Canadian Nuclear Safety Commission

Commission canadienne de sûreté nucléaire

Public meeting

Réunion publique

August 17th, 2016

Le 17 août 2016

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

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

Commission Members present

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

Commissaires présents

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

Secretary:

Mr. Marc Leblanc

Secrétaire:

M. Marc Leblanc

General Counsel:

Ms Lisa Thiele

Avocate générale :

Me Lisa Thiele

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Ottawa, Ontario / Ottawa (Ontario)

--- Upon commencing on Wednesday, August 17, 2016
at 1:05 p.m. / L'audience débute le mercredi
17 août 2016 à 13 h 05

***Opening Remarks**

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

We have simultaneous translation -- or interpretation. Please keep the pace of speech relatively slow so that the interpreters have a chance to keep up.

Des appareils pour l'interprétation sont disponibles à la réception. La version française est au poste 2 and the English version is on channel 1.

I would ask that you please identify yourself before speaking so that the transcripts are as complete and clear as possible.

The transcript should be available on our website sometime at the end of 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 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.

Good afternoon and welcome to 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 webcast.

I would like to start by introducing the Members of the Commission that are here with us today.

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

We already heard from our Commission Secretary, Marc Leblanc.

And we also have with us Ms Lisa Thiele, Senior General Counsel to the Commission.

MR. LEBLANC: The *Nuclear Safety and Control Act* authorizes the Commission to hold meetings for the conduct of its business.

Please refer to the Revised Agenda published on August 15th for the complete list of items to be presented today and tomorrow.

In addition to the written documents reviewed by the Commission for this meeting, CNSC staff will have an opportunity to make presentations and Commission Members will be afforded an opportunity to ask questions on the items before us, not only of staff but also of industry representatives.

Monsieur le Président...?

***CMD 16-M39.B**

Adoption of Agenda

THE PRESIDENT: So with this information, I would like now to call for the adoption of the Agenda.

Do we have concurrence?

So for the record, the Agenda is adopted.

***CMD 16-M40**

Approval of Minutes of Commission Meeting

held June 22 and 23, 2016

THE PRESIDENT: I would like now to call for the approval of the Minutes of the Commission meeting

held June 22nd and 23rd, 2016, as outlined in CMD 16-M40.

Any comments, additions, deletions?

Therefore, for the record, the Minutes are approved.

***CMD 16-M41**

Status Report on Power Reactors

THE PRESIDENT: The first item on the agenda for today is the Status Report on Power Reactors, which is under Commission Member Document CMD 16-M41.

We have representatives from Ontario Power Generation, NB Power and Hydro-Québec in the room with us and some by teleconference.

Let me check the technology first.

From New Brunswick Power, Mr. Céline. I'm sorry if I mispronounce it.

Can you hear us, Mr. Céline? No? New Brunswick? Anybody from New Brunswick?

MR. GAUTHIER: For the record, my name is Rick Gauthier, New Brunswick Power. Derek Mullin should be on the line, Mr. President.

THE PRESIDENT: Okay. If we ask a question, somebody will raise their hand.

And we have, at Hydro-Québec, Monsieur

Olivier.

Monsieur Olivier?

M. LEBLANC: Not yet.

LE PRÉSIDENT : Alors, c'est la même chose avec la technologie. C'est toujours la même histoire, n'est-ce pas?

MR. POULET: Dr. Binder, Monsieur Olivier will be here for tomorrow's presentation on Report on Oversight of Regulatory Reactors.

THE PRESIDENT: But not today?

MR. POULET: Not today. I don't expect him today. Thank you.

THE PRESIDENT: Okay. I just read what I'm told to read.

--- Laughter / Rires

THE PRESIDENT: So we will turn the floor now to Monsieur Frappier, Director General of the Directorate of Power Reactors.

Monsieur Frappier, the floor is yours.

M. FRAPPIER : Merci beaucoup. Thank you very much.

Good afternoon, Mr. President and Members of the Commission. For the record, my name is Gerry Frappier and I am the Director General of the Directorate of Power Reactor Regulation.

With me today, our Power Reactor Program Division Directors plus technical support staff who are available to respond to questions on the Status Report on Power Reactors.

Before we get going on that though, I would like to present a couple of updates to the report.

First, in section 1.4, Pickering. Since the CMD was submitted on August 15th, Pickering Unit 4 is now at 94 percent of full power and it's expected to return to full power within the next few days. On this report it says 78 percent. So that's now up to 94 percent.

Also in Pickering, on the last page there was a typographical error with respect to lubricating oil leak, section b). We say "On August 1, 2015..." It was August 1, 2016. So sorry for that, if that caused any confusion.

Otherwise, that concludes the presentation on power reactors and we are available to answer any questions you may have. And, as you noted, there are members from the licensees available as well.

THE PRESIDENT: Okay, thank you.

Who wants to start questions?

Monsieur Harvey...?

MEMBER HARVEY: Thank you. Merci, Monsieur le Président.

I have a question for Bruce or for the staff. In the comments part of the status report:

> "Unit 4 was manually shut down ... to repair some minor Heat Transport system leakage."

Well, I would like to have some explanation about "minor." If it's minor and you shut down a unit for three weeks, it's not minor. So I would like to have some explanation. Was it minor? Was it...

MR. SAUNDERS: Frank Saunders for the record.

I guess you can always argue about the term "minor." Yeah, we don't consider two weeks of revenue to be minor in any shape.

But in reality, we monitor the leakage from the reactor and we have limits that we operate to, both from a safety point of view and from a financial point of view, because obviously, leaking heavy water is something we then have to recapture through our dryers and then clean up to be able to use it again in the reactor. So when leak levels get to a certain point, we will sit down to fix them.

In this case, these are what we call the Grayloc joints, which are joints that join the feeder tube to the pressure tube and over time sometimes small leaks

develop there. When they start to develop, you need to actually take the joint apart. We call it polish but basically you are taking any rough material off the joint and putting it back together so a leak won't happen. And obviously, we try to have some kind of a quantification so that you don't do that for very, very small leaks, but you do do it when leaks start to approach a level that you think is just not reasonable to maintain.

So it's minor in the sense that there is no piping failure. It's not something unusual or something that we don't expect. This is the maintenance we know we have to do from time to time. So in that aspect it's minor.

Yes, two or three weeks of outage is not minor in a sense, but these do take a while to repair because you have to actually separate that Grayloc from the pressure tube and then you have to put some kind of an ice plug in there so that the water doesn't leak out, do the repair. And it takes time. So each one takes half a day or a day to do. And so it takes more time, but it's not an unusual repair, it's not something we don't do and something that we are well practised in doing.

So it sort of depends on what you think minor is. It's minor in that it's not unexpected, it's not a failure that is unusual in that regard.

MEMBER HARVEY: So the term "minor" is not really appropriate?

MR. LAFRENIÈRE: Ken Lafrenière for the record.

We used the term "minor" in this case because they are way below administrative or regulatory limits that are prescribed in the licence. So it's an activity essentially undertaken by the licensee but not triggered by any regulatory requirements.

MEMBER HARVEY: Maybe it should be good to include that in the comments --

MR. LAFRENIÈRE: Next time.

MEMBER HARVEY: -- instead of just saying "minor," to explain it a little bit more.

THE PRESIDENT: And just to follow up, maybe a description of what is the trigger. I mean this was a manual shutdown, right? So I'm always looking for what is it you're trying to --what is it you need to repair and what was the trigger for the shutdown.

MR. SAUNDERS: Frank Saunders.

Yeah, the trigger was simply that we are monitoring the leak rate. There is no automated trip on this kind of thing. So when you talk about a manual shutdown, that just means we made the decision and we took the reactor offline. So there's no magic to the "manual"

word other than it wasn't an automatic system that shut the reactor down, it was a planned event that we had seen coming, forecast, planned the outage and when the time was right we took the reactor down to do it.

So when we say manual there, that's what we mean. It was not a rush decision. It wasn't something we discovered on Saturday and shut down Saturday night. We have actually been preparing for this for about two months. So, you know, it was a planned event.

MEMBER HARVEY: Is it something that the staff is aware of, that leakage, and could it be some -- it could be a trigger for the staff to push Bruce to do something about that?

MR. FRAPPIER: Gerry Frappier for the record.

So, as Mr. Lafrenière said, the reason we used the word "minor" is because there is not a regulatory implication, there's not a safety issue here with respect to the design of the plant or that there is a leak that's unacceptably high. So it becomes an economic decision by the operator at what point or whether they are going to fix that as long as the leak rate is so small that it's not approaching regulatory limits, and in this case it would be up to Bruce.

Having said that, we are very aware of the

leak rate, it's something that we keep track of ourselves, and so we certainly understood that this was there and that there was a potential coming up for them to be taking an outage to go in and repair it. But I agree with you, the repair job is not minor and in that sense the word is probably misused.

MEMBER HARVEY: Thank you.

MR. SAUNDERS: Yeah. I could add to that -- Frank Saunders for the record -- that the leak rate is on our daily reports all the time. Those reports are copied to the CNSC staff and they do attend the morning meetings frequently and so they are well aware of what leak rates are. There is always some leakage on a big system like that, it's never zero. So they are well aware of it. We report those, we trend those for our own purposes and it is fully available to staff.

THE PRESIDENT: Thank you.

Ms Velshi...?

MEMBER VELSHI: Thank you.

My question is on the elevated tritium levels at Pickering, but I also had just a general comment that I found that in the description of many of these events the descriptions were very general, there weren't any specificities, just as we heard here or somewhere where someone had cut their arm but the severity of the accident

wasn't mentioned.

So on the elevated tritium levels, it says the event happened in September 2015. Again, you know, what was the source of the higher levels, what were the levels? You know, you talked about -- you know, when was the last sampling done? Just provide some more details on what is at issue here.

MR. FRAPPIER: Gerry Frappier for the record.

I will look to perhaps OPG to provide the details that you're looking for.

For our purposes, on September 5th, 2015, there was airborne tritium detected that was higher than expected but still not anywhere near any regulatory limits or whatever. Our inspectors took note of that and have been following it. By April of 2016 there was enough of an indication that there was some tritium that perhaps is in places we didn't expect that much tritium that we suggested this is now becoming something that we would like a report on and OPG did provide a report under section 3.1.1 as an event of regulatory interest.

So again, there's no high levels that are perceived from a health and safety issue, but it was unexpected and therefore something that was of interest. And at that time, we also noted that there was an increase

in the tritiated water levels in some of the groundwater wells very close to the site. So that started becoming quite of interest to ourselves. And OPG was doing an investigation but we wanted to have some more clear reporting on that.

And in June of this year, they provided us with a more formal letter indicating their planned activities. So at that point, we decided that we should be making sure that yourselves as Commissioners are aware that there is this investigation going on and we look forward to getting further information from OPG as they complete their investigation of where the tritiated water is coming from.

And perhaps with that, I would ask OPG to provide additional details as you requested.

MR. GRANT: For the record, Fraser Grant, Director of Operations and Maintenance from the Pickering site.

So I will just refresh again what my friend said.

So tritium releases to the environment from the Pickering site continue to be less than 1 percent of the regulatory limit. So we continue to investigate the cause of this issue.

We have engaged not only our own site engineering but also a third party to come in. We are

following a structured approach to problem solving. We have engaged a local site office and we continue to engage them as we move through this evolution to understand the exact source of this issue.

So enhanced monitoring of any groundwater impacts have been put in place. Based on the technical information that we have from the team in place right now, we do not foresee any impact to the environment from this point on. However, we do have the enhanced monitoring and we are following through with that to ensure that we are well aware of any issues that might develop.

MEMBER VELSHI: So when you talk about elevated levels, how much higher than what you would normally expect?

MR. GRANT: So we have found -- we have managed to sample water from the 056 fuel-handling tunnel where we have seen small amounts of tritium and trace of other elements. So we are seeking to understand what the path is to have that water contaminate that tunnel. At this time, no indication of any ongoing leak from any of the reactors at this time.

THE PRESIDENT: So, you know -- I have asked this a couple of times -- I hope that staff are not constrained by the size of this form and, you know, you can add a lot more information. One of them is I have no idea

where 056 fuel conveyor tunnel is. What is it, is it underground, is it inside the facilities? A little photo, a little explanation as to how it relates to where tritium is. Otherwise, really hard to understand what has happened here.

MR. GRANT: So for the record --

MEMBER VELSHI: Let me just get back to my question, which is, so I still don't know is this an issue. You don't know what's causing the high levels, but I don't know how high the levels are. Are they just slightly above background? When you say the levels in the groundwater are high, that's a bit -- a lot more disturbing, frankly, but how high, is it marginally higher? So give me some numbers to give some comfort.

MR. GRANT: So for the record, Fraser Grant for the Pickering site.

So, Dr. Binder, Commissioner, we can certainly supply that information offsite -- or outside of this meeting. We can give you more details in terms of the physical location and also in terms of some of the very low numbers that we are receiving. So we are looking at numbers that are slightly above background, but no indication that it is actually being caused by the issue that we have on our hands today. So that's what the team is working through, but we can certainly supply more

detailed information offline.

MEMBER VELSHI: Thank you.

And when do you expect to have a better handle on what's causing this?

MR. GRANT: For the record, Fraser Grant for the Pickering site.

So, Commissioner, we have been working through this issue. The location and the complexity of the potential causes of this problem are such that it does require time to go and look at many different avenues, many different issues.

We have made an entry into the tunnel that I spoke about. That is the first time that we have made an entry into this tunnel since the station was commissioned. Not an easy place to get to, I would tell you. So we did work through that safely, following all of our normal procedures and protocols.

In terms of expectations to resolve, we will continue to update the local CNSC office with our progress and as we progress through this we will learn more things and come up with a date at that time.

THE PRESIDENT: Thank you.

Questions...?

Monsieur Tolgyesi...?

MEMBRE TOLGYESI : Merci, Monsieur le

Président. I have two.

There is a leak of -- hydrazine leak at Pickering. We don't know -- what was the volume of the leak?

MR. GRANT: For the record, Fraser Grant from the Pickering site.

The volume of the leak I believe was approximately 8,000 litres of hydrazine leaked from a storage tank into a diked containment area.

MEMBER TOLGYESI: And what was the cause?

MR. GRANT: Fraser Grant for the record.

So the cause of this leak, there were two causes. So there was a human performance error in terms of not following a procedure that left the valve open. It should not have resulted in a leak. There was a mechanical device that should have stopped the leak. That mechanical device also failed. So two contributing causes, human performance error and a failure of a mechanical block.

THE PRESIDENT: And so none of this hydrazine leaked to the lake? I'm just trying to make sure I got that right.

MR. GRANT: Dr. Binder, Fraser Grant.

So you are correct and nothing was released. There was a containment dike built around the hydrazine storage tank and that contained all of the

hydrazine. At no time any personal safety issues. We did call a hazmat emergency that day as a conservative measure but no impact to the environment and no impact to the staff onsite.

THE PRESIDENT: Was this leak filed with the Ministry of Environment of Ontario?

MR. GRANT: That is correct.

THE PRESIDENT: Okay, thank you.

Monsieur Tolgyesi...?

MEMBER TOLGYESI: Were you able to recover this hydrazine or what did you do with it?

MR. GRANT: Fraser Grant for the record.

Yes, we were able to recover the hydrazine. We have a third party that we bring in for spills of this nature. They are equipped with the equipment, the training and the personal protective equipment, and they recovered all of the hydrazine and cleaned it up for us.

MEMBER TOLGYESI: You know, you said it's 8,000 litres. What is the volume of a tank? Because what was the potential -- how did you discover that? Because it's human error, he didn't close the valve. After, a mechanical error because the valve did not work or the system did not work properly. How did you discover that and what will be the potential consequences?

MR. GRANT: Fraser Grant for the record.

So the leak was discovered through a normal operator round. So we do have a rigorous plan for inspecting the plant on a shiftly basis. This is one of the areas that's walked down. So through operator rounds this issue was found, reported and corrected.

In terms of the volume of the tank, I would need to get back to you with the exact volume of the tank.

MEMBER TOLGYESI: You didn't mention potential consequences. What was that?

MR. GRANT: So the potential consequences are health issues for people that come into contact with hydrazine. We verified through our processes. A couple of individuals were sent offsite for medical assessment. They were assessed and returned to site with no follow-up issues.

THE PRESIDENT: Thank you.

Dr. McEwan...?

MEMBER McEWAN: Thank you, Mr. President.

This is a question for Bruce and I guess for staff.

So the hydrogen accident when you were doing the maintenance on that piece of equipment, so it's good the staff member is back to work and presumably fully

recovered, which is excellent. If I remember, this is a procedure that occurs rarely, you know, decade timeframes rather than annual timeframes.

So in the third bullet:

> "the OPEX process has clarified the expectations for all staff..."

If this is something that occurs so infrequently, how do you actually ensure that there is the historical memory and the process memory and process review to ensure that it doesn't get lost again in a change of personnel or again change of procedure?

MR. SAUNDERS: Yeah. As you recall, when we did the root cause on this and I think we briefed you probably four or five months ago now, I can't remember exactly, one of the root causes was exactly what you talked about, and in fact it was one of the causes of this, is that we had lost sight of this somehow. So we made changes to actually -- we have actually adapted a procedure now that includes this. The procedure ties the OPEX into it and we have a place to store the OPEX now so that next time we go to do this the procedure is there, the OPEX is tied to it. And this is the normal way we do it.

If you remember, the nuance on this one was it was a job that had previously normally been done by contractors. So we didn't have a procedure, the contractor

was using his procedure. So we have corrected that.

We've also changed the way we approach the safety bulletins from manufacturers to make sure that they also get tied into our OPEX. That was a bit of a hole in OPEX, in that when people had event, the OPEX was tied in very well. But much like you might get on your car or anything else, we get a safety bulletin, they would be reviewed by engineering. If they were seen to be significant at the time, they would get in the OPEX database. If they weren't significant at the time, they might not. But, as you say, something that's not significant today becomes significant tomorrow, so we've now tied those things together. That was all part of the corrective action program: was to make sure we don't lose track of, you know, what you could define generically as a safety bulletin, I guess, in that it's tied in somehow to our procedure process so if you're going to work on that equipment you will know.

THE PRESIDENT: Mr. Tolgyesi.

MEMBER TOLGYESI: One more for Darlington.

Within two days you had two accidents. Both involved contractor employees. Do you have any special procedures for contractor employees to explain to them what the work is, what are risks? Because you don't have so many accidents with your operation with your

employees and this is two accidents within two days. It was the same contractor, it was a human error or procedures or circumstances which led to these?

And the second one, we don't know what's happened if you don't say about what contractor workers was doing. Only you said cut his right arm. What he was doing?

MR. GREGORIS: Steve Gregoris, Director, Operations and Maintenance, at Darlington, for the record.

So there is a rigorous process that the contractors follow at site. They will follow our processes and standards. Their supervision and workers are trained on an on-boarding system to ensure they understand those standards, and the supervisors have additional training to make sure that they're well versed in those standards and expectations.

There is additional oversight not only through the contractors, but through our own contract management oversight group. That altogether ensures that standards are well understood prior to the job and that they're followed during the job and monitored during the job.

In these two instances, in the first instance it was worker practices in a congested area, where oversight would normally be challenged just with the number

of people that can be in the area. So conditions and practices that, I would say, weren't necessarily, I'll say, the best practices, led to the electrical contact.

For the second event, that event is specific to the Retube Waste Processing Building, so a new structure that's being built to the east of the station, within the protected area, to support Darlington refurbishment and taking components from the reactor and compacting them into shielded waste bins. They were erecting steel as part of the structure for that building and had cut -- brushed their arm against the steel and received a cut.

MEMBER TOLGYESI: Do you have a high level of contract workers on the site? Of the global workforce, how many are your employees and how many are contractors from wherever they are?

MR. GREGORIS: Steve Gregoris, for the record.

We do have approximately 1,500 -- one thousand five hundred -- contractors on site. We have pretty much the same number of permanent employees on site at this time.

THE PRESIDENT: Thank you.

Anybody else?

I have just one question on Pickering, on

Unit 4 shutdown. It's the same observation: the cause of the valve was a boiler level controller malfunction. Again, I'm trying to find out what's the root cause. Why did it malfunction?

MR. GRANT: For the record, Fraser Grant, from Pickering.

The cause of the malfunction was a stuck button on the front of the controller. So the controller was being manipulated by the operator as for approved procedures when the button stuck, causing the level in the boilers to increase.

So crew responded exactly as per their training and as per my expectations. The plant responded as per design. The unit shutdown. No significant issues during the shutdown. So unit placed in a safe state and worked through the issues and the unit has been returned to a high power operation since then.

