been there from the beginning. Utilities do improvements, do upgrades as time goes by. But in terms of mechanical equipment, most of it has been there since the original design.

MEMBER HARVEY: I thought a part of it was new ideas and new -- so I am surprised.

MR. BLAHOIANU: I just want to be precise about your question.

So the seisimic support that you see here are supports that are existing in CANDU plants or could be seen in CANDU plants, are typical for CANDU plants. Not all of them are from CANDU, but they are typical, they are also from other plants like Cernavodă.

But they are typical. These are the kinds of supports that you find or you may find in CANDU plants.

THE PRESIDENT: Again, I am surprised. I thought that post-Fukushima, in fact the NRU, we know that some of the backup pumps, you remember those backup pumps that were not seismically qualified then became qualified? So I am sure they used some of this equipment to do this.

And I am sure that many of our operators, when they walk by after they reinforce -- I remember seeing recently that there was, in the so-called post-Fukushima action plan when they were talking about this north of $700 million refurbishment, I distinctly remember some seisimic reinforcement or some bolting down some emergency power.

Was I dreaming this or...?

MR. FRAPPIER: Gerry Frappier, for the record.

I don't think so. I think the item here is percentage, right? So as we mentioned, these were designed very robustly at the very beginning.

So there is lots of this stuff that you are seeing here in some of these pictures that were original designs and, in particular, let's say at Darlington. But there is many many changes that have been made over time since the original design to improve a seismic response. And I think that was the nature of your question, Monsieur Harvey.

We could get you some more details around here are some of the improvements that have been made over the years if that is of interest to the Commission.

MEMBER HARVEY: No, my idea was that when you think about an earthquake in the public, you think that the building would collapse and that is all.

And this is not the case. I mean, the worst -- it is just all that equipment inside the building that could move and could fall down.

So it is good for that? Is it showing that there is instrumentation and means to secure that equipment?

So I think it is very good, but I am surprised that all the equipment was there right at the beginning.

MR. BLAHOIANU: I just want to mention that the supports, seismic supports, are part of the inspection, regular inspection program of the licensees. They are doing daily -- they are doing so-called walkdowns, routine walkdowns. And also during the period of the outages, they are with the supports -- like numbers, for example, are checked that everything is in place, it operates as designed for.

MEMBER HARVEY: Because I remember we saw some photos in Japan when they had, not at Fukushima, but a few years sooner, they had a big earthquake. And then we see some equipment, they were not down, but they were not at where they were supposed to be.

Were you here when we had those photos?

THE PRESIDENT: That was the previous summer, not the Fukushima, the previous.

MEMBER HARVEY: But they had an earthquake right where it was quite near the reactor.

THE PRESIDENT: Yes, I know, that is the one --

MR. FRAPPIER: Was in 2007 and it is Kashiwazaki, Kariwa.

THE PRESIDENT: Kashiwazaki, right.

MEMBER HARVEY: Yes, that is right.

MR. FRAPPIER: And we did do quite a presentation because we were part of the IAEA team that was sent there to take a look at it about restart. And there was a lot of lessons learned over there.

And your point is well taken about the people think of structures. And so structures of course are the most dramatic thing that you see on pictures.

But if you want your shutdown system to work, if you want to maintain cooling, if you want to be able to monitor, you have to ensure that you have piping that has not fallen.

And of course piping, you can

imagine long strips piping in an earthquake, it is doing a whole bunch of moving, all of which can be calculated as to how much it is going to be and whatnot, and then you ensure you have appropriate supports.

And as we were mentioning in the presentation, some of the analysis that has been done more recently demonstrates that some of these pipes, yes, they are okay themselves, but in fact they might interact with each other and there might be valves that touch each other, in which case that alone could become a problem.

So once you have identified those, then you use these kind of techniques to make sure it doesn't happen.

THE PRESIDENT: Go ahead.

DR. RZENTKOWSKI: Greg Rzentkowski, for the record.

Just to clarify those few points which have been discussed a moment ago. The design basis earthquake is used to demonstrate the integrity of structures, systems, and components under these conditions, seismic conditions assumed.

However, the seismic margin

assessment is used for a different purpose. It is to demonstrate safe shutdown of the plant and capability to maintain the plant in the safe shutdown state. So that means it demonstrates that the operation of the critical functions or critical equipment is not going to be compromised as a result of seismic activity.