THE PRESIDENT: Well, does that give you a comfort level? A stuck button doesn't give me a comfort level at all. Why was the button stuck?

MR. GRANT: Fraser Grant, for the record.

So the controller was replaced with a new controller. In terms of the stuck button that is going through our formal correction action process to understand why the button stuck, what the future implications are, and

how we can prevent it in the future.

THE PRESIDENT: Okay, thank you. You will report that finding.

MR. GRANT: That is correct.

THE PRESIDENT: Thank you.

Anybody else?

Okay, thank you.

***CMD 16-M42**

Written submission from CNC staff

THE PRESIDENT: The next item on the agenda is an information item to provide us with an update on the fitness for service for the Chalk River Laboratory, as outlined in CMD 16-42. This was a request from the Commission made during the April 6, 2016 public hearing.

We understand that we have a representative from CNL joining us via teleconference.

Mr. Pilkington, can you hear us?

DR. PILKINGTON: Yes, Dr. Binder. This is Phil Pilkington here, for the record.

THE PRESIDENT: Okay.

I understand that, Dr. Newland, you will make the presentation.

DR. NEWLAND: No.

THE PRESIDENT: Okay, well pass the baton then. It says here -- I'm just reading what it says here.

MR. LeCLAIR: Good afternoon, Mr. President, members of the Commission.

My name is Jean LeClair. I'm the Director of the Nuclear Laboratories and Research Reactors Division.

With me this afternoon are Nhan Tran, Senior Project Officer, with the Nuclear Laboratories and Research Reactors Division; as well as Dr. David Newland, Director General, with the Directorate of Assessment Analysis, which is a key part of the technical specialists that help support us in our reviews and verification on this particular activity; as well as technical specialists that have been involved on this file.

This is our second report to you, following the direction you gave us at the April Commission meeting. We were here in front of you in June with our first status update. This is our second one. I think we've provided a lot more substance than we did in the first report, and we're here and available and open to answer any of your questions.

THE PRESIDENT: Okay.

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

MEMBER VELSHI: Thank you, Mr. President.

Thank you for the report. It's excellent. This is exactly what we were hoping to get. It very clearly shows what's needed to get to "Satisfactory" and when you expect CNL to complete all the activities.

I have just actually one question, which is on page 2, on the criteria, where you say what's taken into consideration to reach "Satisfactory" is the "planned end of operation of the NRU reactor."

So the question is: that if the reactor was to run for -- say, till 2025, would the requirements be different for it to be fit for service?

MR. LeCLAIR: Jean LeClair, for the record.

The requirements would not change. The impact is on the expectations because there's a number of activities that now would not be going ahead because of the expected shutdown in March 2018 if in fact the reactor were to continue to operate beyond 2018. Taken with your suggestion of 2025, there may be further work that would be necessary to be done to ensure the ongoing fitness for service for the reactor.

So one of the key things, when we're looking at this project going forward, is verifying and ensuring that the activities that are necessary to ensure that the NRU reactor remains fit for service between now

and March 2018 has been done.

If CNL were to come forward with an application and a request to extend NRU beyond March 2018, this is one area we would revisit to make sure that we are again clear on expectations and what further work might be necessary to ensure the ongoing operation of NRU beyond 2018.

MEMBER VELSHI: So let me put this another way: that on the day it stops operating, it will not be in as good a shape -- I'm talking about fitness for service -- as it would have been five years prior to that. So it's not that you're running it to the ground, but you know that it's got an end of life approaching and you may not make as much investment to keep it in as good a shape.

MR. LeCLAIR: I'll begin, and perhaps I'll pass it to CNL because you mentioned the comment around investment, and I think CNL would be in a better position to answer that.

But I think you've summarized it reasonably well in saying that the decisions that need to be made is what work needs to be ensure that it continues to operate till March 2018. If you want to go beyond that, there are other things you would probably do, which, again, are going to cost time and money.

But perhaps I could ask CNL to comment a

bit further in that regard.

MEMBER VELSHI: Thank you.

CNL, and it really is around fitness for service only.

DR. PILKINGTON: Okay. It's Bill Pilkington, for the record.

I'll just take a moment to identify that I have with me today on the phone Mr. Shaun Cotnam, CNL's Chief Regulatory Officer, and Mr. Neil Mantifel, our Director of Equipment Reliability.

I would answer the question somewhat differently in that the original improvement program was based on two five-year licence intervals. So the first Phase 1 of the plan, was intended to be implemented essentially by the end of the licence period, which at that time was October 31st of this year, of 2016. The second phase was intended to be implemented between November 1st of 2016 and October 31st of the 2021, which would have been a second licence interval.

The reason the program is now shortened is that there isn't time between now and March of 2018 to in fact complete all of the activities in the original Phase 2, and it didn't make sense to implement improvement modifications days, weeks or even a few months before the permanent shutdown of the reactor.

So on that basis, the Phase 2 program was reviewed and modified to be appropriate for the remaining life of the NRU reactor.

THE PRESIDENT: Can I -- just let me translate this into -- again, I just want to hear you say, both CNSC staff and CNL, that the last day in 2018 the machine is as safe as it's always intended to be; in other words, there's no -- just because they're going to be shutdown the next day, there is no running into the ground, so to speak. Okay? This would be as safe, the last day, as it's always been safe?

MR. LeCLAIR: Jean LeClair, for the record.

That is correct. The reactor will continue to be safe. In fact, it has to be safe because even during its shutdown state it has to be maintained in a safe shutdown state.

So I agree with you entirely that at the end of March 31st, 2018, the NRU reactor is still expected to be a safe reactor.

THE PRESIDENT: I guess I'm reacting to CNL saying that they may not do some investment they would otherwise do if they expected a licence renewal.

But those investments will not impact the safety of the machine to 2018. CNL, is that right?

DR. PILKINGTON: It's Bill Pilkington, for the record.

So the work that will not be undertaken is work that would introduce operating improvements after the reactor was permanently shut down. So in fact the improvements that will enhance safety right up to the end of life are being implemented and the NRU reactor will be in a better condition at end of life than it has been for decades.

MEMBER VELSHI: Thank you.

THE PRESIDENT: Thank you.

Monsieur Tolgyesi.

MEMBER TOLGYESI: Merci, monsieur le président.

I'm glad to see that there is progress towards the -- to have a reactor which at the end of life will be in much better health than it was during its whole life -- or the last 10, 15 years.

You mentioned for NRU -- because when you're looking at the site, the Chalk River site, I think, according to these conclusions, everything is satisfactory. But at NRU there were 17 items where 10 are completed, 4 will be ended in 2016, and 3 will be ended in 2017.

Did you find or did you observe some additional or other items which then those identified? I

don't know when we identify these -- selected these 17 items. It's a year ago or so.

THE PRESIDENT: Are you asking staff?

MEMBER TOLGYESI: Yes.

MR. LeCLAIR: Jean LeClair, for the record.

Could you please repeat the question -- I'm not quite sure I fully understood your question -- please?

MEMBER TOLGYESI: Here we are facing the 17 items, which, you know, you asked to be fully satisfied to reach a "Satisfactory" level. So over these -- these 17 items were established when? Six months ago? A year ago?

MR. LeCLAIR: So maybe I'll begin by highlighting -- Jean LeClair, for the record -- these are organized by specific areas. These specific areas have been defined through the initiatives that we did when we were defining the safety control areas, which is work that we've been doing over the last three or four years. This work has always been going on. This is about just getting it clarified and putting it in ways that are easier to communicate. So this work has been ongoing on now for -- well, in fact for several years.

So what we've done here is we've just compiled all of it in a clear fashion so that there's a lot

more clarity across those specific areas. So there are no additional items. This summarizes all the work that's been going on, which we've been communicating the Commission now, I think in our -- not I think. In our CMD, we pointed out since 2009, the number of times we've been in front of the Commission.

So there's nothing new here. All we've done is presented information that we've been presenting previously, with a lot more clarity -- with a lot more clarity with regard to the details on expectations, as well as established target dates, when the work's going to be done.

So there's nothing new here, it's just presenting the same information, I think in a clearer way.

MEMBER TOLGYESI: As the NRU should reach all 17, that means that it will become "Satisfactory," at the earliest, sometime in April of -- May or June, 2017, or if those items to be completed in 2016 will be completed, you will re-rate to the "Satisfactory" level.

MR. LeCLAIR: Jean LeClair, for the record.

So, yes, our expectation -- these target date -- I should mention these target dates were established by us looking at what work needed to be done and working with the licensee to establish dates that they

understood, recognized and agreed to. So these dates are CNL's dates, these are -- so -- and we agree with what's here.

So the expectation is -- by the way, the dates are the end dates. We would hope, we would expect, that the licensee would try to get these done sooner rather than later. And we will verify when work gets done, and if they get closed earlier we certainly will let the Commission know.

But these are the dates that are set. And, yes, we're saying that with this work completed by this date, we expect to be able to come back to the Commission and change the rating on these to "Satisfactory." And, eventually, as you noted, based on that last end date, we would now be able to say that overall rating for Chalk River Laboratories has a rating of "Satisfactory" in the area of fitness for service.

THE PRESIDENT: So am I to understand, then, that you will continue to come to us on a monthly basis, on a meeting or hearing basis, and update this chart and tell us whether it's on target, not on target, et cetera, et cetera?

And, CNL, you agreed to that? Let me start with CNL. You agree with this kind of approach?

DR. PILKINGTON: Bill Pilkington, for the

record.

Yes, Dr. Binder, we do agree with the approach.

MR. LECLAIR: Jean LeClair, for the record.

Yes, that's exactly the approach: we would be updating the Appendix A tables and providing these to the -- and Appendix B tables, and providing these to the Commission at the next meetings, and continuing to keep you up to date.

THE PRESIDENT: Thank you.

Dr. McEwan.

MEMBER McEWAN: Thank you, Mr. President.

If I go to page 4 of the CMD, which is the maintenance table, number 6, "Ensure that critical spare parts are available to support maintenance work." So the answer to this, that they "f*lagged 215 high priority spare parts components*," is that something that they have just done, and that up until now there has been a random approach to the acquisition of spare parts?

My second question is: if they've identified for 142 of the components out of 215, how can you regard this as completed CNL if we still have a backlog of 70-odd parts that have not yet been identified?

MR. LeCLAIR: So the question is in two

parts. I believe the first part, with regards to the number of components and the high priority spare parts, perhaps CNL can answer that part.

With regards to CNSC staff's basis for the conclusion of "Satisfactory," I'd ask Mr. Nhan Tran if he could reply.

MR. TRAN: My name is Nhan Tran, for the record.

So CNL hasn't completed identify the spare -- excuse me, sourcing the replacements for these high priority spare parts, but they've gotten to a point where CNSC staff are not concerned with their ability to do so. So it's not that we're waiting for every single item to be checked off, it's that they've identified the items, they're working on identifying the spares, and they're progressing at a rate that we're happy with. So because of that, we don't have any concern in their ability to close out that item.

As Mr. LeClair mentioned, we'll pass it to CNL to comment on when exactly those items were identified and the suitability of those 215.

MEMBER McEWAN: Okay, so let me just chip in there: "*215 high priority spare parts components for which suitable replacements are being identified*," this implies that over the lifetime of this item there have been

215 spare part components that were not identified, and that there was no real understanding of -- my early reading of this, there was no understanding of where they were going to come from.

So if we're going to be really proactive, I'm surprised that you have that much confidence in the organization's ability to find the other 70 when they've had no ability to find 215 over the past six, eight, ten years.

THE PRESIDENT: Why don't we let CNL try to dig this up. That's why some of you have noticed that I'm a bit anal about maintenance logs and backlogs, and it's a good question for this, I guess, aging facility. So maybe spare parts are not necessarily available.

But, CNL, please, explain what's going on here.

DR. PILKINGTON: It's Bill Pilkington, for the record.

The identification of critical spares comes out of taking a systematic approach of going through systems, of having programs like aging management, system health monitoring, having those kinds of programs in place which allow us to make -- or take a systematic approach and identify those spares that we have not previously stocked that we need to going forward.

I would ask Neil Mantifel to provide more information.

MR. MANTIFEL: Neil Mantifel, CNL Director, Equipment Liability, for the record.

So as part of the system health program development and implementation, when we started the Integrated Implementation Plan in 2011 the program was developed and implemented and resulted in categorizing the components on all the 46 systems that were identified in NRU and starting a critical spares assessment process for those systems.

The system responsible experts worked through their systems and have identified these 215 items. They've been identified in the first two years of the program and have been working down this list over the last three years. A lot of these components are not immediately purchasable off the shelf; they are obsolete and require modern equivalents to be specified, so it takes time to find a modern spare.

In addition to these 215, as we have been implementing the Gig-1(ph) hardware equipment upgrades at NRU, spare parts for those new components have also been purchased when the replacement parts have been installed, so there's ready spares for any replaced or refurbished equipment also in NRU. So it's a systematic approach

following the system health process to identify the critical components and ensure we have modern equivalents for the spares that we require.

MEMBER McEWAN: So -- thank you.

So that leads to two other questions. The first is, before 2011, how did you manage?

And secondly, I really remain unconvinced by CNSC staff regarding the section is complete until it is complete rather than semi-complete.

MR. MANTIFEL: Neil Mantifel, for the record.

So prior to 2011, NRU did not have a systematic approach using a system health program to identify the critical components, so the spare parts inventory was based on the knowledge and expertise of the individuals working in the technical sections of NRU at that time, so most of those staff are very experienced and have a very good idea of what components are single points of vulnerability or a critical component and had adequate spares.

The system health process did identify some gaps and some obsolete items that were -- needed more time to resolve the spare parts issues. So we did have a process prior to 2011. The systematic approach has improved that process.

THE PRESIDENT: But just to reply to Dr. McEwan about this completely, if I understand the CNSC staff intention is here, they say CNSC -- CNL completed this action, but you will continue to monitor its implementation and report to us on the monthly basis on progress.

MR. LeCLAIR: So just to clarify first, perhaps I'd just go back to reiterate what Nhan mentioned earlier, which is the key thing is they have a plan by which they're going about and they're replacing these parts. They're doing it within a reasonable timeline.

I believe CNL has highlighted that this is not -- if you can allow me to be a bit facetious, they're not ordering parts from Canadian Tire. They require a fair amount of work, and a lot of these are very difficult parts to acquire. They take a fair amount of time.

The key thing for us in establishing satisfactory performance is not that they've replaced all the parts but, rather, that they have a plan in place, that they're delivering on their commitments, that they are -- that they're moving forward and they're moving in the right direction.

I also want to highlight, this is not an indication that because this part is not available that somehow that makes the safety of NRU in a critical state.

NRU is running safely.

This is about situations where perhaps a reactor would be shut down and could not start back up, for instance. It's not directly -- directly tied to safety.

So again, I want to highlight, the importance is that there's a plan in place, they've put in a program, they've made sufficient progress, they're acting diligently on it and they're being responsive. And based on that, CNSC staff concluded that the performance is satisfactory on this one item.

THE PRESIDENT: Thank you.

Monsieur Harvey?

MEMBER HARVEY: Merci, monsieur le président. A few questions.

In some, of not many, items -- there were 17 items. There are some which are qualitative, and it's difficult for us to have -- to make our own opinion how to set -- how satisfaction is obtained. For example, number 1, you -- this is written, "The improved operability of equipment and high-priority repair job have decreased, indicating improvements reliability and operability", but that -- we've got to take for granted that this is okay.

But to what extent -- how many -- well, could you -- do you have some figures to indicate that it is important, it's not important, it's major or minor? So

it would be good to have some figures to permit us to have an idea of the importance of the -- what has been done by CNL.

MR. LeCLAIR: Jean LeClair, for the record.

So I'll take that as an action for the next update. We can certainly provide for -- there's a lot of material to substantiate this conclusion.

We get routine quarterly progress reports on the IIP, and we have system health reports. We have several data points that are provided to us that substantiate this.

So I'll make a commitment for the next update that we can bring forward something more substantive on this particular item to provide you an example in more detail on all that -- that -- how we come to that conclusion.

MEMBER HARVEY: Because there is many item.

Number 2 is he same thing, and number 5 and number 6. And on page -- anyway, so I think you should make an effort to put some figures and numbers and to illustrate the importance of the work that has been done and the work having to be done, so ---

THE PRESIDENT: Let's find a balancing.

We don't want all IIP documentation. I've seen the volume that's a couple of feet thick. But you should put enough material here to give us the indication, the parameters that you will actually measure. If there are numerical parameters, that would be very useful to have.

And the good thing is that once you put it in, it should be easy to update and monitor this as you come to us on a monthly basis, so that should be a good thing to do, I think.

Monsieur Harvey?

MEMBER HARVEY: Otherwise, you just have to take for granted that, okay, it's finished, but sometimes it's not completely finished. You have to figure the importance. Otherwise, okay, you say it's finished, but for us, it's not enough.

That's a comment.

THE PRESIDENT: Okay. Anybody else?

Go ahead, Dr. McEwan.

MEMBER McEWAN: Sorry. Just again sort of following up on this theme, so if I go to, again, page 4, number 5, "Reduce overdue preventive maintenance jobs", again, that's an area where there really would be value in some quantification.

But I guess what would be also helpful to understand in the context of that what would be a

satisfactory status or satisfactory outcome for you to regard the target completion date at the end of this year as met.

MR. LeCLAIR: Jean LeClair.

I'm listening intently, and we certainly will take that all in consideration for the next report so we can provide some more substance on a few of these items, get more clarify for you.

THE PRESIDENT: Okay. Thank you.

CNL, do you want to -- go ahead.

MEMBER HARVEY: About the structural integrity, and it's on page 5 -- at the top of page 5, the second -- third paragraph:

> "CNL has found no discernible change in the vessel wall thickness since 2010."

And two lines below:

> "CNL has not been able to fully verify that the corrosion mechanism has stopped."

And the line after:

> "CNL continued to demonstrate that the vessel maintains the required structural integrity..."

You've got three sentences and which are

not really aligned because if you don't know exactly, you cannot verify something, how can you say it's like ---

MR. LeCLAIR: So I'll ask Blair Carroll, technical specialist, if he could respond to your question, please.

THE PRESIDENT: Come closer to the mic.

MR. CARROLL: Just with regards to the vessel, when we're talking about structural integrity of the vessel, we're looking at the state of the vessel to ensure that it will not fail catastrophically, it can maintain its design loads without having a significant failure that would impact safety.

As far as the inspection results have gone for the inspection program, there has been no detected change in wall thickness within the bounds of the inspection tool capabilities, so as far as we can -- as far as we -- all the information we have at this point, there has been no significant change of the vessel wall thickness.

When looking at some of the visual inspection results, the colours of the wall has changed a little bit. There has been some minor changes in surface roughness, that sort of thing, so we know that there's the potential that corrosion could be going, but it's not going -- it's not continuing at a rate where it would

challenge the integrity of the vessel.

It may be -- there is always the possibility that there could be corrosion in some place where we have not had measurements that could lead to a small leak. That leak would not affect the safe operation of the vessel.

You would still be able to shut down the vessel. It just may affect the ability to operate the vessel. It would not affect the ability to safely shut it down.

THE PRESIDENT: Okay. Thank you.

So some of this criteria you just used to demonstrate that you -- how you make a decision is something we would really like to see more of rather than, "Trust us. We looked at it, and everything is good".

We need a little bit more than that, numerically if possible, or qualitative if -- like assessing rust penetration. I mean, a lot of it can be measured.

I know some of those -- when they repair the vessel, I -- we -- I become an expert in welding parameters, so we don't want to see any of those kind of a thing, but some -- a little bit more that give us a comfort level that when you say it's complete, it's really complete.

Okay? Anything else?

CNL, final comments?

DR. PILKINGTON: It's Bill Pilkington, for the record.

And as another, I guess, trained expert in welding aluminium, I would point out that, since 2011, we've had a comprehensive in-service inspection program in place for the vessel that all of the inspections in the program have been carried out on schedule. In fact, the last inspection for this year for the fifth cycle was completed in July of this year during our planned extended maintenance outage of the NRU, and we will be submitting a report to the CNSC in mid-October with all of the results.

I would also point out that the fitness for service program that we're following was, in fact, developed to assure that the vessel is fit for service actually up until the year 2021.

So we're confident that we have a good program, we're confident that we're implementing it effectively, and we're satisfied with the results.

Thank you.

THE PRESIDENT: Thank you.

We -- I'd like to move on to the next item now, and it is -- it's an information item to provide us with an update on the Development of Licence Limits for

Hazardous Substances, specific emphasis on uranium mines and mills, as outlined in CMD 16-35. This was a request from the Commission made during the April 6, 2016 public hearing.

And we have representatives from Environment and Climate Change Canada to help us with questions. I understand that Mr. Rinker will make the presentation.

Please proceed.

***CMD 16-M35**

Oral presentation by CNSC staff

MR. RINKER: Good afternoon, Mr. President and Members of the Commission. My name is Mike Rinker, and I'm the Director General of the Directorate of Environmental and Radiation Protection and Assessment.

I'm accompanied today with Malcolm McKee, the Lead Technical Advisor for the same Directorate, and Mr. Bob Lojk, the Director of the Uranium Mines and Mills Division.

We are here today to update the Commission on action item M2011-08 titled Cameco Mid-Term Report on the Safety Performance of the Key Lake Operation. This presentation follows a memorandum that was provided to the

Commission on the same topic in February of 2016.

While action number M2011-08 is specific to the Key Lake mill requesting release limits for molybdenum, selenium and uranium, this issue has broader implications for the development of a common approach to the derivation of release limits for both nuclear and hazardous substances for all facilities regulated under the *Nuclear Safety and Control Act*. Thus, this presentation also serves to update the Commission on action item H2015-14 on setting release limits for the Darlington nuclear power plant.

As a result of the information provided in this presentation and the proposed path forward, staff will close the presentation with a request that the Commission consider these two actions to be closed with a commitment to provide updates within the annual regulatory oversight reports with respect to Key Lake and Darlington and with updates on the overall approach for all facilities in the annual regulatory framework report.

I will now pass the presentation to Mr. Malcolm McKee.

MR. McKEE: Good afternoon, Mr. President and Members of the Commission.

Today's presentation will utilize the following outline. First we will review current practice

related to controls on releases and the inclusions of limits within the CNSC licensing framework.

This will be followed by a review of the regulatory history specifically associated with uranium, molybdenum and selenium.

We will then present on the status of discussion paper BIS-12-02 on the process for establishing release limits and action levels at nuclear facilities and the proposed path forward within the CNSC's regulatory framework.

Since the completion of the public comment period on discussion paper 12-02, there have been a number of major international and national regulatory initiatives with the potential to influence the CNSC's approach to establishing release limits in general as well as more specifically with respect to selenium.

These influencing initiatives will be presented as well as their potential effects on CNSC decisions related to licence limits.

We will conclude with a summary of the key elements of the presentation and a request with a justification for the closing of action items M2011-08 and H2015-14.

First, staff would like to emphasize that the environment is currently protected from releases from

uranium mines and mills. Releases of molybdenum, selenium and uranium and all other nuclear and hazardous substances are controlled to acceptable levels as a result of upgrades to effluent treatment systems specifically for these substances, the application of action levels to ensure proper operation of these treatment systems and enhanced effluent and receiving environment monitoring and reporting requirements to verify that the environment is adequately protected.

Regulatory expectations with respect to effluent limits and action levels are clearly identified within a facility's Licence Condition Handbook.

Current release limits for uranium mines and mills are the Federal Metal Mining Effluent Regulations, more commonly referred to as the MMERs. These limits are identified within a facility's Licence Condition Handbook with respect to uranium mines and mills.

The MMERs authorize the release of the following deleterious substances in mine effluents: arsenic, copper, lead, nickel, zinc, radium-226, total suspended solids, and provide a range for acceptable pH levels. They also include cyanide. However, as this substance is not used in uranium mining and milling, it is not part of the CNSC licensing framework.

Additional non-MMER substances requiring

regulatory control such as molybdenum, selenium and uranium are currently regulated by the CNSC with the application of action administrative levels which are also identified as such in a Licence Condition Handbook.

The CNSC regulatory history associated with these non-MMER substances will be briefly presented. First we will address uranium.

CNSC technical specialists completed an environmental risk assessment on releases of radionuclides from nuclear facilities with respect to impacts on non-human biota on behalf of Environment Canada, now known as Environment and Climate Change Canada, and Health Canada.

This ERA was completed under the *Canadian Environmental Protection Act* Priority Substance List 2.

The assessment report, published in 2003, concluded that ionizing radiation emitted by releases of radionuclides was not CEPA toxic. However, it was concluded that releases of uranium and uranium compounds contained in effluent from uranium mines and mills were entering the environment in quantities or concentrations that may have a harmful effect on the environment and its biological diversity based on the chemical toxicity of uranium.

This CEPA toxic determination was based on

the evaluations associated with Cluff Lake, Key Lake and Rabbit Lake.

Following the CEPA toxic determination, Environment Canada determined that the most appropriate federal statute for managing uranium releases was the *Nuclear Safety and Control Act*. This was formalized in the original Memorandum of Understanding between CNSC and Environment Canada.

CNSC regulatory risk management activities can be sub-divided into two categories. One involved demonstrating that current releases were now being adequately controlled or that releases had ceased. The other involved regulatory action requiring the modification to water management and treatment systems.

For example, no modifications to treatment systems were required at Key Lake, as it was demonstrated that the CEPA toxic determination arose from releases occurring prior to the 1998 installation of a reverse osmosis treatment system on dewatering water releases.

Similarly, no modifications to water treatment systems was required for Cluff Lake, as the facility was applying for a decommissioning licence at the time of the CEPA toxic determination.

A decommissioning licence was granted in 2004, and effluent releases ceased shortly after.

Thus, of the three facilities associated with a CEPA toxic determination, regulatory action requiring the upgrading of effluent treatment systems was only necessary at the Rabbit Lake facility.

The Commission required Cameco to identify, commission and operate an upgraded effluent treatment system to reduce uranium releases.

Here we see the performance of Cameco's uranium treatment system at Rabbit Lake after the 2007 commissioning period through to 2015. In the 2007 commissioning period, the upgraded system achieved approximately 85 percent or more reduction in uranium effluent concentration and total loadings compared to the pre-CEPA assessment 10-year average.

The red and green line represent the action level and administrative levels, respectively, both of which were revised downward in 2009 after a period of monitoring to reflect the increased stability in the performance of the treatment system.

These results indicate that uranium releases are well controlled at the Rabbit Lake mine and mill, and risk management efforts were successful.

These risk management activities and their progress were documented in an annual report that was co-authored by the CNSC and Environment and Climate Change

Canada covering the years from 2007 to 2010. These annual reports are available on the CNSC web site.

Uranium releases were deemed effectively managed under the CNSC-Environment and Climate Change Canada Memorandum of Understanding upon completion of the 2010 annual report.

Uranium releases are now reported as part of the annual uranium mines and mills regulatory oversight reports presented to the Commission.

We will now discuss the CNSC regulatory history associated with molybdenum and selenium.

Formal increased regulatory interest in these two substances initially arose in 2004 as a result of staff reviews of existing monitoring data, new science, and a series of environmental risk assessments associated with licensing actions for new and existing mines. Discussions between the CNSC and the uranium mining sector resulted in enhanced monitoring and special investigations at potential sites of concern.

This was followed in 2006 by the completion of a CNSC staff environmental risk assessment for the Key Lake facility that was submitted for external peer review.

This assessment predicted the potential for molybdenum effects on terrestrial animals consuming

aquatic vegetation and associated sediments such as moose and muskrat. In addition, the assessment, together with enhanced monitoring and the special investigations, confirmed that selenium was impacting fish as a result of releases from the mill.

In a letter written pursuant to subsection 12(2), the General Nuclear and Safety Control Regulations, the CNSC required Cameco to develop and submit an action plan to limit the risks posed by releases of selenium and molybdenum at the Key Lake mill.

In 2007, the Commission further imposed enforcement action on Cameco with the addition of a licence condition with the same requirement, to limit the risk to the environment from molybdenum and selenium.

In 2008, Cameco complied with its requirements to identify, commission and operate upgraded treatment systems to control and reduce releases of these substances in the Key lake effluent.

The results of the CNSC regulatory oversight and Cameco's upgrades to the treatment system are evident in this figure. The molybdenum reduction treatment circuit has significantly lowered effluent concentrations and loadings to the environment.

The red line represents the action level of 0.6 milligrams per litre, and the green line represents

Cameco's administration level of 0.3 milligrams per litre.

The results demonstrate that Cameco's taking adequate precaution to control releases of molybdenum in effluent from their effluent water treatment plant.

This figure indicates the success in reducing selenium in effluent. Releases -- release of selenium to the environment are now controlled through additional modifications to the molybdenum circuit and substantial improvements to the site water balance.

The red line indicates the action level of .035 milligrams per litre, and the green the administrative level of 0.028 milligrams per litre.

As a result of this new treatment circuit as well as improvements to site water management, selenium concentrations have decreased to levels considered protective to the environment.

To assess this, a molybdenum-selenium pre-treatment environmental baseline was established in 2007, with follow-up monitoring program implemented in 2008 to assess the adequacy of these reductions in stimulating recovery in the receiving waters.

This program is designed to document improvements in effluent quality and assess recovery within a range of environmental compartments in a receiving

environment such as water, sediments, aquatic plants and a number of fish species.

Effluent and water quality are reported annually to the Commission in the annual regulatory oversight reports, as these are monitored frequently within each year. As the predicted rate of recovery differs amongst the remaining monitoring compartments, reporting of these results is dependent on their sampling frequency.

The initial recovery monitoring assessment cycle is concluded with the 2017 sampling.

An evaluation against pre-treatment 2007 baseline will be completed and reported to the Commission in a regulatory oversight report for the uranium mines and mills. The need to continue this enhanced monitoring program will be evaluated at that time based on the results of this assessment.

As a result of lessons learned from the Key Lake mine and mill, the uranium mining industry proactively undertook effluent treatment optimization projects to reduce releases of selenium and molybdenum at a number of other mining and milling sites.

Mines and mills that have further augmented their technologies and techniques with respect to managing molybdenum and selenium include McArthur River, the Rabbit Lake facility and the McClean Lake mine and

mill.

While uranium and molybdenum and selenium releases are currently controlled there is yet no formal licence limits. At the request of the Commission, staff commenced a process to identify and document a formal approach to the development of limits for these or any other substances determined by the CNSC to merit specific regulatory action.

The objective was to evaluate CNSC practices or proposals against international, national and provincial best practices, where practical standardize approaches throughout the nuclear fuel cycle and, whenever possible, harmonize with existing provincial and federal legislation. This activity culminated in the 2012 release of a discussion paper, DIS 12-02 entitled, "Process for Establishing Release Limits and Action Levels at Nuclear Facilities".

The discussion paper generated extensive interest from environmental non-governmental organizations, industry and other regulatory bodies. The comment period was closed with a multi-stakeholder workshop focusing on a few complex issues. The outcomes for the workshop are summarized in the workshop report published in 2013 which is available on the CNSC website.

As a result of stakeholder feedback on the

discussion paper, CNSC staff proceeded along two courses of action. The first was to address setting action levels under a CSA standard, thereby determining a standardized approach across the nuclear industry.

The second was to develop a common process for setting release limits within a regulatory document which allows for a need of flexibility when dealing with multiple jurisdictions, hazardous substances and nuclear substances.

Since the closing of the public review period for the discussion paper, significant process has been made -- progress has been made on standardizing environmental action levels. This standardization has been achieved through the development of a Canadian Standards Association document N288.8, "Guidelines for establishing and implementing action levels to control emissions for nuclear facilities".

Progress on this standard has been rapid. The work commenced in 2014, completed public review in 2016 and is on track for publication in the first quarter of 2017.

Progress on the methodologies for developing release limits however, has had to be delayed to account for a number of international and national initiatives with the potential to influence the CNSC

approaches to the derivation of limits. To date, these initiatives have either been completed or have recently advanced to the point that CNSC staff can anticipate and account for their influences.

It has been determined that CNSC can now proceed to drafting the formal CNSC regulatory approach and methodologies taking into account stakeholder input and the outcomes from these recent international and national initiatives.

The CNSC's regulatory approach to setting release limits will be formalized within the regulatory document system in two parts. At the September 2016 Commission proceedings, the Commission will be presented with Part 1 of a significantly-updated environmental protection Regulatory Document 2.9.1, "Environmental Policy, Assessment and Protective Measures".

This regulatory document, represented by the left portion of the slide, will formally document the role of environmental assessment under CEA 2012 and the NSCA, the CNSC Environmental Protection Polices and Principles and the environmental protection measures at the heart of the environmental protection framework and their support of CSA standards.

If approved, portions of this document will establish the basic principles related to the controls

of releases such as expectations for best available technology economically achievable, or BATEA, and treatment design for new facilities or an adaptive management for existing facilities and documentation of the requirement for toxicity testing of effluents released of fish-bearing waters. The importance of the latter will become evident when we discuss federal developments under the *Fisheries Act*.

Part 2 of Regulatory Document 2.9.1 entitled "Process for Establishing Release Limits and Actions Levels at Nuclear Facilities", is under development and planned for public comment in 2017. This document will establish the approach to determining release limits for nuclear facilities.

I would like to briefly present on the status of a number of international and national activities and their potential to influence CNSC regulatory activities with respect to release limits. Two of these specifically focussed on selenium, the U.S. Environmental Protection Agency, or EPA, "Revision of the Selenium Water Quality Criteria for the Protection of Aquatic Life" and the *Canadian Environmental Protection Act,* or CEPA, toxicity assessment of selenium.

Two other activities associated with the *Fisheries Act* have broader implications for release limits

in general. These involve the review of the *Metal Mining Effluent Regulations* and the development of ministerial regulations under the *Fisheries Act.*

First, we'll start with the U.S. EPA. This shot -- slide -- shows the history of the U.S. EPA's attempts to incorporate the unique toxicology of selenium and its complex biogeochemical cycling into the regulatory structure of the *Clean Water Act*. The original 1999 EPA criteria for the protection of aquatic life was based on a specified water concentration as is typical for such criteria in both Canada and the U.S.

In 2004, a draft proposal adding a primary criterion based on fish tissue, selenium concentration, was vigorously challenged by industry as overprotective and by non-governmental organizations as under-protective. This led to an extensive re-evaluation which included targeted research and the incorporation of additional scientific studies, including those completed at the Saskatchewan uranium mines as a result of CNSC regulatory oversight.

This rigorous process was recently completed with the June 30th 2016 publication of a final EPA criterion. The final criteria are even more complex incorporating water-based criteria which differ for flowing water, such as rivers and streams, versus standing water such as ponds and lakes.

In addition, fish tissue criteria are to take precedent over water criteria with egg and ovary selenium concentrations being the preferred tissue for assessment when it can be appropriately collected and measured.

The EPA expects to release guidance on the use of these criteria for regulatory purposes, their use in the development of end-of-pipe industrial release limits and fish tissue field sampling protocols later in 2016.

The EPA criteria have, have had and will continue to have significant influence on CNSC regulation of selenium releases. The CNSC's initial focus on selenium coincided with the release of the 2004 EPA fish tissue criteria and relied heavily on the new developing science at that time.

The final EPA criteria and the new science continue to support Commission decisions related to the need to regulate the releases of selenium.

The EPA guidance for application to effluent-permitting process will be of significant value to CNSC staff and licensees as the approach proposed by staff in the release limit discussion paper was significantly modelled on the U.S. permitting process.

Now, we will discuss the three Canadian government initiatives with the potential to influence CNSC

practices related to release limits.

CNSC technical staff have directly and indirectly supported all three of these activities. Involvement has included the provision of release and environmental data associated with CNSC-regulated facilities and CNSC staff risk assessment, presentations and discussions on the CNSC regulatory approach with respect to effluents in general and selenium in particular and active participation in working groups and specialist technical teams.

The first of these three Canadian initiatives to be addressed is the assessment of selenium as a toxic substance under the *Canadian Environmental Protection Act*.

The CEPA-toxic assessment commenced in 2013 with two separate reports released for public comment in 2015. The first was a formal CEPA-toxic technical risk assessment report with a simultaneous release of the accompanying risk management document required for any conclusion that a substance is CEPA-toxic.

These draft reports were published by Environment and Climate Change Canada and Health Canada and proposed to conclude that selenium and its compounds meet two of the three criteria for a CEPA-toxic substance; that is, they concluded that releases of selenium and its

compounds have or may have an immediate or long-term harmful effect on the environment or its biological diversity and that releases constitute or may constitute a danger in Canada to human life or health.

The CEPA-toxic conclusion identified six industrial sectors as those meriting risk management activities. These sectors were metal mining which includes uranium mining, coal mining, coal-fired electricity generation associated with coal mining operations, base metal smelting and refining, public waste water treatment plants; in other words, sewage plants, and agriculture.

The overall risk management objective for selenium was identified as being to achieve the lowest level of releases to water technically and economically feasible taking into consideration socio-economic factors. It should be noted that this objective is the same objective that the CNSC is already applying in our selenium risk management activities.

While selenium has been proposed as CEPA-toxic, the resultant risk management activities are still in their infancy. For example, risk management activities proposed for the metal mining sector at this time are limited to additional data gathering, specifically the gathering of data on fish tissue levels downstream of effluent releases.

The draft CEPA-toxic determination demonstrates the appropriateness of the Commission's 2006 conclusion that selenium merits regulatory oversight under the NSCA. Current CNSC expectations exceed all of the CEPA-toxic risk management proposals. As a release for the final CEPA-toxic determination with associated risk management plans will not occur until as late as mid-2020. Staff propose to continue to regulate selenium as they have done since first acting on this substance back in 2004.

As the CEPA-toxic process is not likely to yield any specific selenium regulatory requirements or release limits for a number of years, the CNSC will have to move forward with this initiative on their own while maintaining close communications with Environment and Climate Change Canada.

We will now shift the discussion from the *Canadian Environmental Protection Act* to the *Fisheries Act*, specifically section 36 of the *Fisheries Act.*

First, however, we need to clarify a few key aspects of this section of the Act. Section 36, more commonly referred to as the deleterious substance section, is administered by Environment and Climate Change Canada. It quite simply prohibits the release of deleterious substances to fish-bearing waters.

A deleterious substance has been legally

interpreted very broadly. It is a substance having a potentially harmful chemical, physical or biological effect on fish or fish habitat. However, key to the interpretation of deleterious is that it is the substance itself that is determinative to be deleterious by nature and not the resultant concentration of that substance in the receiving waters. Thus, no demonstration of harmful effect in the actual fish-bearing water receiving the effluent is necessarily required.

The effects or factors reducing bioavailability and, thus, toxicity in the receiving environment may not be taken into account when Environment and Climate Change Canada determines if a contravention of section 36 of the *Fisheries Act* has occurred. Until recently, section 36 of the *Fisheries Act* only authorized the release of deleterious substances through a Governor-in-Council regulation made under the Act. The *Metal Mining Effluent Regulations* are an example of such regulations.

Thus, a permit or licence authorizing releases, whether it be from provincial or even other federal authorities such as the CNSC does not count as authorization under the *Fisheries Act*. This means facilities in full compliance with their permits or licences can still face a section -- a *Fisheries Act* charge

under section 36.

Of additional note, the Regulations authorize the release of a specific set of deleterious substances and not the effluent as a whole. For example, a mining effluent that meets all of the MMER release limits can still be in violation of section 36 for any other substance it contains, say for example, selenium as it is not specifically addressed by the regulation.

Due to the importance to the regulation of uranium mines and mills CNSC staff have actively been involved in the development of the original MMER and follow-up reviews, such as the 2005 three-year review and the recent 10-year review. In fact, it was during the three-year review that selenium was added to the quarterly characterization of all metal mining effluents, in part due to CNSC staff concerns that these substances may be of regulatory interest for all metal mines and not just uranium mines.

The 10-year review was launched in 2013 to address a number of proposed significant changes to the Regulations. This was an extensive exercise involving multiple stakeholders extending over two years and covering a wide range of proposals. These involved reducing limits for current substances under the MMERs to respect the BATEA concept; developing release limits for four new substances,

one of which was selenium; adding additional effluent acute lethality test; modifying the existing requirements for periodic effluent characterization to include among other constituents uranium; modifying receiving environment monitoring requirements and providing more regulatory certainty to coal and diamond mining by incorporating them into the MMERs.

The review has been concluded and Environment and Climate Change Canada staff have reported back to the Minister for consideration of proposals. Some of the general conclusions arising from the review directly relate to establishing release limits under the NSCA and will be briefly discussed.

First, formal recognition is now being given to the expectation that technology-based limits, for example water treatment technology, must be periodically reviewed and revised if they are to be referred to as best available technology economically achievable and should apply to own and mining developments. This conforms with the CNSC staff expectation and the specific BATEA references in Regulatory Document 2.9.1 to be presented to the Commission in September.