So this is a significant difference between design-basis earthquake and seismic margin assessment. The seismic margin assessment has been performed in every single plant and led to the identification of many improvements which have been implemented over the years.

But the main have been implemented as part of the refurbishment activities and later on as a part of the Fukushima Action Plan. So this work is largely completed by now.

THE PRESIDENT: Okay, thank you.

Ms Velshi?

MEMBER VELSHI: Thank you, Mr. President.

You mentioned about putting this presentation on the website. And I don't know whether you meant this presentation or something on the website around that.

Because my comment was that this is probably not the most accessible kind of presentation, it probably needs to be made a lot more simpler. Just to get the message across better. But I am sure you will be looking into that?

THE PRESIDENT: I thought they considered this to be the simple version.

--- Laughter / Rires

MEMBER VELSHI: So you may want to test it before you put it on there.

MR. FRAPPIER: That is why we have a communications group, and they are going to help make sure that this is accessible, as you say.

MEMBER VELSHI: Yes.

Some of the things we have been hearing from the public has been the increased risk of severe earthquakes or the increased likelihood of severe earthquakes due to climate change or fracking. And your presentation is kind of silent on that.

I wondered if you could comment on that?

MR. FRAPPIER: Gerry Frappier, for

the record.

We will give a comment. But if you really want to get into details, we probably would need to have a little bit more time.

Because most of that part of the equation, if you like, we get from our friends at Natural Resources Canada. I think Dr. John Adams has been in front of the Commission several times and some others.

But clearly, that community, especially in North America, and I would say eastern North America, the community is in the process of reviewing a lot or has been in the past few years in the process of reviewing a lot of scientific information, a lot of information from different earthquakes, and are making changes to their understanding and the sort of reports and the sort of conclusions that they come to affect us in a great way because, of course, that is what we are going to be using for our work. So there has been quite a bit of work.

But to bring a whole bunch of detail to that, Andrei can maybe say a couple of things, but I think we would really want to have sort of maybe NRCan or somebody like that before you.

MEMBER VELSHI: Andrei, before your answer. Sorry, I didn't want detail, I just wanted kind of a bottom line. Is it going up or not?

MR. BLAHOIANU: NRCan already provided this information in a public hearing definitely, and the main point was that such fracking itself would induce earthquake up to the level of let's say Richter 5.

These are extremely low earthquakes and no buildings should fail because of an earthquake of this magnitude. And definitely nuclear power plants are a very special category, so they would not feel any damage because of such earthquake.

Secondly, to my best knowledge, is that no such exploration, no fracking could be done in the vicinity of a plant unless the local government and the plant are consulted. And these are prohibited for a certain distance. So to ensure that whatever PGA such an earthquake would induce will be very very low.

MR. FRAPPIER: Gerry Frappier, for the record.

If I could also add. Earlier this morning Mr. Jammel mentioned about external reviews from the IAEA. And we are arranging to get an IAEA review, they call it a SEED Review, which is Site External Event Design Review -- it is a long name, but sounds nice as an acronym.

And they are going to be coming. We have asked them to come and take at look at where are we with respect to our site specific seismic hazard assessment? We are getting the information in from our licensees, we are undertaking a review, we have NRCan undertaking a review, and now we are going to have this international body of experts who will come.

And I would imagine those results will at some point come before the Commission, and that might be the better time to really get a good sense on the geology side, if you like, because that is what it is going to be all about.

MEMBER VELSHI: Thank you.

And my last question. For plants like Darlington or Bruce considering refurbishment, is the review-level earthquake -- I don't even know if I have my terminology right -- but is that level for new plants or is it the 1 in

1,000 for existing plants? Like, what do they assess against?

MR. BLAHOIANU: The review-level earthquake, as we said, it is a benchmarking earthquake. And the way that could be picked could be picked in two ways. Could be picked in a deterministic way, in the sense that you assume a particular PGA, Peak Ground Acceleration, which is an acceleration of the soil itself, the ground itself. And for North America, for central-east North America this magic number compare against is 0.3g.

The other way is to pick on a probabilistic basis. And, for example, you have like mean or various percentile, 84 percentile, with an earthquake with a probability of occurrence 1 in 10,000 years. So one or the other, are both acceptable in a sense to benchmark against.

Because by the end, it doesn't matter how high is the earthquake, what you want to identify, you want to identify which components will -- you want to see the capacity of the components and automate it to determine the HCLPF of the plant from the HCLPF of the components themselves.

The reason that, as I said, the deterministic, the recommended number is 0.3g or probabilistic is 1 in 10,000 years, is that seismologists found that in centralist of North America an earthquake with the probability of occurrence 1 in 10,000 years it is around this number, 0.3g, so this is why it is done. The beauty, if you pick the number, you don't have to do the study to determine the reviewable earthquake, you just take it as is.

THE PRESIDENT: Dr. McEwan.

MEMBER McEWAN: No, thank you.

THE PRESIDENT: Building on just what you say, I would like to take even further. You continuously come in front of us and demonstrate to us how even 1 in 10,000 it is safe.

I don't know if you do this. I would like to go into reverse. I would like to ask what PGA will actually cause core damage and release? Because at the end of the day, from the public, they won't understand all those kinds of .3, et cetera.

What we have to come to explain is doesn't matter what severe accident is going to happen, we now put in place the ability to cool it and shut it down.

And I don't know why you cannot do the reverse and actually calculate the PGA where you know things are going to breakdown. And nevertheless, you know what you are going to do to mitigate. Why is that not a good approach?

You want to start?

DR. RZENTKOWSKI: Yes. Greg Rzentkowski.

Actually that is a very good approach. As a matter of fact, it is being used by the Licensee, but they never disclose the number for which you break the system or impede its functionality. What they do, they take the number where it can still demonstrate a safe shutdown of the plan. And, for example, during the Point Lepreau licensing, we discussed seismicity at length, and they demonstrated to us that for 0.4g earthquake they can still meet the probabilistic safety goals of 10^{-5} for core damage frequency and 10^{-6} for large release frequency.

But they demonstrated this in the positive way. If the magnitude is such, we can safely shutdown the plant.

You are referring to when can we break the system? I am quite sure if we exceeded 0.4 it would probably come to that.

THE PRESIDENT: But we just finished doing a study about -- the SAR Study about -- we hypothesize some core damage, release some radiation. And the whole idea was to be able to answer the question, what will you do if?

DR. RZENTKOWSKI: That is correct. But this answer we get typically from that probabilistic safety assessment because there we can identify all main contributors to the probabilistic safety goals and really focus on those which are the most important.

THE PRESIDENT: Yes. But we can never simulate the seismic event that is causing the breach.

DR. RZENTKOWSKI: No, because we use the aggregate numbers. So we consider all sources, potential sources, of external hazards. And at the end, we assume certain consequences. And those consequences are used as a boundary condition to define emergency response. So that is how we do it.

THE PRESIDENT: Look, what I am

looking for -- okay, go ahead.

MR. FRAPPIER: Gerry Frappier, for the record.

I know exactly what you are looking for. And I will tell you, the brain doesn't quite work that way on this side of the table.

So we have what we call the HCLPF, right? So this is the level for the plant that we have high level of confidence that you are not going to have a problem. All right?

So that is the level that we are quite interested in, because that is where we want to be, is a high level of confidence that we are not going to have a problem.

We could extrapolate further to start saying, okay, what are some of the things that are going to fail and at what point do they fail? And start coming up with numbers that would be higher than that where we could have, you know, some sort of level of confidence. But it becomes quite a spectrum and it becomes...

Like, it is not going to all of a sudden turn into everything collapses unless you go way out there and you start having the structure itself collapse, if that is what you want to get to.

But the point though is that when is a failure serious enough for your scenario is not so obvious to me. Like, if we have a shutdown system that doesn't work, is that what you mean or do you mean we have to have containment that completely collapses?

THE PRESIDENT: Again in layman language, in very simple language, you shake the core, right, and you do a scenario, one scenario, where you shake the core. What is the shake? What power do you need to actually shake the core so there will be a breach. I don't care where. Maybe a locker, maybe a large locker.

And the whole purpose of such a scenario is to explain what the mitigation, the external mitigation you will come to bear. We never talk about that.

MR. FRAPPIER: Gerry Frappier, for the record.

Well, in a sense we do that all the way, you know, all the time. So if you are going to have an earthquake, you know, you are going to shake the whole building including the core and all this sort of stuff.

And what we do from a seismic safety perspective is we are looking at, you know, again trying to find that level where we have very high confidence. As long as you are below that level you are going to be okay, and that that level is a reasonable level given where you are situated on the planet.