Environment and Climate Change Canada also propose the addition of an invertebrate acute toxicity test to the already existing rainbow trout test as a means of

demonstrating that effluents are not acutely lethal to fish. This is consistent with CNSC-regulated facilities in Ontario where the CNSC harmonizes with the provincial requirements but the addition of this invertebrate acute toxicity test would be a new requirement for facilities located outside of Ontario.

Selenium received extensive attention during the 10-year review. There is clear consensus among participants that selenium requires some form of regulation. However, no specific release limit was -- has been determined. Instead, Environment and Climate Change Canada indicated, with broad stakeholder support, their preference for limits to be based on site-specific risk assessments. This is a marked departure from historical regulatory practice under the *Fisheries Act* where exposure-based limits have been resisted as these types of limits take into account the effects of dilution by natural receiving waters.

Unfortunately, a specific methodology for developing the exposure-based limits has yet to be determined by Environment and Climate Change Canada.

Consideration is currently being given to the use of some as yet unspecified effluent concentration as a trigger to require downstream fish tissue monitoring. This conforms with the CEPA risk management proposal to

obtain additional selenium fish tissue downstream from effluent releases. The CNSC licence facilities are already required to do this where their effluent and ERA indicates the potential for selenium to accumulate to levels of concerns in fish tissues.

The broad stakeholder support for site-specific, exposure-based limits with associate mixing zones is important to the CNSC as this approach aligns with discussion paper -- with those proposed in discussion paper 12-02 which proposed a flexible approach utilizing technology and/or exposure-based limits as appropriate.

Thus, the CNSC's current environmental risk assessment-based approach incorporating site-specific risk management, including treatment options analyses and installation where necessary continues to represent best industry and regulatory practice for this substance.

Uranium releases receive limited attention in the 10-year review of the MMER. Environment and Climate Change Canada proposed the addition of uranium to the expanded list of substances to be measured in the effluent on a quarterly basis as opposed to the more frequent weekly monitoring and monthly reporting required for the specific deleterious substances authorized under the Act. This data would allow Environment and Climate Change Canada to determine whether uranium releases at metal mines in

general merit additional regulation.

As uranium mines are already required by the CNSC to measure and report uranium for all effluent releases to the environment as part of routine monitoring and reporting, this additional MMER requirement has little impact on the uranium mining sector.

Environmental non-government organizations indicated their support for developing limits for a substantial list of additional substances including uranium. These receive limited discussion due to the need to address the other higher priority substances which were selected based on a risk or their demonstrated regulation in other countries.

The final Canadian initiative influencing CNSC activities related to the development of release limits is that of ministerial regulations. It has long been recognized that there was a potential for conflict between the *Fisheries Act* and other regulatory permitting processes. This creates a climate of regulatory uncertainty where a facility in full compliance with their permits and licences could still face a charge under section 36 of the *Fisheries Act*.

To address this, enabling regulations were published in the Canada Gazette in 2014 to allow the creation of ministerial sector regulations as an efficient

means of authorizing lower-risk deposits already well controlled by recognized instruments or processes outside of the *Fisheries Act*. To qualify for ministerial regulations three criteria must be demonstrated:

- First, the release must be authorized under federal or provincial law and subject to enforcement and compliance regime;

- Second, the deposit or release must not be acutely lethal and concentrations in the deposit or receiving waters must satisfy the Canadian Water Quality Guidelines or recommendations for those guidelines on their application or recommendations of any peer-reviewed guidelines adopted by a federal or provincial body;

- The third of the conditions requires that the effects of such a deposit on fish and fish habitat and the use of fish by man have been evaluated in a manner which is scientifically defensible.

All three of these conditions are currently met by the CNSC regulatory process, have been documented in Part I of Regulatory Document 2.9.1 to be presented in September proceedings and/or proposed within the release limit discussion paper.

CNSC staff have been engaged with Environment and Climate Change Canada since the coming into force of the enabling regulations to demonstrate that the

CNSC licensing and compliance process meets these conditions. These discussions have been prolonged, partly as a result of the lack of formally documented environmental system within the CNSC regulatory document framework. This has necessitated a series of extensive communications and meetings outlining the CNSC framework and presenting case studies demonstrating their application. This will be remedied should the Commission approve Part 1 of Regulatory Document 2.9.1 scheduled, as I said, for the September Commission hearing.

There has also been significant discussion between the CNSC and Environment and Climate Change Canada with respect to the scope of any nuclear sector ministerial regulation. Opening discussions restricted the scope to thermal releases at nuclear power plants, though the CNSC believes that the scope should apply to releases for the complete nuclear fuel cycle and include all relevant effluent constituents if we are to address regulatory certainty and prevent dilution of regulatory responsibility.

In summary, there has been a significant international and national activity that needed to be considered and accounted for before the CNSC finalized proposals for the development of release limits, especially for novel contaminants associated with uranium mining.

This slide summarizes the status of each of these initiatives and staff's proposed path forward.

Two of these initiatives, the U.S. EPA selenium criteria and the 10-year review of the MMERs have been completed and developments arising from them will be accounted for in the CNSC approach to setting release limits.

The CEPA toxic assessment for selenium will require a number of years to work through the formal process before anything such as a federal limit is derived. However, the draft conclusion and risk management proposals support current CNSC regulatory actions. Staff are therefore confident that the proposals for the development of licence limits will be in line with any future decisions related to the final outcome of the selenium CEPA toxic assessment.

Lastly, discussions with Environment and Climate Change Canada with respect to obtaining ministerial regulations, while currently on hold, will continue to be pursued in order to provide further clarity and regulatory certainty for the regulation of releases under the NSCA.

In conclusion, staff emphasize that releases of nuclear and hazardous substances are currently controlled and regulated in a manner protective of the environment.

To summarize the proposed regulatory path forward, the Commission can expect to see significant activity on the documentation of regulatory expectations for environmental protection, culminating in a published process for developing release limits and application of these to specific substances in CNSC licences.

This will commence with a September 2016 presentation to the Commission of Part I of Regulatory Document-2.9.1, Environmental Protection: Environmental Policy, Assessments and Protection Measures.

Part I will include the CNSC's role of environmental assessment under CEAA 2012 and the NSCA, the environmental protection policies and principles, and the environmental protection measures with their supportive CSA standards.

Part I will also serve to formally establish the criteria required to qualify for ministerial regulations under section 36 of the *Fisheries Act*.

This will be followed by Part II of Regulatory Document-2.9.1 proposed to be released for public comment in 2017.

Part II will specifically address technical details on the development of release limits and action levels and will formally incorporate CSA Standard N288.8 on action levels at that time.

With the documentation of the CNSC environmental protection regulatory framework, the CNSC is well positioned to demonstrate the compliance with the qualifying conditions for ministerial regulations. Staff propose to continue pursuing access to these regulations as a means of attaining regulatory certainty and efficiency while ensuring protection of the environment.

Finally, CNSC staff request that the Commission consider action items M2011-08 and H-2015-14 be closed on the basis:

- that contaminant specific updates be provided within the annual regulatory oversight reports for each sector;

- that the proposal to include the process and timeline for developing effluent release limits within Phase II of REGDOC-2.9.1 is acceptable; and

- that updates on Regulatory Document-2.9.1 will be provided in the annual regulatory framework report to the Commission.

MR. RINKER: Thank you for your attention. That concludes our presentation and we're available for any questions you may have.

THE PRESIDENT: Okay. So let's jump into the question period.

I should have introduced -- the Department

of Environment Canada and Climate Change has been mentioned quite a few times and we have a single representative, Ms Nardia Ali, the Manager, Compliance, Promotion and Expert Support. So thank you for being here.

And let's start the questions with Monsieur Tolgyesi.

MEMBRE TOLGYESI : Merci, Monsieur le Président.

There is a document which is reference document 16-M35, and on page 6 there is a statement that:

> "Environment Canada indicated with industry support that they would continue to pursue development of a methodology for deriving a site-specific exposure-based limit for selenium." (As read)

But this is a significant deviation from historic regulatory practice under the *Fisheries Act*, where limits have been always technology-based. Is Fisheries actively participating on these workshops?

MS ALI: Nardia Ali, Environment and Climate Change Canada.

Do you mean Fisheries and Oceans, are they participating? No, because the responsibility for deleterious substance is now the responsibility of the

Minister of Environment and Climate Change Canada. So the working groups are established by Environment and Climate Change Canada. We have been involving the CNSC staff from DERPA in those working groups.

MR. RINKER: Just to add some clarity, section 36 of the *Fisheries Act* belongs to Environment Canada, while the rest of the *Fisheries Act* resides with Fisheries and Oceans Canada.

MEMBER TOLGYESI: So Environment Canada could decide whatever methodology they will use and -- sorry for the expression -- Fisheries and Oceans have nothing to say?

MS ALI: Well, Environment Canada will carry the lead but they will consult I guess with scientists and researchers in the Department of Fisheries and Oceans who would have data and information that would contribute to selecting the best guideline or limit.

MEMBER TOLGYESI: And you were saying you are consulting. So what's the position up to now of Fisheries and Oceans, are you open to these discussions? Because usually Fisheries and Oceans are quite -- how should I say that -- stiff, don't move, no flexibility.

MS ALI: Well, the deleterious substance portion of the Act, as Mr. Rinker said, is now the responsibility of Environment Canada. So there are

specific groups and working groups within Environment and Climate Change Canada that will be reviewing all the available information. And there is actually a draft screening report that they are addressing comments on that right now and, you know, the later versions of those reports will be released I guess by next year.

MEMBER TOLGYESI: So same document, on page 3 you are talking about deleterious substances and you are saying there that:

> "No demonstration of harmful effect in the actual fish breeding water is required. Effects of dilution or other risk mitigation measures may not be taken into account." (As read)

Does that mean that the simple act of releasing without considering volume or concentration becomes a contravention or there is a threshold where under such a limit release will be considered having no effect, whereas about that limit there are harmful effects and therefore contravention?

MS ALI: The interpretation of the Act, or the black-and-white interpretation is that you cannot deposit any substance that has been shown to be deleterious unless it's authorized by regulation.

THE PRESIDENT: Staff, do you want to

elaborate? The idea here is the difference between theory and practice, okay. So what's the practice here?

MR. RINKER: Mike Rinker for the record.

So in general, there's also, you know, a history of how Environment Canada would take enforcement action and there's a number of criteria which they would go through before -- at least in our experience, what we have observed -- before they would take such action.

One of the main ones is, you know, has industry done their due diligence to prevent such releases? And, you know, you can question what does due diligence mean, but I think, you know, best available technology economically achievable, have they done basically what would be expected of a responsible industry to prevent those releases and documented that there is no harm occurring? And those are the sort of things that Environment Canada has in the past considered, of whether they would take enforcement action or not.

MS ALI: Can I just add? Yes. I just wanted to add further to that. Nardia Ali, Environment and Climate Change Canada.

Environment Canada provides technical advice to the Canadian Nuclear Safety Commission through our MOU, and our advice, you know, ensures protection of the environment because we work with them to come up with

the appropriate discharge limits.

THE PRESIDENT: Okay, thank you.

Dr. McEwan...?

MEMBER McEWAN: Thank you.

How would selenium or molybdenum toxicity manifest itself in fish or, more importantly, in the traditional food chain?

MR. McKEE: Okay. First, I will address selenium. Selenium, as I said, has a unique toxicology, especially -- the most sensitive species are fish, predominantly because the fish deposit the selenium within their yolk and then that results in embryonic teratogenic effects, deformed offspring, as the yolk is utilized as a food source for the developing embryo.

The molybdenum, as we said, the decision based on molybdenum was based on the protection of moose and muskrat species that were consuming -- that consume large amounts of sediment and macrophytes and through that ingestion route are taking up large concentrations of molybdenum and it results in molybdenosis, which is generally commonly referred to as a wasting disease. So it affects the gastrointestinal tract, it affects nutrient uptake. Copper deficiency arises because of the conflict between molybdenum and copper.

The selenium -- the CEPA toxic

determination, as you saw, had a determination of affecting human health. That was predominantly based on assessments of selenium, total blood selenium concentrations specifically identifying indigenous communities on traditional diets, with the Inuit in northern Canada having the highest total selenium blood levels because of consumption of marine mammals predominantly. Now, if you have -- since fish take up quite substantial levels of selenium, if you have a subsistence diet with very high levels of fish intake, that is also a potential pathway.

MEMBER McEWAN: And the impact on human health of high selenium levels?

MR. McKEE: That results in selenosis which has predominantly issues of hair loss, nail loss, brittle nails and gastrointestinal effects are the most common effects. Very severe exposures can lead to some neural disorders.

Yes, and as I have been asked to clarify, effects associated with uranium mines that we have been regulating are all based on effects on -- potential effects on fish development, and then any cases of fish consumption restrictions have been put in a couple of places just to ensure that we have no concerns, though none of those areas are heavily fished.

MEMBER McEWAN: Okay. So I think what I'm

understanding from that is that given the way it passages through the food chain there would actually be relatively early warning signs at the level of the fish or at the level of the moose before it really ran the risk of moving into the human population?

MR. McKEE: Yes, that's exactly correct.

LE PRÉSIDENT : Monsieur Harvey...?

MEMBER HARVEY: What can we expect for the coming years, in two years, five years, seven years, taking into account things like you mention in your document, that when we place a regulation on the best available technology that it has to be revised from time to time? So what could be different in five years for example for uranium?

MR. McKEE: An ideal example of that is the Regulatory Document-2.9.1, and its statement with respect to expectations of BATEA for facility design and treatment technologies is that all new facilities will undertake assessments of existing technologies in place and will be adopting the most efficient and most protective technologies.

We are already -- because requiring extensive retrofits and upgrades to an existing facility is far more expensive than actually upgrading, putting in the latest in a new facility, we are already seeing the industry responding to these activities.

So for example, the last two proposals for new uranium mines in Canada both proposed treatment systems that currently exceed all of the treatment system designs in the existing mines, uranium mines in Canada, which already exceed treatment designs for the majority of metal mines in Canada.

So the ideal is you are looking to ensure that this drives continuous improvement in technology and that new technologies get adopted and taken up as new facilities are built.

MR. RINKER: If I could add just one point. Mike Rinker for the record.

So we don't see any expectations for changes in the mining industry because they are already leaders in terms of their technology, but the release limits may change with the revision, for example, of the *Metal Mining Effluent Regulations*. Our technology-based numbers, they have been fairly stable over a long period of time because they haven't been revised to what we would consider current best available technology economically achievable. So if there was a review of what do we mean by best available technology economically achievable every five years under the *Metal Mining Effluent Regulations*, we may see a change to those release limits over every review period. And we could see that in our Licence Condition

Handbook.

MEMBER HARVEY: Okay. But if a new plant for example asks for a licence and there's two or three available technologies, one's better than another with different results, so are you going to impose the most effective technology or that will be left to the licensee to make his own choice?

MR. RINKER: Mike Rinker for the record.

So it's best available technology economically achievable, so that economic factor is a part of the consideration, but if there was certainly one technology that performs better from a pollution prevention standpoint and it was economically achievable, then we would be -- we would look at that very seriously and I'm not sure what an argument would be to say that they wouldn't do that.

MEMBER HARVEY: Okay, thank you.

THE PRESIDENT: Ms Velshi...?

MEMBER VELSHI: Thank you. I have a number of very short questions.

You mention that there are a few other industrial sectors where selenium is a problem. Does that apply to molybdenum as well?

MR. McKEE: A CEPA toxic assessment has not been done on molybdenum, but molybdenum was looked at

under the *Metal Mining Effluent Regulations* 10-year review. My understanding is it has been a requirement in the metal mines to four times a year characterize their molybdenum and that was so Environment and Climate Change Canada could evaluate whether releases was a broad problem in the mining industry for molybdenum. You have to remember, they are regulating in excess of 100 mines and their determination was that it wasn't common enough as a high effluent release to merit a national regulation.

MEMBER VELSHI: But other than collecting data, they don't have like action levels or anything like that to manage the risk?

MR. McKEE: No. Molybdenum is not covered by the *Metal Mining Effluent Regulations*, though it would be covered by the section 36 prohibition on release.

MEMBER VELSHI: The CSA Standard N288.8, who would be on the working group that is developing that besides the licensee and CNSC folks?

MR. LOJK: Bob Lojk for the record.

The CSA, as an organization which is allowed to produce national standards of Canada, has a matrix requirement that they have to have stakeholders, industry people, government organizations and the like in it. So they cannot form a committee unless the committee has representation from a broad spectrum of stakeholders

per essentially requirements to be considered a national standard of Canada, and they do, it's a very important consideration.

MEMBER VELSHI: Because you did say that the discussion paper, when you had a workshop on that, there was a lot of interest and a lot of different stakeholders. Would those folks be involved in developing the CSA standard? Or I guess certainly during the review process there may be, but what about in the actual development?

MR. RINKER: Mike Rinker for the record.

So a lot of the comments and concerns we received then were from industry and industry is well represented, but there were also non-governmental organizations who had some concerns and members of the public. I don't believe that they are represented on this. However, there is a public consultation period that is -- I'm not sure, I will ask Mr. McKee to provide the schedule on that -- for which they could comment on this. The CNSC contributes to the CSA in such a way that the standards are publicly available, they don't have to be purchased.

MEMBER VELSHI: After the fact though, right?

MR. McKEE: Malcolm McKee for the record.

The public review period was completed

when that would have gone out for a full general public review.

MEMBER VELSHI: Okay. And my last question, and maybe it is for Environment and Climate Control Canada.

So even after the CNSC has issued REGDOC-2.9.1, there is still no assurance of a ministerial regulation being allowed?

MS ALI: What would happen is we would have -- our people, our policy people have indicated that at the current time they don't have the resources to complete the review of the CNSC regulatory regime that they have to do before they proceed with a ministerial Reg because of other priorities in their group, but my understanding is that they have been speaking with Brian Torrie and other DGs at the CNSC about reevaluating priorities later this year and that's the status of it as of now.

MEMBER VELSHI: So it's more just a resourcing issue than any policy type concern then?

MS ALI: Right now, yes.

MEMBER VELSHI: Thank you.

THE PRESIDENT: Any other questions?

First of all, I have to tell you I'm really impressed with all the research that has been done

by your shop, particularly as, as you know, we are accused of muzzling researchers here. I'm not sure you were muzzled to lead the charge here.

And I'm really happy to hear that you're not waiting for the EPA, nor for Environment Canada, nor for Fisheries and Oceans, because you have to come up with practical, measurable environmental protective measures. And I remember all the debate when Cameco put their treatment for selenium.

In fact, my question is -- I thought you guys were invited to brief the EPA U.S. on -- or the U.S. NRC, I can't remember -- on selenium, and in fact my question is: Are you really the world expert in terms of having real available data of impact of some of those deleterious material on fish?

MR. McKEE: Malcolm McKee for the record.

Yes, we were invited to provide a briefing to the EPA just prior to their development of their final criteria. We provided a breakdown of how we identified their issue and how we moved towards regulatory controls.

In terms of leaders, we are definitely the leaders within Canada with the two sites -- the two jurisdictions in Canada with the greatest information on selenium and selenium releases are coal operations in the Elk Valley in Southern B.C. and uranium mining in Northern

Saskatchewan.

THE PRESIDENT: But isn't it true if you demonstrate what reasonable protective limits are, that will impact many, many other industries, not only uranium but coal and some other facilities, so there will be an enormous impact if government will start adopting those limits?

MR. McKEE: The regulatory action and the resultant research, and to be fair, responses by Cameco Corporation, have resulted in a significant number of top-quality publications in the scientific literature coming out of the University of Saskatchewan Toxicology Centre, and those research papers were of key importance in the Canadian CEPA toxic assessment and, as I said, did make it into the papers utilized for the U.S. EPA toxicity assessment.

THE PRESIDENT: So that's my last question.

You've been doing this research for years now. I understand that posting some of this work on our Web is one way of making it public. What's the matter with publishing this stuff in peer review, scientific magazines, et cetera, et cetera, et cetera? Why don't you do lots more of that?

MR. RINKER: Mike Rinker for the record.

So we certainly hear that and we have published in a number of areas and we usually take, you know, themes of research and have our teams working on this, and from what I hear, selenium is the one that's going to be published on next.

THE PRESIDENT: So you are planning to publish some of the work you have done over the years on this?

MR. RINKER: It's difficult to say we're going to put it in a publication, in a journal, because there's a peer review process and we have to put it together.

The first step is we will be putting it on our own CNSC website as information on the approach we've taken and the data we've used, and the responses of industry and the cascading responses to the universities in Saskatchewan I think is an important story to tell, and then we will putting abstracts together to determine where we can present this sort of information.