But for the failure modes that you are talking about, all those failure modes, as Dr. Rzentkowski mentioned, the PSA is covering all of those. So for whatever reason a pressure tube might fail, whether it is because of the shaking or whatever the reason might be, that is already in our sort of what would we do about that?

So everything that we are going to find as to here is a failure, we are going to be sort of showing well, here is why that failure can be handled by the design. And it is not so obvious to drive the design to the point where you are guaranteed you are going to have a huge release of radioactivity. And I am not sure what the point --

THE PRESIDENT: Using your own language, you say as long as we are below this level we are safe. Okay. So what is this level? Because the hypothesis is above this level you are not.

So without getting into if you give me this number then I would ask you what happens if you are above this level, and you have to tell me what is going to happen.

MR. JAMMAL: It is Ramzi Jammal, for the record.

Sir, if you allow me on this discussion. In one of the hearings you asked the same question of Dr. Rzentkowski, and then he made the comment that at that point there will be a release --

THE PRESIDENT: And he was being quoted extensively after that, I remember that.

MR. JAMMAL: So that is why am intervening here. It doesn't matter what it is going to be, at whatever magnitude that core is going to shake or is going to break, as my colleagues mentioned, taking into consideration all the PSA and the mitigation measures, that at any cost we will maintain and ensure that the core is cold.

Is a release, then the study, the

SAR Study has shown that what protective measures will be taken off site. And that is the key point that we need to put the emphasis on.

Yes, you are asking a hypothetically question. We will look into the answer. But at the same time it is going back regardless of the shaking of the core. You have other elements, as you know, the vault around the calandria, the capacity to cool. And so all these will have to fail to render us into that situation.

THE PRESIDENT: Again, look, in Point Lepreau -- and again, I hate to prolong this -- in Point Lepreau we are going to have a very extensive study coming in front of us. I hope it will give the maximum number where everything will be safe.

Because then I will ask you what happens if it goes beyond that, and you are going to give me an answer as to we have taken external mitigation to deal with a doomsday scenario without necessarily knowing all the details of what breaks.

MR. FRAPPIER: Gerry Frappier, for the record.

So two things just based on where the conversation... It is very important to know that this is not what we would often call a cliff-edge effect, that you have a line, and if you are below that line you are safe. And if you are one notch above that line the whole -- you know, it is a whole catastrophe, the doomsday scenario or whatever. That is not how this is going to play out.

First of all, designed-based earthquakes is not aligned or above the designed-based earthquake, all of sudden you are going to have this huge release of radioactivity.

The HCLPF is this sort of next thing that we would get to. And this is the line where we have high confidence that you are not going to have any problem.

If you go a little bit above that line, our confidence level starts going down. But you are still not going to have all of a sudden a complete catastrophic event.

And if I understand what you are saying, you would like to know at what level are we sure we are going to have a catastrophic event? And let us think about that a bit and...

THE PRESIDENT: It is funny that you mention that you don't kind of one number. Yet, the core damage frequency is a very precise number. And if you ever, God forbid go above that, all of a sudden all kinds of things need to happen.

And so, you know, we need to deal with -- we always keep saying safe safe safe, and we never talk about that we are now planning for a doomsday scenario and putting mitigation on side to try to deal with a doomsday scenario. We always shy away from dealing with a doomsday scenario.

Go ahead.

DR. RZENTKOWSKI: Without prolonging this discussion, I am sorry, but I have to clarify the Commission's expectations versus the Point Lepreau assessment. Because we asked Point Lepreau only to define the maximum hazard expected at this site, seismic hazard expected, with the return period 1 in 10,000 years. So they would tell us what is the maximum expected ground acceleration at this site. In terms of predicting the impact on the facility, so in other words in terms of estimating the risk, they have to perform seismic PSA. I had those discussions with the management of New Brunswick Power and they committed to do so. But this analysis will be finished by December 2015 and it is not included as a part of the Commission's decision.

THE PRESIDENT: Well, all I can tell you is we are always going to ask the same questions, what would happen if...? And we will expect you guys to come up with some answers.

DR. RZENTKOWSKI: Yes. New Brunswick Power is working on the answers. But what I am saying is by December 2014, we will know what the hazard is, not the risk yet.

THE PRESIDENT: Okay.

Any final thoughts?

Thank you. Thank you very much.

--- Whereupon the meeting concluded at 1:13 p.m. /
La réunion s'est terminée à 13 h 13