THE PRESIDENT: Thank you.

Any...?

Monsieur Tolgyesi...?

MEMBER TOLGYESI: I have just one for Environment Canada.

We were told that there are six industrial

sectors where the selenium stuff applies. There was mention of agriculture, sewage, which is municipalities. How are these other sectors progressing in selenium releases?

MS ALI: Nardia Ali, Environment and Climate Change Canada.

I'm afraid I don't have the information to answer that question, but the screening report with a lot of different information is going to be finalized and released later this year.

I did want to take the opportunity to say, though, that because Environment and Climate Change Canada recognizes the experience of the CNSC, because you have already implemented selenium regulatory requirements at uranium mines, we recognize that the CNSC has valuable regulatory knowledge and experience to offer, so we are actually having them -- we have invited them to review and comment on some of the draft screening assessments, risk management approaches, et cetera, at the same time as Environment Canada's internal review to ensure that we can capitalize on that experience and expertise.

MEMBER TOLGYESI: Do you work with your provincial counterparts? Because there is a provincial regulation also. So is there a kind of exchange of information and approaches?

MS ALI: I'm not on the actual working group. I can't comment on the provincial interactions. I mean we can get back to the Commission on that.

THE PRESIDENT: I know that staff has a lot of experience working with the Saskatchewan government.

MR. McKEE: Malcolm McKee for the record.

Especially for the 10-year review of the *Metal Mining Effluent Regulations* there is extensive participation by a number of provinces in that activity, also environmental non-government organizations and indigenous groups as well as federal regulators and external scientific advisors.

THE PRESIDENT: Anything else?

Okay, we will take a break for 15 minutes. Be back at 3:30. Thank you.

--- Upon recessing at 3:17 p.m. / Suspension à 15 h 17

--- Upon resuming at 3:35 p.m. / Reprise à 15 h 35

***CMD 16-M34**

Oral presentation by CNSC staff

THE PRESIDENT: Okay, we are ready to continue and the next item on the agenda is an information item to provide us with a technical briefing on Risk-informed Assessment of CANDU Safety Issues, as

outlined in CMD 16-M34.

We have representatives from Bruce Power and Ontario Power Generation in the room to answer any questions. So welcome to all.

I understand from CNSC staff, Mr. Frappier, that you will get us going. Please proceed.

MR. FRAPPIER: Thank you very much.

Perhaps just before we get going on that, we would like to make a small correction on an error on the things we talked about earlier today. So I would ask Mr. Robin Manley to put something on the record.

MR. MANLEY: Thank you very much.

Robin Manley for the record. I am the Vice President of Nuclear Regulatory Affairs and Stakeholder Relations at OPG.

On behalf of OPG, I would like to correct one statement that was made by our staff earlier this afternoon during the Status Report on Power Reactors.

A Commissioner asked whether the Pickering hydrazine leak was reported as a spill to the Ministry of Environment. In fact, this event was not a spill. The leak was entirely contained internally and no release to the environment occurred, no spill occurred. Thus, the event does not meet the spill reporting criterion and therefore it was not reported to the Ministry of

Environment. We apologize for the error.

THE PRESIDENT: Okay, thank you.

Monsieur Frappier...?

MR. FRAPPIER: Okay.

Good afternoon, Mr. President, Members of the Commission. For the record, my name is Gerry Frappier. I am the Director General of the Directorate of Power Reactor Regulations.

I would like to thank you for the opportunity to present the risk-informed assessment of CANDU safety issues as a technical briefing.

With me today are Dr. David Newland, Director General of the Directorate of Assessment and Analysis, and Dr. Doug Miller, Lead Technical Advisor for the Directorate of Major Project Management and Regulatory Improvements.

We also have numerous technical personnel that are available to provide details and, as you mentioned, the licensees are here, including New Brunswick Power. You mentioned OPG and Bruce, but New Brunswick Power is also here.

THE PRESIDENT: Sorry about that.

MR. FRAPPIER: And so today's presentation will provide some background on the CANDU safety issues, discuss a bit how we did the categorization since last we

spoke to the Commission on these items, our approach to managing the CANDU safety issues, the current status of them and then some conclusions.

Thanks, Doug. There we go.

Before we get into the details, I would like to provide some context, however.

This presentation will provide some details on some very, very technical subject matters which can lead to -- which I'm concerned might lead to some confusion with respect to the current status of our operating plants, our operating reactors.

So I would just like to start off by being very clear that the nuclear reactors operating in Canada meet all the regulatory requirements and licensees are qualified and are making adequate provisions to operate the reactors. The safety cases for currently operating reactors fully apply the defence-in-depth framework and have appropriately conservative safety margins.

However, in the nuclear business that's never quite enough. We are always looking for more and so, as a healthy safety culture of nuclear regulators includes having a questioning attitude, looking for opportunities to continuously improve safety and increase regulatory knowledge, it's within that context that these issues are being talked about today.

Ongoing regulatory research, peer reviews from international experts and taking operating experience into account are key aspects of continuous safety improvements and increasing our regulatory knowledge for problems today, but more importantly for problems that might come tomorrow.

So the risk-informed assessment of CANDU safety issues focuses on the activities undertaken to confirm the adequacy of safety margins, increase regulatory knowledge, enhancing the safety of CANDU reactors.

And with that, I will turn it over to Dr. Doug Miller who will continue on with the presentation.

DR. MILLER: Doug Miller for the record.

Regulatory decisions are based on the best available science, but a regulator needs to have a questioning attitude, seeking continuous safety improvement and increasing regulatory knowledge. As such, one element in the framework of the International Atomic Energy Agency activities is to assist member states in reassessing the safety of operating nuclear power plants.

In collaboration with the International Atomic Energy Agency, regulators of countries operating each type of reactor initiated work to enhance regulatory effectiveness through the exchange of safety-related information. This initiative resulted in the

identification of generic safety issues for several reactor types.

The compilations were published as technical documents, or TECDOCs as they are called, and include:

- TECDOC 640, Safety Issues for the Russian-designed reactors WWER-440, which was published in 1992;

- TECDOC 1044, Generic Safety Issues for Light Water Reactors, that includes both pressurized and boiling water reactors and was published in 1988; and finally,

- TECDOC 1554, Generic Safety Issues for Pressurized Heavy Water Reactors, or CANDU type reactors, and was published in 2007.

These represented at the time a compilation of what was defined as safety issues for these three types of reactors. There is information in a CMD indicating the list of items identified by experts with operating experience for each reactor type.

It is through initiatives such as this that the best available science is used, but also at the same time challenged.

In 2007, CNSC staff were the main contributors in the development of the International Atomic

Energy Agency's technical document on Generic Safety Issues for Nuclear Power Plants with Pressurized Heavy Water Reactors.

We also developed an initial list of technical issues using this document and consolidated the safety issues in this with the CNSC's Generic Action Items that existed at the time, which included findings from ongoing nuclear safety research and experience feedback from regulatory oversight of currently operating CANDU reactors in Canada and worldwide.

Collectively, these technical issues were referred to as the CANDU Safety Issues or sometimes we call them CSIs.

The CANDU Safety Issues topics include the adequacy of computer codes, safety analysis methodologies, aging of system structures and components, fire protection, seismic design, functions of pumps and valves, electrical system performance, instrumentation and control system performance, containment, auxiliary systems such as service water and instrument air, fuel behaviour and reactor core behaviour.

So it really did focus on the areas that we refer to as safety analysis, plant design and fitness for service, collectively those three safety and control areas.

So as discussed, ongoing regulatory research and taking operating experience into account are key aspects of continuous safety improvements and increasing regulatory knowledge.

We have reported on these initiatives in regulatory oversight reports and during licence renewals. However, this CMD consolidates the CNSC staff reviews.

This CMD will describe the risk-informed decision-making process followed to develop the path forward for resolution of the CANDU safety issues.

In 2007, an expert team of CNSC staff followed an expert elicitation process to assess the CANDU safety issues as follows.

CNSC experts considered whether the item was addressed in initial licensing of the facility, whether safety analysis methodologies were appropriate or designed upgrades have been made since initial licensing.

The CANDU safety issue, the item that you see in the report, was determined not to be an issue in Canada if this was the case. These are referred to as Category 1 CANDU safety issues.

Next, we considered whether existing measures in place by licensees need additional confirmation or improved knowledge or understanding was needed to reconfirm the adequacy of safety margins. If the answer

was no, it was determined that the licensees have appropriate control measures in place to address the issue and to continue to maintain safety margins.

The CNSC, through their regulatory oversight, continues to monitor licensees' management and continued progress towards resolution of the issue or management of the issue. These were referred to as Category 2 safety issues.

Category 2 CANDU safety issues can be those subject to ongoing regulatory oversight such as component lifecycle management programs that involve component inspections and review of inspection results by CNSC staff. In addition, they can be those subject to an ongoing review such as the results from an analysis methodology.

An issue was categorized as a Category 3 CANDU safety issue if further experiments, research and/or analysis are required to improve knowledge and understanding of the issue or to confirm the adequacy of the safety margins. In this case, the CNSC's risk-informed decision-making process was applied to develop the path forward or, as we say, the risk control measure for issue resolution.

The CNSC reconfirms the adequacy of safety margins and monitors licensees' management of the issue to

ensure its timely and effective resolution.

So to summarize, Category 1 is not an issue in Canada. There is minimal regulatory oversight unless there is a change regarding the item, that there is a discovery or OPEX worldwide that would make you challenge some thinking, but that has been very rare.

Category 2, the issue is potential concern in Canada. However, the licensees have appropriate control measures in place to address the issue and to maintain safety margins. The CNSC continues to monitor licensees' management and progress towards the issue.

For Category 3, the issue is a concern in Canada. However, the licensees have control measures in place to maintain safety margins, but further experiments and/or analysis are required to improve knowledge and understanding of the issue and to reconfirm the adequacy of safety margins.

The CNSC evaluates the reconfirmation of safety margins and continues to monitor licensees' management of the issue to ensure its timely and effective resolution. Essentially, Category 3 items require more focused regulatory oversight.

An example of the Category 1 CANDU safety issue is as follows.

One of them was systematic internal

flooding assessment, including backflow through floor drains. So if there is an inadvertent spill, could a backflow impact on safety systems? Direct flooding from liquid releases as well as backflow flooding of safety systems through drains is a potential problem with implications that are broad in nature.

In Canada, a systematic assessment of internal flooding is a licensing prerequisite. It had to be done from day one. For example, calculation for reactor building flooding was done to show that the flooding sources in the reactor building did not affect safety functions needed to control the reactor.

An example of a Category 2 is steam generator tube integrity. Concerns relating to the steam generator tube integrity stem from the fact that the steam generator tubing is subject to a variety of degradation mechanisms. These degradation mechanisms can impair tube integrity if they are not managed effectively.

As part of safe operation, Canadian utilities are required to develop and implement steam generator tube integrity programs. The tubes are inspected according to the periodic inspection program as per the requirements and acceptance criteria in CSA standards. In addition, in-service inspection plans are developed to manage the ongoing in-service degradation discovered during

inspections.

The CNSC reviews inspection results, but we also look at the adequacy of the plans in view of the inspection results and looking forward, taking OPEX into account, where to focus efforts on any novel or unexpected steam generator tube degradation issues.

We will provide more specific details on the status of Category 3 CANDU safety issues in just a couple of minutes.

In 2007 when we did the initial assessment, there were 24 Category 1 issues, 29 Category 2 issues and 21 Category 3 issues. Overall, through industry's efforts in addressing the Category 3 CANDU safety issues and the CNSC's effort in assessing submissions, there are now 25 Category 1 issues, 45 Category 2 issues and four Category 3 issues.

The re-categorization process includes the following steps:

- a licensee will provide their submissions stating their request for re-categorization and include the supporting documentation addressing the path forward, the risk control measures;

- the CNSC staff then review the submission and evaluate the re-categorization request based in view of the measures to be taken for the CANDU safety

issue;

- after it has been verified that the risk control measures have been implemented, the Category 3 CANDU safety issue is re-categorized to Category 1 or 2.

The definitions just provided are used to determine if the CANDU safety issue is moved to Category 1 or Category 2.

From 2007 through 2009, the CNSC applied its risk-informed decision making process to review and document the status of the Category 3 CANDU safety issues, determine the risk significance of the Category 3 CANDU safety issues and develop the path forward for the resolution. As mentioned, these are the risk control measures.

Risk control measures could include changes to the design, modifying operational practices and improvements to the knowledge base, for example through carrying out experiments and research or carrying out further, more detailed analyses.

The risk assessment that was developed in a 2009 report was reviewed by CNSC management, questioned, challenged and revised according to our management system processes, and then the CNSC staff engaged with industry to develop the risk control measures for resolution of the Category 3 CANDU safety issues.

It is important to note that following the risk assessment there were no items that required immediate attention by the licensees.

The final report was published in 2009 and was made available to the public. We have presented this work in an International Atomic Energy Agency meeting on good practices in heavy water reactor operation, also to the CANDU senior regulators and it was also documented in the 2010 report to the Convention on Nuclear Safety.

As discussed, through application of the risk-informed decision making-process, there were 4 remaining Category 3 CANDU safety issues.

I will now turn the presentation over to Dr. David Newland.

DR. NEWLAND: Good afternoon, Mr. President, Members of the Commission. My name is David Newland and I am the Director General of the Directorate of Assessment and Analysis.

First, I would like to note that the industry has made significant progress in implementing the risk control measures for the CANDU safety issues, thereby enhancing the safety of CANDU reactors.

The remaining four Category 3 CANDU safety issues are related to need for systematic assessment of high-energy line break effects, analysis for void

reactivity coefficient, fuel behaviour in high temperature transients and, lastly, fuel behaviour in power pulse transients.

The regulatory positions and paths forwards for addressing these Category 3 issues are well established. Further experimental work and analysis are required to confirm the acceptance criteria and analysis methodologies proposed for use in licensing applications.

We will discuss the status of each of these four Category 3 issues in more detail in the upcoming slides.

High-energy pipes are those containing fluids at high pressure or temperature. In the event of a break of one of these pipes, there is an energy release which could lead to safety systems, equipment, structures or components being damaged.

For the primary side, Darlington Nuclear Power Plant was the first CANDU station that explicitly addressed the requirements for protecting systems, structures and components from the effects of postulated primary heat transport pipe rupture based upon industry best practices at the time that the station was designed.

The design of the Darlington Station has adequately protected the systems, structures and components from the consequences associated with a postulated rupture

of high-energy piping by constructing isolation barriers and engineered restraints against jet impingement and pipe-whip or through leak-before-break assessments being performed.

An assessment was also performed for the Bruce B Station at the design stage.

However, for other nuclear power plants in Canada, the issue of high-energy line breaks on the primary side was not fully addressed during the design stage. The layout of plant and equipment applied the defence-in-depth philosophy and implemented physical separation of special safety systems and separation between high-energy systems and special safety systems. However, not all energy lines and locations were analyzed at that time.

On the secondary side, all CANDU nuclear power plants have constructed isolation barriers, engineered restraints or performed leak-before-break assessments to confirm that the impacts from high-energy line breaks are acceptable.

So for the path forward, licensees must complete a systematic review of high-energy piping breaks inside containment, assess the consequential damage associated with a postulated failure and identify potential design improvements if necessary.

Interim measures are in place, including

appropriate periodic inspection and maintenance activities to support fitness-for-service of high-energy pipes.

Moving to the current status, Bruce Power and OPG Darlington have submitted documentation to address the risk control measures sufficient to have this issue recategorized as a Category 2 issue. Bruce Power and OPG Darlington are expected to carry out further analyses to confirm and, if necessary, update their initial assessments, taking into consideration modern analysis approaches, operating experience and the potential effects of plant aging.

The methodology for systematic assessment of high-energy line break effects have been completed for Pickering A, Pickering B and Point Lepreau.

OPG provided the assessment report for Pickering units 5 through 8 for CNSC review in July 2016.

The assessment report for Pickering Units 1 and 4 is expected to be submitted to the CNSC for review by the end of 2016.

For Point Lepreau, a comprehensive assessment is being performed for all relevant pipes in the reactor building. It is expected that the systematic assessment will identify and address any potential residual issues. The final assessment report is expected to be submitted in September 2016 and this is expected to be

reclassified to Category 2 by the end of 2016. Recategorization will be based on the outcome of CNSC review of licensee's research outcomes.

Large break loss of coolant accidents (LBLOCA) is a category of accidents within the design basis for CANDU reactors. This category of accidents includes the postulated break of any large pipe or header in the primary heat transport system.

Computer code simulations of large break LOCA accidents are performed to demonstrate that the performance of the safety systems is adequate and that the consequences of the accident are acceptable. In particular, the simulations must demonstrate that the shutdown systems are effective in shutting down the reactor and that the emergency core cooling systems keep the fuel temperatures below acceptable criteria.

In the original identification of issues, five interconnected issues were identified for large break LOCAs. These issues are related to the adequacy of the knowledge base needed to support safety margins for these accidents.

These were:

- uncertainties associated with the void reactivity coefficient;

- behaviour of the fuel during power pulse

transients;

- behaviour of the fuel in high temperature transients;

- rate of coolant voiding; and finally,

- moderator temperature predictions.

For the latter two, the experimental knowledge base has been expanded over recent years so that these two issues could be recategorized to Category 2. This represents good progress in addressing the issues pertaining to large break loss of coolant accidents.

We will now describe each of the three remaining Category 3 issues.

Before describing each of the issues, it is worth spending a little time outlining the sequence of events during a large break loss of coolant accident.

When the postulated break of the primary heat transfer system occurs, the coolant pressure rapidly drops and the coolant boils, turning to steam. This is referred to as "voiding." Because of the positive void reactivity coefficient, this increase in voiding results in an increase in power. This so-called power pulse it terminated very quickly, within a few seconds, by the automatic action of the two shutdown systems.

As more coolant flows out of the heat transport system and the pressure drops further, the fuel

heats up, and this is subsequently cooled by the action of the automated emergency core cooling system. Over the longer term, the emergency core cooling system keeps the fuel cool until the event can be finally terminated.

With respect to analysis for the void reactivity coefficient, the characteristics of the power pulse size and duration are based to a large degree on the void reactivity coefficient. It is important that the analyses used an appropriate value for this coefficient in the predictions of the power pulse and in the assessment of the adequacy of the shutdown systems.

This parameter has been subject to multiple research and development findings, which have reduced the calculated safety margins for large break loss of coolant accidents. In addition, due to a limited number of experimental data, there is uncertainty with respect to the true value of this parameter.

Over the years, as these findings have come about, defence in depth and design and operational enhancements have been implemented to provide adequate safety margins. Such measures include operational constraints and power deratings.

Regarding fuel behaviour in power pulse transients, as previously described, during a large break LOCA there is a rapid power increase, the power pulse,

which results in energy being deposited into the fuel. The behaviour of the fuel under such conditions is determined by a combination of experimental data and complex analytical models.

There is a limited set of experimental data of CANDU fuel behaviour under power pulse conditions, and therefore it is difficult to validate -- fully validate computer code predictions at these higher energies. As described previously, defence in depth and design and operational enhancements have been implemented to ensure that those safety margins are adequate given this uncertainty in the experimental database.

With regards to fuel behaviour in high temperature transients, a large break LOCA results in a mismatch between the heat generation rate in the fuel and the heat removal by the coolant such that the fuel temperature rises. If the fuel bundle temperature becomes excessive, fuel bundle deformation could occur. Such changes in bundle geometry need to be better understood. Once again, defence in depth and design and operational enhancements have been implemented to ensure that the safety margins are adequate given this uncertainty in the experimental database.

We will now turn our attention to the final risk control measures for these three category 3

CANDU safety issues.

A CNSC industry working group was convened with a mandate to better define the issues pertaining to large break LOCA and to identify effective risk control measures. The main conclusion of the working group is that a composite analytical approach is a combined solution that could address all three remaining issues related to these accidents.

The composite analytical approach involves analytical refinements aimed at providing a more representative assessment of the consequences of this event, taking into account pipe breaks, reactive physics and fuel behaviour.

With improved knowledge of uncertainties, improved methodologies and the implementation of modern standards, this approach is expected to confirm the adequacy of existing design provisions and safety margins.

Specifically, this approach will be demonstrating that the probability of a large break loss of coolant accident is very low, such that the appropriate analysis methodology could be used to assess the accident consequences; demonstrating the adequacy of safety margins for large break loss of coolant accidents through the use of realistic assumptions for pipe failure probability and break opening times; thirdly, ensuring that the

assumptions, criteria and data used in the analysis are well supported, void coefficient of reactivity and reactive kinetic parameters and a set of parameter limits which assure that integrity of the fuel is maintained; and, finally, demonstrating the effectiveness of the two shutdown systems and the emergency core cooling system through use of appropriate acceptance criteria in the analysis of these accidents.

CNSC staff acknowledges the significant efforts spent by the industry to complete the composite analytical approach and to consolidate the current state of knowledge in key areas. The pilot project demonstrated that this approach is a viable solution to realistically predict safety margins for large break loss of coolant accidents.

Regarding reactive physics, the industry has made significant efforts and progress in introducing more rigorous methods in the process of evaluation and estimation of uncertainties in CANDU reactor physics code predictions. The overall trend and progress is positive; however, further research and development and analysis is needed to address uncertainties and the scalability of the experimental data to representative CANDU conditions.

Regarding fuel behaviour, the industry has proposed a comprehensive framework, as well as a systematic

process for the identification of the barriers needed to be protected, and their associated failure mechanisms. The derived acceptance criteria defined by the industry represent an improvement in comparison to the previous formulation and are better aligned with best international practice. Further work is needed regarding the technical basis for these criteria.

The pilot analysis was an extensive industry effort, and CNSC staff note that there is consistent implementation of information from all technical areas considered. The industry has stated that a complete sensitivity analysis will be submitted with the planned regulatory submission using the composite analytical approach methodology. Details of the plans will be submitted by industry in 2017 and full regulatory submissions are expected in 2019.

In summary, there is a clear path forward to closure and we anticipate, subject to the regulatory review of submitted analyses, that all category 3 issues will be recategorized in 2019.

I will now turn the presentation back to Mr. Frappier.

MR. FRAPPIER: Thank you.

So as mentioned there are 45 category 2 CANDU safety issues that require ongoing regulatory

oversight. The status of these issues is assessed as part of the CNSC's ongoing regulatory oversight in the appropriate safety and control areas of safety analysis, design or fitness for service. This includes ongoing reviews of component life cycle management programs, supporting aging management and fitness for service, assessments of remaining confirmatory analyses that are ongoing, and our verification of design modifications. These are tracked through the existing processes and any significant development will be captured and communicated to the Commission in the annual regulatory oversight report that will be -- as we're going to be doing tomorrow.

Ongoing reviews to ensure that we stay up to date with any safety issue will be carried out through the Periodic Safety Reviews that will become part of all licensees' licence conditions.

There were three interventions on this CMD, so we'd like to talk a little bit about what we heard on those.

Overall, the intervenors questioned the basis for the initial categorization and for recategorization of the CANDU safety issues. Detailed comments were provided regarding total loss of alternating current power, fire protection, fuel channels, hydrogen control, primary heat transport system relief capability,

emergency core cooling strainers and several others.

CNSC staff emphasized that a rigorous processes for the initial categorization, and subsequent recategorizations, were followed at all times and were used for the initial categorization and for a recategorization of the category 3 safety issues.

The basis of the initial categorization was documented in the CNSC report, "Development of Regulatory Position on CANDU Safety Issues: Categorization of Safety Issues," which was published in 2007.

For recategorization of CANDU safety issues, licensees provide their submissions, stating their request for recategorizstion, including supporting documentation. CNSC staff then review the submission and evaluate the recategorization request based in view of the risk control measures that are going to be put in place for the CANDU safety issue.

CNSC staff apply their in-depth science and engineering expertise in the assessment of licensees' submissions and independent technical panels have been called, and will continue to be called, in areas were established support -- were established to support assessment of licensees' submissions.

So in conclusion, safety analysis and design have always been conservative and all reactor types

have ongoing research activities worldwide. Periodically it is useful to review the information from research and operating experience and pull them together into the safety issues or safety areas for more consideration.

We have consolidated the safety issues in the IAEA TECHDOC on generic safety issues for nuclear power plants with pressurized heavy water reactors that Doug talked about earlier, with the CNSC's own generic action items that included findings from ongoing nuclear safety research and experienced feedback from regulatory oversight of currently operating reactors in Canada and worldwide.

Licensees must undertake focused actions on issues where further experiments and/or analysis are required to improve knowledge and understanding of the issue and to reconfirm the adequacy of safety margins.

It is important to note that, as Dr. Miller mentioned, following the original risk assessments there were no items that required immediate regulatory action by licensees -- or by the CNSC or by licensees.

Through application of the CNSC risk-informed decision-making process, the category 3 CANDU safety issues have been addressed. The remaining four category 3 CSIs are related to the systematic assessment of high energy line break, the analysis of -- for void reactivity coefficient, fuel behaviour in high temperature

and fuel behaviour in power pulse transients, with the latter three grouped together as they relate to reactor behaviour during large break loss of coolant accidents, as previously discussed by Dr. Newland.

The CNSC will continue to report on progress towards resolution of these category 3 items.

Currently, there are 45 category 2 CSIs, where licensees have appropriate control measures in place to address the issue and maintain safety margins. The status of these issues is assessed as part of the CNSC's ongoing regulatory oversight of nuclear power plants, and going forward we will identify and establish the path forward for safety concerns through the Period Safety Review process carried out in accordance with the CNSC regulatory document on periodic safety reviews.

And with that our presentation is complete. We do have an example that is in the thing that we can go through if the Commission wants to, but at this point we thought we'd stop and provide opportunity for any questions you might have.

THE PRESIDENT: Thank you.

I think it's been normal procedure before getting into the question period, we like to start with the interventions that were submitted to us, and there were three of them.

Marc, do you want to take us through this?

MR. LEBLANC: Okay.

So we will proceed with each of the written submissions and the question period will be opened after each of those interventions.

***CMD 16-M34.1**

Written submission from Michel A. Duguay

MR. LEBLANC: So the first submission is from Dr. Michel Duguay, as outlined in CMD 16-M34.1.

Are there any questions from the Commission members on this submission?

THE PRESIDENT: Dr. McEwan.

MEMBER McEWAN: Thank you, Mr. President.

I'm actually going to use this to link back to a question that worried me on the three. I think all three have done slightly.

I had some sympathy with his comment of the -- how does he describe it? -- "clearly- and oft=stated statements that the Category 3 safety issues are 'expected'" to be solved. And certainly as I read the document I did get a little bit of a sense that you're going to force a solution rather than allow a solution to come through.

But let me just reflect that back on slide 6, which is your flow diagram of the categorization of safety issues.

So as you've described it in the document, this is a dynamic issue. You address the individual safety issue, you address the way in which it has been resolved, and then you make a determination and recommendation on whether or not it should be recategorized, and this is an ongoing process. I think in slide 21 you say that you're continuing to monitor category 2.

So the implication of that process is that this is actually a dynamic process and that the flow from category 1 to 2 to 3 to 3 to 2 to 1 could be bidirectional depending on findings in new science, findings in the pipelines. So perhaps you could try and build that into a story of how you actually achieve that and the circumstances that would lead the flow going one way or going the other.

MR. FRAPPIER: Gerry Frappier, for the record.

I'll start, and ask Dr. Miller to add a little bit to it.

So I think it's important to realize that what we're talking about here is safety issues that, under certain circumstances, we would like to have a better

understanding of how the reactor is going to perform. And there's good reasons for that, because, as you mentioned, research can come out that would surprise us a little bit or perhaps go in negative directions, if you like, as opposed to positive directions.

So when we're making reference to expectations -- just coming back to Dr. Duguay's comment -- we expect results I guess would be the right way of saying. Whether the results are positive or negative will determine when we get those results, so I take his point that you can't predict what the research is going to come out with, and so that's not the intent here. The intent here is to drive that certain research results will be available by a certain time, and then we can take steps at that point.

But at any time if there's what we call discovery issues from research, there's a requirement on licensees to inform us. Obviously, for their own purposes they are going to be looking at what is the impact of that discovery item. That process might lead to, and often leads to, we need to reassess something. During that reassessment, if we discovered that we had an issue that was previously thought to be category 2, but we now find ourselves in the position where there's more attention needed to it, then we would pop it up to become a category 3, if you like.

So that is a dynamic process, and the way you described it is exactly true.

So perhaps -- Doug, I don't know if you want to add to that.

MR. MILLER: Doug Miller, for the record.

I think Gerry explained it very well. The example that we provided at the end of the deck is also an illustration where, after sufficient work has been done, where they've demonstrated that the concerns are alleviated, that they have either introduced new materials or addressed the design or shown that a phenomena that occurs in another reactor type cannot occur in a CANDU, then we would say, yes, we have sufficient confidence, for example with the emergency core cooling system, that the strainers are appropriately designed and can perform their function. If the design is very good, it's category 1, unless -- there could be international OPEXs that we would ask for research be done to address that.

But in this case -- and that's why we provided the example in both the CMD and the deck -- is an illustration where very good work was done by industry to show that the chemical effects that could happen in a pressurized light water reactor in the U.S., for example, could not happen in a CANDU because of the unique approach for the CANDU reactors for that system.

THE PRESIDENT: But to Dr. McEwan, if this is truly dynamic, and it could possibly be two-way, I'm thinking about parameters change with age and you may -- what you thought was a category 1 may all of sudden -- you know what, maybe we should take another look, and become, I don't know, category 2 or 3, would be -- so I'm not sure.

By the way, I love this chart, just so you know. Me, personally, I thought it was good chart, but I'm not sure about the language. I like the generic -- the GAI, the generic action items, because safety issues to me means *safety issues*, and how can you be comfortable with safety issues no matter what, so -- but I understood what you were trying to say here, and I think there may be some better way of describing the dynamic nature of this chart.

MEMBER VELSHI: I have a question for --

THE PRESIDENT: Go ahead.

MEMBER VELSHI: -- because I'd like to follow up on that, given the two-way possibility that the flow chart probably needs to be revised to show that, because right now it just shows it going from 3 to 2 to 1 or 3 to 1.

The second one, which is what the intervenor -- the concern the intervenor has raised, and that Dr. McEwan has brought up, and I don't think we have closed it fully, is the certainty with which -- so if I

look at page 13 of CMD 16-M34, the last paragraph under section 3.1 -- or just before 3.2, you know it says with great certainty, "Given the current progress, it is expected that acceptance will occur in 2017 which will allow the three" whatever to move.

I think you need to change the language to say, you know, based on your analysis and review, because it does say that this is definitely going to be happening the way it's written.

MR. FRAPPIER: Gerry Frappier, for the record, and maybe I'll get Dave to add to that.

In this particular case, as we've talked about, we've done a lot -- our industry's done a lot of work, and we've done a lot of reviewing of that work, of what they call the CAA, if you like, and that requires them to do a lot of analysis. But the expectation is that that analysis is going to demonstrate that the margins associated with large break LOCA are much, much larger than what we have now.

So to take a very simple example -- it's a very complicated example, but in simple terms, the -- currently, the analysis assumes that the largest pipe breaks instantaneously.

We've all done mathematics. If you put zero as the time, it causes all kinds of problems, so we,

in fact, have a small, few milliseconds that we say that it takes for it to break.

But industry is demonstrating that it wouldn't break that fast, and the void reactivity that we're very concerned about is very, very, very sensitive to that time. So if that time becomes a little bit bigger than what it is now, we know that that power pulse is going to be much, much lower than what -- than what current analysis uses.

So in this particular case, there is some foreshadowing, if you like, that we believe this is going to be a good outcome.

Right now, the analyses are using very, very conservative approaches, and they have consequences that we know about, but at least it's always in the safer direction so we don't worry about it as much. With the new analysis, they're going to be able to understand that a little bit better, and we think there will be good results from that.

So that's the way we -- why we worded it that way, but I take your point that we should be, in general, let's wait and see.

MEMBER VELSHI: Exactly. Because even if I look at it -- so that addresses three of the four issues, but even if I look at the fourth issue on page 15, again,

the language is the final assessment is to be submitted in September, and it's expected to be reclassified. It's almost it's a given, it's a fait accompli.

THE PRESIDENT: I'm just wondering whether you are trying to put pressure on industries that deliver here rather than -- you know, this is a joint venture, I assume, so I'm just wondering whether you are putting the -- and it's a language of interpretation. I can see that you can put some uncertainty to the word "expected", but I just wonder whether you want to put some certainty into target date for closure and which is a planning concept, not a certainty built in.

So I don't know; maybe industry want to comment on that.

MR. SAUNDERS: Frank Saunders, for the record.

I think I would. I mean, there's always pressure to try and do these things to get them done and, I mean, certainly CNSC would like it sooner and so would we, quite frankly, so the pressure's really self-induced. But I think the important concept here on this particular one on the large break LOCA is we've actually done this work with a generic CANDU, so we've worked the methodology, we've developed the methodology, tested it on a generic CANDU.

So what we're doing right now is taking that and translating it into the specific Bruce reactors because we volunteered to go first to develop the actual safety case.

You can't introduce any of these new concepts until you actually do the safety case to demonstrate that they work, so what we're doing now is not developing a new technique. We're taking that technique, translating it to the specific design of the Bruce reactors and creating the safety case that would go with it.

CNSC staff will then have to review that safety case once we're done and then accept it, so we actually do have a high confidence it will work, but it -- because we're beyond the experimental stage, we're actually into the doing it stage now.

So it could be wrong. I mean, it doesn't -- it's not for sure, but we're pretty confident that we will be successful there. Otherwise, you know, we wouldn't be spending the money and the effort to do it, quite frankly.

THE PRESIDENT: Okay. I think we interrupted Dr. McEwan. Were you finished your question?

MEMBER McEWAN: Sorry? I'm now going to follow on --

THE PRESIDENT: We'll do as many rounds as

we need.

MEMBER McEWAN: So you said that you've now got evidence that the break constraints that you're putting into the modeling now are conservative and that the break is likely to occur more slowly.

Is that based on modeling or is it based on experimentation, and how do you develop the data to allow you to say that?

THE PRESIDENT: Who is there; industry?

MR. SAUNDERS: Frank Saunders, for the record.

It's based on a bit of both, right. It's based on modeling and it's based on experimental data that's available.

It is difficult -- I mean, essentially, it's near impossible to actually break these pipes in a straight pipe, and so you just can't go find a lab somewhere and say "Break that pipe for me and see what it looks like" because these pipes are very, very robust. You don't really expect them to break.

So we've used data from around the world, but the data is not exactly the same as CANDU because, mostly, the other reactors operate, actually, at higher pressure and higher temperature than we do and use slightly larger diameter pipes, so the

circumstances are not absolutely entirely the same, and hence the need for the analysis and the interpretation. But it is based on very sound science.

Most designs do not assume an instantaneous break on the large pipes, not a guillotine break. And we're not suggesting that you can't have a leak on a large pipe. We're just saying you can't have that complete shear on a pipe, that that is virtually impossible unless there's some mechanical mechanism that would actually make that occur.

And of course, as you heard in our designs, we make sure that there isn't anything there that can make that mechanical mechanism happen.

So we're very confident in that. I will say CNSC staff were very difficult to convince on this. That's why it was a five or six-year effort. It wasn't the -- this wasn't something we did in a couple months. It's been a very extended period of time.

This has been the major focus since we started because we've seen this -- of all the issues that are listed in the CANDU safety issues, this is the one that we felt deserved the most attention and really needed to be resolved to everybody's satisfaction.

So it's been a very long progress gathering lots of data, doing tests and engaging experts

from around the world. This was not done really simply with our staff. We engaged a lot of experts in this process.

THE PRESIDENT: Okay. Monsieur Harvey?

MR. FRAPPIER: I was just going to say if we could add to that. Perhaps Vali Tavasoli could provide some clarity here.

MR. TAVASOLI: For the record, my name is Vali Tavasoli, Director of Reactor Physics and Fuel Division.

The problem with the traditional methodology is more than assuming an instantaneous break. The way it is -- it models the scenario, it models at a very extremely unlikely event because it simultaneously assumes that a large break in a very large pipe is credible and, at the same time, when the break happens, it happens instantaneously and also, on top of it, it assumes that the reactor is-- at the time of accident, is operating simultaneously at all safe operating envelope limits.

So by doing that, you're modeling a very extremely -- an extremely unlikely event and, therefore, the predicted safety margin is very unlikely, is unrealistic. That is the problem.

With respect, for example, to the model for opening of the break instantaneous, even if you

increase it a little bit to 40, 50, 60 millisecond instead of one millisecond that was assumed, the fluid still has some inertia for leaving the system. It has to reverse its direction and get out.

So yes, it does add a lot of conservatism, but there are other elements that makes this scenario very unrealistic.

THE PRESIDENT: Okay, I'll bite. So what happened between 2007 when you made this assumption to now, all of a sudden, you said it's an unrealistic assumption? Why didn't you start with that assumption?

MR. FRAPPIER: So the -- Gerry Frappier, for the record, and then Vali, you can add.

So I think it's important to know that sometimes it's about how easy it is to analyze, too. So if you have the historic sort of large break LOCA was one that allowed itself to be analyzed and everybody knew was very, very conservative, it's going to require you to have much bigger margins than required but, from a safety perspective, that's okay.

From an industry perspective, that's a little bit more difficult, but if they can -- you know, they'll do what's required by the regulator.

So with much more sophistication in our analytical capabilities now, there's the potential to look

at things a little bit differently and, at the same time, ensure that it's conservative.

And I don't know if you wanted to add to that, Vali.

MR. TAVASOLI: Yes. Just as -- for the record, this is Vali Tavasoli.

Just as Mr. Frappier said, the development of this model was done in late eighties when computational capability was very limited, so to simplify the scenario, a binding type of scenario was developed, and that capability has increased a lot.

More than that, in the past decade, because of various things that have been done, we have developed a much better understanding of large LOCA. One of them I've already mentioned about the unrealistic nature of the scenario and an unlikely existence of that predicted safety margin.

More than that, various sensitivity analysis done in the past 10 years has shown that slight deviations from key assumptions for the model, it increases the safety margin quite a bit. And more than that, the -- one of -- the work which was done for one of the related CANDU safety issues that Dr. Newland mentioned, PF-12 for channel voiding following a large LOCA, it revealed that the predictions of thermo-hydraulic codes that predicts the

changing coolant density, the change in the voiding rate and the power pulse, that those thermo-hydraulic codes over-predict the size of the power pulse by significant margin.

So when you put all of this together, you can see that why we think that we can wait long enough until the methodology -- the new analytical framework is developed and implemented.

THE PRESIDENT: Okay. Thank you.

Monsieur Harvey.

MEMBER HARVEY: In the same line, you mentioned very conservative assumption and then with the explanation, you know, that, I think, at the same time, with the knowledge, with the experience sometimes we move and we modify that, maybe moving from a very conservative to conservative to less conservative.

So this is not something fixed at the time. I mean, if you had done that 10 years ago, maybe the conservative assumption is not the same today.

So how can we -- from our perspective, when you say very conservative assumption, how can we interpret that, how conservative it is? It's not a certitude. It's not a guarantee. It's an assumption.

MR. FRAPPIER: Gerry Frappier, for the record.

That's a tough question to answer, actually.

So in some cases, we have -- some of the analytical methods come with some clear criteria, if you like, and we could probably bring some of those onto the table as to what is the -- you know, it demonstrates that the dose to the -- to a worker would not exceed a certain amount.

In some cases, it's a margin that's put there so that we have sufficient room to handle things that might be discovered, as we were just sort of saying. But in all cases, we have methodologies that are agreed upon as to how to go about doing the analysis itself.

So I don't know if somebody else wants to help me with safety margins, what's the best way of describing how --

THE PRESIDENT: Well, let me try to maybe put words in.

I think you'll always be conservative, so even when the result comes in, you'll still be conservative, but maybe less conservative, if I understood where you're going with this, because as a regulator -- as an operator, they want to be less regulated to give them a little bit more flexibility on power. As a regulator, we want to make sure that it's absolutely safe.

So there's always going to be this creative tension between operator and regulator; right? Even though they come up with some proof that now you can relax the margin, you're going to keep the margin as conservative as you think it should be.

MR. FRAPPIER: Gerry Frappier, for the record.

It certainly always has to be conservative, and we'll insist on that. It's about the level of knowledge you know about what you're dealing with.

But Doug, you said you were going to add something?

MR. MILLER: Doug Miller, for the record.

Yes, Gerry, that's what I was going to say. As the research progresses, for example, on fuel behaviour under accident conditions or the reactivity coefficients, over the past decade in particular there's been much greater understanding of these parameters. You have more confidence in the understanding of the parameters and you can make a little bit more realistic assumptions about the phenomena, how sensitive is reactor behaviour to the phenomena and then establish safety margins appropriately.

Based on that, you might say we didn't know as much in the past, so we were very, very cautious.

We understand more now, and you can adjust. You can make some changes to the assumptions based on your understanding of the phenomena, and that's very much where the research comes in in getting a better understanding of the criteria.

Plant events can tell you as well that that's something we have to look at and then do the research just to support and confirm, to understand what was going on. It gives confidence in --

THE PRESIDENT: Okay. I think we're now moving into the generic discussion. We still have Dr. Duguay as an intervention, so can we keep our discussion -- because we've got two other interventions here, so -- and then there will be a round for anything else.

I'm just trying to look at a clock.

MR. FRAPPIER: Perhaps we could -- Gerry Frappier, for the record.

Perhaps we could add two more things and, like you say, it will help, perhaps, in the generic discussion because I think Vali Tavasoli was going to have something, and perhaps John Jin, about this concept of margins.

MR. TAVASOLI: For the record, this is Vali Tavasoli.

I don't think you're reducing the conservatism. The idea here about this new analytical

framework is that it has to be consistent with the requirements in the Regulatory Document 241 where it allows to use more realistic methodologies if the probability of the event is very low.

So the idea here is to demonstrate that the occurrence of the large break in a large pipe is of low enough frequency so that we could apply the more realistic methodology to us as the consequences.

That is consistent with our regulatory requirements.

THE PRESIDENT: Thank you.

You wanted to add something?

MR. JIN: John Jin, for the record.

If I add something more, when you accept -- or when you try to remove the excessive conservatism, it should be based on the strong evidence, and evidence came from the accumulation of the operating experience over the world and from the several hundred reactor operations, and also coming from the progress made in the research project, for instance, for the fuel generator in different countries to improve the understanding of the revision mechanism or, thereby, the management plan or instruction program.

So with the progress of technology or improvement in the understanding, we are able to review if

there is any excessive conservatism.

THE PRESIDENT: Okay. Thank you.

Still questions on Dr. Duguay. Any question?

Okay. Marc.

MR. LEBLANC: The next submission is from Dr. Frank Greening as outlined in CMD 16-M34.2. Questions from the Commission Members on this submission.

***CMD 16-M34.2**

Written submission from Frank Greening

THE PRESIDENT: Go ahead, Dr. McEwan.

MEMBER McEWAN: Because this question will actually lead into the -- back to the end of the last conversation.

On page 1 of Dr. Greening's conversation, he says, in the last paragraph:

> "This item raises the question, how well do the technical capabilities available to NPP provide the requisite knowledge and skills to safely operate."

And I guess, by definition, if I can extrapolate that, to make some of these decisions around

new models for safety, again, if we take the pipe break.

So I am guessing that the experimentation and the experience to develop new models within the conservative framework is something that requires not only expertise within CNSC and within industry, but also more widely, universities or other operators.

How do you actually build that into your recategorization and your definition of these categories?

MR. FRAPPIER: Gerry Frappier, for the record, and then I'll pass it to Doug as to how it's factored into recategorization.

But in general, I mean, he's certainly correct. You need to have solid group of technical capability and skill set at the regulator, sure, with respect to being able to do appropriate reviews, and we have many, many excellently qualified technical people here, but more importantly is you have to have it at industry and you have to have the research capabilities at universities. And I would point out Chalk River in particular has done a lot of different work and maintains a lot of the codes.

You also have to have a framework, a structure of standards and expectations that people have to go through, so if you want to have a code, you have to -- let me throw the word out there -- you have to validate

that code.

Well, there's standards on how you have to do that. There's expectations with respect to data and whatnot, and those have been codified into both the regulatory framework but, more importantly, into industry standards and whatnot.

As far as how we take that into consideration within the recategorization, perhaps, Doug, you might want to add to that.

MR. MILLER: As part of the recategorization process, and I alluded it -- alluded to it in the presentation, is that, often, or in a few cases, we have either relied on contractor reports that Mr. -- contractor work that Mr. Blair Carroll could support as well as independent technical panels are established, representatives from universities that are selected by the industry and CNSC to give an independent opinion on the positions put forward by both sides.

So often, the CNSC and industry will rely on these technical panels for alternate opinions regarding the science and engineering, so I would say that Mr. Tavasoli and Mr. Carroll could follow up and explain what --

THE PRESIDENT: But I think that there is actually question -- questioning whether we have the

technical skills in-house. I'm talking about people skills both in the industry and in here in this to actually do the analysis.

So yes or no? Industry?

MR. SAUNDERS: I mean, we have -- we have a very large group of highly-qualified staff when it comes to engineering and other specialists, but even with that, I mean, we're talking over 500 staff that specialize in engineering and various functions and physicists and others who specialize in reactor physics. So we're well equipped to know. But even there, there's no company and no operation which has all the specialists and people who are specialized in particular techniques or analytical approaches that you might want to know, so you hire that expertise.

And when we do that, of course, we check the pedigree. We check who the people are, what they've done, where they've done it, whether that work has been successful. And when we're providing safety cases to CNSC, they actually require us to demonstrate that the experts we hired are actually expertise, right.

So -- and they require us to demonstrate that we've taken the expert's work and looked at it from a system point of view, which is our specialty, right. We know how the plant's designed, we know how it works. And

that we have factored those things in.

So do we have absolutely everybody that would do everything? No. And I think if you -- if I said yes to that, you'd wonder what was wrong with me, but we certainly know where to find that and we certainly spend money and R&D and those other things to make sure those expertises are maintained and that we've got people we can reach out to when we need to.

THE PRESIDENT: Other questions?

Ms. Velshi.

MEMBER VELSHI: So it's more a comment both on this intervention and the one after that, and it's to do with what Mr. Frappier has said at the outset, that this is a very technical area.

And if I look at your slide 22 on what we heard, it was a very broad brush of, well, you know, there were concerns, but, you know, we've got a robust process and we've got the expertise and we've handled this well.

I couldn't even begin to ask you the right questions on what the two interventions are asking, system dew point, thermo siphoning. I mean, you could tell me and I wouldn't know.

And just as we do with -- and so here's a suggestion. Just as we do with governing documents and when we send them out for comments and we go, "Here is what

we heard, here is what the intervenor came with and here is our disposition of their comments, comment by comment or the significant comments and that -- I would find that very helpful. Here is agreement. Here there isn't and here is the reason why. It makes it much easier to follow up.

Right now, frankly, I don't even know how to ask questions other than going through section by section on, "What's your comment on this?" And I wouldn't even understand your response, frankly. So thoughts?

MR. FRAPPIER: So Gerry Frappier for the record.

So we have done that work as you are talking about. So we do have some of the questions and answers. It's a little bit different than the more formal process that we have for interventions at licensing hearings and that. But we have a question and answer thing saying if this is the question, what would be the answer? Who is our expert that's on that?

And we could provide that if that would be helpful, but it's still going to be very, very technical.

I think part of what we have to look at is that (a) we have an ability and we often do go seek outside expertise for a certain subject area if it's a subject area that we are not familiar with.

As Bruce Power said, we'll -- mostly what

we are doing is we are forcing industry to do their job right and we have to be knowledgeable enough to ask some questions and knowledgeable enough to do exactly what you were just sort of saying there; understand what they are suggesting and realizing how that's generally accepted engineering practice or that's very, very innovative and we need to have some additional support in our analysis.

But we do have a pretty big group here at CNSC so we are several hundred engineers and specialists and these are the things that we do, if you like.

But if you are interested in having more of the technical rigour that we went through on these analyses, we could take an action to supply that.

MEMBER VELSHI: Well, so the intervenors have put in a lot of effort and I think we owe it to them that there is -- that they get feedback on what staff think of the issues they have raised and how do we close that loop the best way.

MR. FRAPPIER: Okay.

THE PRESIDENT: They can close down all the question period. They are right here now. What are you suggesting here?

MR. FRAPPIER: Oh, I'm not sure I suggested it but if the Commission desires it, we have -- I'll say it paragraph by paragraph. But let's say idea by

idea, we have dispositioning tables as to what we think the answer is to that. We can clean that up a little bit because, like I said, it's not done as formally as what we do for a REGDOC that has comments or for the licensing hearings. But if that's useful we could take an action to provide that.

MEMBER VELSHI: Sorry. Before we get to Mr. Jammal, my suggestion then would be that we would just attach that to our proceedings or something, so that they know that this is how staff has responded to their submission.

THE PRESIDENT: Mr. Jammal...?

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

A couple things I'd like to go through the -- it's going to be a long answer -- with respect to the development of the regulatory process with respect to the regulatory document itself that is going and will go through a consultation process and comments that are being incorporated.

My colleagues have mentioned multiple new regulatory documents. That is demonstrating the improvements that has taken place and the new requirements we are imposing on the industry. So the consultation process takes into consideration dispositioning of the

comments. The difficulties we're having here is not the challenge being raised by the intervenors but what is the intent of the intervenors being raised here? Is it the credibility of the staff or is it the technical issues?

The credibility of the staff, we have one of the most competent regulators in the world with respect to leading at multiple levels, with respect to the new science and the new technology. So the science-based information that we use for our regulatory decision-making is sound. We undergo international peer review.

With respect to the convention of rigorous safety, the generic action item, at the time they were generic and the key point of our colleagues with respect to our safety culture, call them CANDU safety issues and a fundamental principle of the CNSC safety culture to say it's a continuous enhancement with respect to safety. That's the intent.

Your question is dispositioning the comments arising by the intervenors. We will do this. We will continue to do and provide opportunity for anyone with respect to that intervention.

During relicensing of Darlington, during relicensing here of Bruce, we had all of these discussions with respect to all the knowledge we've got in place, conservatism that we based our regulatory decision upon and

the information we have.

Bruce Power just underwent an IAEA peer review. It's called an OSART, an operation safety -- I forget what they are -- T stands for.

But those peer reviews, Pickering is undergoing an OSART peer review with respect to the life extension and future of the operations. So we have multiple layers.

And I accept the challenge you are asking us to do. We will do it. But we will continue to review. It's not a one-off. We have periodic safety reviews that will continue and provide everyone an opportunity to comment on this.

So yes, we will take that direction because you are the Commission. We report to you and you provide us the direction. But it's going to be ongoing continuing science.

The key point here I will like to highlight to the Commission is a design of the AGS, yes, there were challenges but currently based on the information we've got, the OPEX, we impose requirements on the licensees such as for example purging through CO2 and changes that enhanced the capacity to monitor.

So that's what we would like us to be able to put forth for the public that conservatism we've got in

place is adequate, but we'll continue to take on the challenges let it from the Commission or the intervenors.

THE PRESIDENT: Okay. Look, we will take all of this kind of -- and we'll make a decision as to what to do next.

In the meantime, I really would like to know are there any issues regarding Dr. Greening here that you want to raise right now. Anybody want to raise this?

MEMBER McEWAN: Yes, but I think if we had the dispositions --

THE PRESIDENT: Well, we are not going to do a disposition now.

MEMBER McEWAN: No, no, no. What I am saying is there are some direct questions that arise out of it. If the dispositions are done, it may well answer them.

THE PRESIDENT: Right. But are you not sure how -- anyhow, we'll have to take this and think what is the process to do this. I'm not sure that we right now know exactly how it's going to play out. Because you know, staff will say something and Dr. Greening will have another thing to say on staff's comments. So I can see us going into a circular discussion here. So we may have to find a different process to doing that.

But in the meantime, I really would like to say what is it we are going to do with Dr. Greening

right now or defer it for later?

MEMBER HARVEY: Just one point. It's not an issue with this; it's an assertion here and I just want to comment about that.

THE PRESIDENT: Go ahead. **MEMBER HARVEY:** It's about the capability of NPP and the CNSC. He takes the -- he takes the Bruce event, alpha event and he mentioned:

> "The (nuclear) industry was not expecting the presence of alpha contamination in any of the nuclear units in Canada."

So I just want to have a comment about that, why the industry --

THE PRESIDENT: Well, I am very reluctant to reopen. We have talked about this now a long time, many times so this is like reopening the file again. This is totally out of scope here.

MEMBER HARVEY: Just if all is not open. And I don't want --

THE PRESIDENT: A quickie from Bruce.

MR. SAUNDERS: Dr. Binder, I agree with you. These questions have been answered many, many times; right. There was an error in judgment at Bruce. We have resolved it. We now have one of the best alpha monitoring

systems in the world.

There was an issue in transition from an operating plant that had been sitting, actually not operating for several years and there was a human error made in the judgment. It was as simple as that. Once we discovered it, we reacted to it. We did all the right stuff. We had independent reviews and various other things.

The issue is resolved. Everybody has their dose. There is no outstanding issue there at all.

So I don't know why the issue keeps coming up, quite frankly. We've admitted full out that we got it wrong, that we made a mistake and we fixed it.

THE PRESIDENT: Yeah. I think even CNSC admitted that there was an error in relying on one particular measurement.

MR. SAUNDERS: That's right

THE PRESIDENT: That the beta measurement to be a proxy for alpha, and that was publicly admitted as a mistake and there was follow up. So I don't want to reopen this file again.

Okay, thank you.

Anybody -- anything else on Dr. Greening's intervention right now?

--- Pause

THE PRESIDENT: There may be a follow-up but we'll determine that later.

So let me move on to -- Marc...?

***CMD 16-M34.3**

Written submission from Sunil Nijhawan

THE SECRETARY: Yes. So the next submission is from Dr. Sunil Nijhawan, as outlined in CMD 16-M34.3.

Questions from Members on this submission?

THE PRESIDENT: So this is even more lengthy and detailed, but if there is any kind of a generic question that one wants to pose right now?

Dr. Tolgyesi...?

MEMBER TOLGYESI: I have one on page 3, one, two, three, fourth paragraph, last two lines and intervenor is saying why have OPG and Bruce Power not pressure tested the containment indicates?

So could you answer?

MR. SAUNDERS: We just did it, actually. So I don't know. We follow a schedule that CNSC lays out for us to test these things, to test it, to report it as usual.

Certainly, the frequency of testing is

over time in the vacuum building being reduced because we have evidence to show that you don't need to do it. But we do every six years a containment test and it's the pressure test and a leak test and those reports are submitted to CNSC as per requirement.

And we just did Bruce A a couple of months ago and we did Bruce B last year.

MR. FRAPPIER: Gerry Frappier for the record, and maybe I'll get John Jin to add to that.

There is a CSA standard associated with this kind of pressure testing of structures. It's in the licence and requires -- it's a requirement to be followed. But it is not something you do every year. There is different components to it, but I think the one he is making reference to is done every like 12 years or something like that.

But I might be wrong so perhaps, Dr. Jin, you could help me?

DR. JIN: John Jin for the record. I am the Director of Operation and Engineering Assessment Division.

And I don't agree with the intervenor's statement about the pressure test of the building or vacuum building. There is a requirement coming from the CSA as mentioned by Gerry Frappier. There is CSA 287.7 requiring

the -- providing the frequency or methodology for the containment rate test or vacuum building test.

And the licensees have been compliant with the requirement. For instance, for the Bruce A Unit 1 containment testing in 2007, 2012 and 2016, I have a long list of the evidence that the licensee has been conducting the pressure test.

So in conclusion, the licensees are compliant with the CSA requirement which provides the requirement for the pressure test and the leak rate test of the containment.

THE PRESIDENT: Anybody else? Okay. We obviously -- did you also have an item by item disposition of this presentation? Okay. So just to know because we will have to deliberate this to what do we -- how we -- disposition of some of those comments.

I don't think it will be useful for us to go line by line here because there are many, many comments made here that, as Ms Velshi said, deserve an answer.

So right now, so let's look at staff's presentation. Are there any other comments on the whole presentation by staff? Mr. Harvey...?

MEMBER HARVEY: On page -- that's 8, that's your maybe categories and the number of issues.

I just want -- when we look at it like

this I feel like everything had moved recently. So could you just give us an idea from 20-21, this is to say that 17 issues moved from Category 3 to 2. So could you give us an idea, since 2007 till now how it did move?

MR. MILLER: Doug Miller for the record.

From really 2009, once the 2009 report was finished, with the agreed-to risk control measures, industry has addressed 17 of those items. Some of them have been a little bit easier to address than others, some that they have verified for example that they have done design modifications regarding the open design of balance of plant and they have proactively addressed that through design.

There is other -- so it's really been a spectrum of continuous progress from 2009 to 2016. It all depends on the complexity of the work. For example, the ECCS strainer example that's provided in the CMD and in the presentation is that they did that work five or six years ago and they were able to show that the chemical effects seen in the U.S. were done.

So they -- it's kind of like a horse race where some -- or a turtle race where some went faster, some went slower. For example, for hydrogen behaviour as part of also Fukushima, they installed the passive autocatalytic recombiners. Some of that was done in the -- around

2010-2011.

Two of the items -- I think it's -- there's two of them that have gone to Category 1. That's the ECCS strainer and I think molten fuel/moderator interaction. The rest, some of them are still ongoing, a little bit of review and we have to look at the regulatory position.

MEMBER HARVEY: Where?

MR. MILLER: Each item was addressed on their own but some can be addressed more readily than others.

MEMBER HARVEY: Yeah. Yeah.

And when we are talking of Category 1, if there is no concerns in Canada for that category, why do we have that category?

MR. FRAPPIER: So the philosophy and approach that we took -- when the IAEA document was published in 2007, we took it upon ourselves to systematically address the findings and observations in that IAEA document and provide a Canada-specific disposition for the observation because they had not put them into categories. It was almost a 300-page document of things observed for CANDUs.

The CNSC proactively looked at design safety analysis and fitness for service topics and said we

put them -- we put them into categories where these were in really good shape in Canada, these the licensees have adequate programs and measures, these need a little bit more attention. And that's how the Category 1s came about is that when we went back to the international community we could show that in Canada it's been dispositioned, it's been addressed.

MEMBER HARVEY: Just to say that the Category 1, those 25 issues, there is -- they can apply it in India for example or elsewhere in the world for CANDU reactors.

MR. FRAPPIER: So Gerry Frappier for the record.

So they may be an issue in another country or may not. What we wanted to do is that we didn't want to lose the list, if you like. So Category 1, as far as we are concerned there is nothing else that has to be done or to close. If this was a normal list you would just drop it off the list, right? It's done. But because they do have perhaps some linkages to other countries and definitely to the IAEA document, we wanted to make sure that we could at all times have a list of whatever happened to that subject and so we put them in Category 1. We can show that the effort that was done or the fact it didn't apply to CANDU reactors in Canada at all and have that on the record.

THE PRESIDENT: So what I find strange about this table is -- so in 2007 we had added it up. I think it's 74 issues. In 2016 we still have 74. What happened to new issues, Fukushima? I thought there would be all kinds of issues. How about PSA, multi-unit site-specific? Where are they in this table?

MR. FRAPPIER: So Gerry Frappier for the record.

So they are not in this table, is the answer. That's why we are saying towards the end that we are going to start putting all of these together into something that we track. We track Fukushima action items completely separately from these although some have some interactions because they were identified as problems here beforehand.

Similarly with the multi-unit PSA and that's not tracked through this system at all.

THE PRESIDENT: So you see, what I took on reading all of this here is that we -- again, it's language and interpretation of what is an issue and definitely what is a safety issue and what is a research subject? And I'm sure -- I'm not sure I am still clear about some of those categories where the ongoing research will go forever and things that you can actually close. And so -- and of course, the missing pieces on new issues.

So if this was an intention to get rid of the 2007 IAEA work, you know, you should have started with this. We are trying to get rid -- to close those things. But then you should give me the table of new issues because there are always new issues.

So I think there is some work to do on this one.

MR. FRAPPIER: Understood.

THE PRESIDENT: I think we're -- I feel that we have exhausted this subject. So what I would like to do is take a break, 20 past? I think -- 25 past, until 25 past and we'll go with the next item.

Thank you.

--- Upon recessing at 5:08 p.m. /
Suspension à 17 h 08
--- Upon resuming at 5:28 p.m. /
Reprise à 17 h 28

***CMD 16-M46**

Oral presentation by CNSC expert

THE PRESIDENT: Okay. We're ready to proceed.

For this particular item, I would like to

start this meeting I think with a few introductory remarks.

An anonymous letter purportedly sent by some CNSC specialist was addressed to me in my capacity as the President of the CNSC. As is the case with all letters raising concerns, whether signed or anonymous, it is important to me as the Chief Executive Officer to determine as quickly as possible whether the concerns raised present possible safety or security issues.

In this particular case, the allegations implied that not all the important information concerning probability safety analysis, or PSA, were presented to the Commission in recent licensing hearings. It was therefore important to me to assess whether there was merit to these allegations that might require the review of those licensing decisions.

Such analysis is best done by CNSC, which is the Canadian expert on PSA. And contrary to some media stories, CNSC management does not muzzle our staff. In fact, the CNSC encourages scientific debate on complex issues the organization faces. In fact, we are encouraging our staff to publish, post, present their work in appropriate venues, in appropriate literature.

In my many years in government, I have never seen a more open and competent professional team of experts doing their job with integrity and dedication to

ensure safety and security of nuclear operations. I therefore asked Peter Elder, a senior advisor at the CNSC, to personally look into the allegations and to report back on his findings.

I have also received other letters and there have been media stories raising various issues, including whether there should be an independent third-party review of the allegations and not an internal review. However, it should be understood that to request an internal review by an experienced employee who is not involved in the files that are the subject of the complaint, instead of resulting immediately to third parties, is recognized as best practice in all fields and by other regulators, including the United States Nuclear Regulatory Commission. It is speedier as it is conducted by a knowledgeable internal expert who, while not external, is still removed from the alleged irregularities.

Therefore, the purpose of this agenda item is to provide an opportunity for Mr. Elder to present his report to the Commission and for the Commission Members to ask questions of Mr. Elder and other CNSC staff experts.

As the letter is anonymous, there is obviously no opportunity to ask questions of the authors of the letter.

The Commission Members, who are

independent from the CNSC staff, the industry, from government and from each other, will then determine whether additional steps or measures are required. This would include whether further or other reviews are warranted. Their determination will be reflected in the minutes of this meeting. Thank you.

We will now move on to the report by Mr. Elder, as outlined in CMD 16-M46.

Mr. Elder...?

MR. ELDER: Thank you.

Good afternoon, Mr. President, Members of the Commission. For the record, my name is Peter Elder. I am currently a Strategic Advisor in the Office of the Vice President of Regulatory Operations.

As has been mentioned, this presentation is on my technical review of an anonymous letter. The full report is attached to CMD 16-M46.

I was requested to perform this review in June 2016 by President Binder after the receipt of an anonymous letter. My presentation will cover each of the five cases raised in the anonymous letter before presenting conclusions and recommendations.

Before starting, I would like to note that some of the references included in my report are protected. The Commission Members have been provided with the full

versions of all the references. Where they exist, redacted versions of the protected references have been provided to members of the public when they are requested.

The anonymous letter was received in May of 2016. The authors claim they are CNSC staff and raise concerns that the Commission was not provided all the necessary information for the 2015 licensing decisions on Darlington and Bruce Power nuclear generating stations. Some of the allegations claim that safety reviews were not done by licensees, nor reviewed by CNSC staff. This would be a serious regulatory issue and a thorough technical review was warranted.

The five cases provided are all technical in nature and all make reference to probabilistic safety assessments. Any review would need to balance the required knowledge of both the technical material and the review and assessment processes of the CNSC, with no direct involvement from the technical and management decisions on those issues.

I was chosen for the internal technical review because I have the relevant technical experience. I have worked as a technical specialist in safety analysis and did the lead licensing of power reactors for many years. As a Manager at the CNSC, I have managed both technical groups, including the Probabilistic Safety

Assessment and Reliability Division for 18 months from its creation in 2006, as well as Licensing and Compliance Divisions and Directorates.

It was important for my review to have direct access to all relevant material, including the protected PSA results and reviews. Of equal importance is understanding of the CNSC review processes and the checks and balances that these processes contain. If the allegations were true, these checks and balances would have had to fail.

While I do have the technical background in safety analysis, I have not had any responsibilities for the regulation of operating nuclear power plants since 2008. In the period covered by the allegations, 2014 and 2015, I was actually on a leave of absence, so I had no direct or indirect involvement in the 2015 licensing hearings.

For my review, all the allegations were accepted as written. There was no attempt to determine whether the letter was actually from CNSC staff.

While not explicit in the letter for every case, the implied allegation is that CNSC management were not allowing the technical reviews to be conducted or the results of those technical reviews to be presented to the Commission.

So I started my review with the documented technical assessments by CNSC specialists and compared them with what was officially communicated to licensees and presented to the Commission. I also reviewed how the internal process to producing these was applied because it allows CNSC staff -- any CNSC staff involved in the CMD to review and comment on the regulatory position being taken before the CMD is finalized. All comments on the CMDs are documented in the CNSC's internal document management systems.

For reasons that I will explain in more detail, I also looked at how the PSA results were used and whether the use was consistent with their role in the current regulatory framework, that is, were the rules currently in place followed?

My conclusions are based on facts found through extensive review of the documented evidence. I also did a review of the Commission transcripts to determine if the issues raised were addressed in any fashion and whether, in my opinion, additional information could or should have been provided to the Commission for those hearings.

In total, I reviewed hundreds of documents containing many thousands of pages. In most cases, there were multiple technical documentation associated with the

cases. The references included in my report are the key documents that support my conclusion but do not represent an exhaustive list of all the technical information.

As I have noted, all the allegations make reference to probabilistic safety assessments, or PSAs, which is only one of many topics that CNSC staff systematically review for licensing decisions. A PSA is part of the safety and control area of safety analysis, which is one of 14 standard areas that CNSC use.

Here, you can see that PSA is only one of the six specific areas within safety analysis. Overall, it is one of 83 specific areas included in the CNSC assessment of NPPs.

So any review of the regulatory importance of a factor or opinion in one specific safety area needs to discuss and determine how it fits into the overall safety context.

In this case, this is: What was the importance of the PSA and very specific versions of PSAs to the licensing decisions for Bruce and Darlington? It's also to look at what was the relevant importance of deterministic safety analysis compared to probabilistic safety analysis to the licensing recommendations by CNSC staff.

I explained what each are used for in the

next few slides.

Deterministic safety analysis has always been the main analysis that supports the safety case of NPPs. It is used to set operational limits and there are very strict rules in place that NPPs must operate within the analyzed configuration, i.e. within their safety report, at all times. There are also licence conditions that require that prior to any design change the new configuration must be shown to be within the documented safety analysis or a new safety analysis must be performed.

Deterministic analysis is done in a conservative manner such that it should always bound the operating conditions of NPP. For example, instead of calculating the probability of a failure of a system, deterministic analysis just assumes that the system fails. It also applies the concept of defence-in-depth under which there should be multiple independent barriers to prevent and mitigate events and accidents.

PSAs are a newer tool that were developed to complement deterministic safety analysis. They look at a broader range of initiating events than deterministic analysis and they do model the probabilities of failure. This allows the assessment of weaknesses that may be common to more than one defence-in-depth barrier. It is also a powerful tool to identify safety improvements.

However, like any tool, PSAs do have limitations. The main limitation is that principles like defence-in-depth cannot be assigned a probability.

For example, during the refurbishment of Point Lepreau, a third standby diesel generator was added to strengthen the deterministic defence-in-depth provisions. However, there was no measurable reduction in risk calculated by the PSA since the PSA modelled the operational procedures NB Power had been using to compensate for the change in the -- for only having one diesel generator or when one diesel generator was out of service.

While these procedures manage the risk, applying deterministic principles eliminated the need to rely on operational principles at all and this is one of the things that defence-in-depth asks you to do. A design change is always preferable to an operational procedural fix.

Solely relying on a PSA would have argued against the safety improvement. So you need -- the point here is that PSAs should not be used in isolation, not because they identify -- they are very good at identifying risk, but sometimes they underestimate some risk as well.

Which leads then to the question of what PSAs have been and can be useful for.

PSAs have shown that -- for example, I will start with the potential improvements. PSAs have shown that the major contributor to core damage in almost all CANDUs are steam line breaks. This has led to design changes to protect the plant against such breaks as well as procedural changes.

PSAs have also identified that certain support systems which were not initially considered to have a safety role do actually play a safety role. For example, many valves and components in NPP need pressurized air to function. This is provided by what's called the instrument error system. The PSA demonstrated that the instrument error system has an important safety function. This has led to changes in how maintenance is done on those systems and added reliability targets for the systems.

There is another point around PSAs that are used as a day-to-day -- very valuable is what I refer to as a day-to-day tool for assessing safety. This is to assess changes in risk after event or before maintenance work. The results can be used by both licensees and regulators to risk-inform inspections so that more significant areas get more inspection levels.

We can also use them to assess the importance of one single failure. Does one failure actually increase the chances of you having a severe

accident or is it irrelevant to that? So you can identify which components in the plant are the most important.

So PSAs are an important part of modern nuclear regulation, but they are not used to set limits or to set the licensing basis of NPPs in Canada.

In licensing in Canada, the key contributor to the PSA has been to help identify improvements around reactor refurbishments. The other day-to-day uses of PSAs are not tied to a licensing decision but are an important part of ongoing safety programs.

So I'm now going to turn to the five cases and walk through them briefly one by one.

In each case, my presentation focuses on the key allegation, although each of the allegations within the case is fully reviewed in the CMD.

The first case involves refurbishment of Darlington. From my view, the most serious allegation is, and I quote:

> "OPG did not submit regulatory quality studies for the refurbishment configuration." (As read)

This would mean that OPG did not analyze a change to a special safety system, which would be a violation of several licence conditions. This change

involves the isolation of part of the containment special safety system to allow the refurbishment work. OPG plans to refurbish one or two out of the four units at Darlington while the remaining ones are in operation. The containment system must remain fully functional to support the operating units.

My review found the following facts.

OPG does have a safety case for the refurbishment configuration in its safety report. There is operational experience with this configuration from the commissioning of Darlington in the early 1990s and with other refurbishments like Bruce Power. Before the Darlington hearings, CNSC staff reviewed the technical basis for the refurbishment, looking both at the deterministic and probabilistic analysis submitted by OPG. These reviews did not identify any concerns with the refurbishment configuration. The CNSC staff CMD for Darlington is consistent with the results of these technical reviews.

In this case, the evidence completely contradicts the statements in the letter. The allegations are unfounded and there's no impact on safety. OPG did analyze a refurbishment configuration, CNSC staff did review this analysis and factor it into the reviews for the Commission CMDs.

The significance of the change on the PSA was also considered prior to Darlington licensing and found that it was not considered to be a significant change, and I can explain that in more detail if you want.

Like any change to a special safety system, CNSC staff are planning further compliance activities to verify that OPG remains in compliance with its safety case, but the necessary safety rules are already in place in the Darlington licence.

The second case basically claims that CNSC staff did not or could not review the 2015 Darlington PSA prior to the hearings in the fall of 2015.

I reviewed the depth of CNSC staff review, taking into consideration the importance of the 2015 PSA and the fact that it was in the overall safety case for Darlington refurbishment. The 2015 PSA was an update of the 2011 Darlington PSA. The main purpose for the update according to OPG was to model the as refurbished Darlington NPP and quantify the reduction in risk from the improvements. It was not used to identify those improvements. Those had been identified through Darlington's integrated safety review that used the 2011 PSA.

So the key PSA in terms of identifying the improvement was the 2011 version. This PSA was thoroughly

reviewed since it was submitted before the Darlington hearing and found to meet all CNSC requirements. As such, the level of CNSC staff review for 2015, which confirmed the accepted methodologies were used and focused on the major changes, was appropriate. The fact that the PSA had been recently submitted was clear in the CNSC staff CMD, as was the fact that new PSA did not identify any new risks.

In conclusion, the 2015 PSA was reviewed at a high level prior to the Darlington hearings in 2015, consistent with its importance to the licence renewal. The allegation that CNSC staff did not review the 2015 PSA is unfounded. As is normal, ongoing compliance activities are planned and being conducted around that PSA, but the requirements for that PSA and the acceptance criteria for those compliance reviews are in place in the Darlington licence and Licence Condition Handbook.

In case 3, there was an allegation that Bruce Power's PSA, one for Bruce A and one for Bruce B, were not adequately reviewed, although in this case it is stated that Bruce Power was not compliant with its licence, and in this case there is a slight difference from the Darlington case, where it's stated that Bruce Power was not in compliance with the licence and CNSC staff "actively discouraged" technical staff from reviewing the PSA.

In terms of compliance with this licence,

the licence condition is quoted on the slide. The License Condition states that:

> "PSAs shall be performed in accordance with CNSC document S-294. S-294 requires the licensee to submit the PSA methodologies for CNSC staff acceptance prior to performing the actual PSA." (As read)

The evidence shows that Bruce Power followed all the required steps in S-294 but clearly underestimated the time required to get CNSC staff acceptance. This resulted in the final documentation for the PSA being submitted later than expected, but this was never a licence condition. The results of the PSA were available on the date committed to by Bruce Power, but some supporting documentations were submitted about six months later.

On the depth of review, there was clearly internal disagreement among CNSC staff -- not management but staff -- on the level of review necessary, given the previous acceptance of the methodologies. But the direction from CNSC management was to conduct compliance activities for input into the licensing CMD. This included an inspection of the PSA conducted on the Bruce Power site. The inspections and assessments all concluded that Bruce

Power was in compliance with CNSC regulatory requirements.

In conclusion, there was a similar level of review for the Bruce Power PSA as for all other PSA, for example the 2011 Darlington PSA. All the reviews confirmed that Bruce Power was in compliance with regulatory requirements. Rather than discouraging reviews, CNSC management directed compliance work to be done prior to the Bruce Power hearings. The work was done and concluded that Bruce Power was compliant. So the allegations for Case 3, I found to be unfounded.

For Case 4, the anonymous letter is correct in stating that the Geological Survey of Canada identified some concerns with models that support the 2011 Darlington seismic PSA. So I reviewed what CNSC staff did with the Geological Survey of Canada review and what was the status of the concerns raised at the time of the Darlington hearing.

The report by the Geological Survey of Canada was received by the CNSC in February of 2015. Given the nature of the concerns, CNSC staff formally required OPG to provide justification for its model and assess the impacts of the differences in model on the overall seismic PSA. OPG provided the required information in June of 2015. With this additional information, CNSC staff concluded that any underestimation from the model was not

significant to the overall risk calculated by the PSA. All this work was done prior to the 2015 hearings. CNSC staff response was completely as expected. They made sure that the issues raised by the Geological Survey of Canada were addressed by the licensee in a timely manner.

In conclusion, the differences in the seismic models were appropriately investigated prior to the Darlington hearings. CNSC staff had sufficient information to conclude that there was no issue of regulatory importance with the differences in the models or any impact on safety. In other words, any uncertainty due to the difference in models would not change the overall regulatory conclusions with respect to the Darlington seismic PSA.

The last case, and I will quote what I feel is the most important allegation in that case, is -- this is the quote:

> "Without the information from a Level 3 PSA, the CNSC Commissioners cannot judge whether Ontario's Emergency Response Plan is adequate."
> (As read)

A Level 3 PSA studies the public health and societal consequences from release to the environment predicted by Level 2 PSAs. However, currently in Canada,

there are no regulatory requirements for Level 3 PSAs. Accepted methodology on how to perform or review a Level 3 PSA do not exist. Therefore, the CNSC would not have any criteria on how to review a Level 3 PSA.

For many decades, the CNSC and other regulators have relied on deterministic analysis, along with other tools like emergency exercises, to assess offsite emergency plans. Level 2 PSAs are used in defining the accidents that merit further analysis. The approach to assessing offsite radiological consequences is defined in CSA Standard N288.2-14. This uses a bounding deterministic approach to this rather than a probabilistic one.

OPG does have what they consider to be a Level 3 PSA that was done in 2011. The results of this PSA are available on their website. In that document, it actually shows that using a probabilistic approach to the accident that was done in the environmental assessment gives releases that are probably an order of magnitude lower than what was actually used in the environmental assessment. The environmental assessment uses a bounding deterministic approach to determine the dose to the public. They also had done a probabilistic approach to this one. The probabilistic approach, because it looks at variabilities, things like wind direction, actually predicts a lower release to the public. So what was done

for Darlington for an environmental assessment and then again in the discussion in the hearings was actually a more conservative or bounding assessment.

So in conclusion on this one, for the 2015 Darlington hearings, the Commission was provided with information on the consequences of severe accidents and CNSC appropriately used a deterministic consequence analysis. A Level 3 PSA, for which there are neither requirements nor acceptance criteria, would not be consistent with international regulatory requirements and would really not have added much to that debate. There was a very lengthy debate, you will remember, around the choice of accidents. So I found that the allegation for case 5 that a Level 3 PSA was absolutely required to assess this to be completely unfounded.

In conducting this review, I have noted some general observations that are common to most of these cases.

In each case, the authors' conclusions are based solely on the PSA and don't consider the whole safety case, which actually is what does the PSA say in conjunction to what the deterministic analysis said.

Secondly, I found that some of the allegations didn't present all of the facts, even when these were publicly available. For example, the inspection

of the Bruce Power PSA was discussed in the staff CMD for the 2015 hearings and it was clear in that CMD that the inspection was important to the CNSC staff's overall conclusion on the PSA, but it's not mentioned at all in the letter.

Finally, the allegations around the shortcomings in the PSAs are not consistent with the document position by the CNSC's PSA specialist.

So in conclusion, the CNSC staff positions taken for the 2015 Bruce Power and Darlington licensing hearing are well supported by the technical reviews that were done by CNSC specialists. I found no situation where relevant information from the technical reviews was withheld from the Commission.

All the cases overstate the importance of the PSAs with respect to the licensing decision. For example, two of the cases raised concern over the 2015 Darlington PSA update when it was the 2011 PSA that was used to help determine the refurbishment improvements. So from a regulatory point of view, the 2011 PSA is much more important than the 2015 one.

This is not to say in any way that PSAs are not important. They are an important tool and licensees are required to have quality PSAs. However, insights from the PSAs are not always the key in terms of

determining what a licensing decision should be.

While I did not find any technical merit to the allegations, during the course of the review, I did note some areas for improvement.

The first one is specific to PSAs. I found the language in the CNSC's requirements for PSAs open to interpretation. This could be improved to clarify the CNSC's expectations for PSAs and the importance of PSAs in the regulatory framework. As I said at the beginning, PSAs have an important role and this should be clearly reflected in the CNSC's regulatory documentation.

The second is a general observation with respect to technical reviews. The CNSC has a systematic process for developing the regulatory positions taken in CMDs. Expanding this process so that technical reviews that support the licensing are also done in a systematic and risk-informed manner would be useful.

Lastly, in technical organizations like the CNSC, there will always be differences of technical and scientific opinion. Hearing and being open to multiple opinions is part of a healthy safety culture. The CNSC does have extensive tools for staff to raise issues. However, if the authors were CNSC staff, they were clearly not familiar with the tools since those tools includes ones under which they could have had their identity protected if

they were concerned about reprisal. Therefore, I recommend that there should be ongoing communication to staff about these processes and they should be encouraged to use them and encouraged to use internal processes.

That concludes my presentation. I would be happy to answer any questions. Thank you.

THE PRESIDENT: Thank you.

So why don't we get into the question period. Let me start with Monsieur Harvey.

MEMBRE HARVEY : Merci, Monsieur le Président.

You mentioned, Mr. Elder, that the PSA was not used in Canada for regulation and requirements. I'm sorry, I lost the place. Well, I will reverse my question. Is the PSA used differently elsewhere than in Canada?

MR. ELDER: So what I'm saying is that the PSAs are not used to actually set limits. So there are a number of -- there is in fact a very complex set of operational limits for nuclear power plants. How they are used in Canada, how we have used them in the integrated safety reviews is very consistent to how they are used in other countries like the U.K. for periodic safety reviews. So they are used as a tool to identify potential improvements.

In most cases, and in Canada here, the

licensees always all have targets and limits that they say they will meet for those PSAs, and if they can't meet those targets, they have to make a change so that they meet those PSAs. But it's not a limit in terms of -- it's not an operational limit, it's the kind of -- I'll use an example and say it doesn't set the speed limit for your car, it may tell you how often you need to go get your brakes checked. You should do both, but it doesn't set the day-to-day requirements of how you run the plant. And that is very consistent with how it is used internationally.

One of the -- the thing you will see internationally, and you will see international experts on PSAs say this all the time, is don't believe the actual number, that's not what's important. What's important is what's it saying about the plant, what's it saying about the weaknesses in the plant, what's it saying, that if I change this, do I get safer or does it have no impact on safety? That's what a PSA tells you.

The absolute number, when you say the core damage -- they use things like the core damage frequency is 10^{-5}. Well, you can't use that very equal, you've got to take that with a big grain of salt. That's not the real purpose of the PSA. There is (indiscernible) who said, you should have a -- you should look at that and compare yourself to other similar plants to see if there's

something different about yours than the other ones, you should investigate it, but it's not the key regulatory decision tool.

And where we have used them in the integrated safety reviews is actually to identify improvements and then you redo the PSA and it will quantify those improvements. And this is what they did for Darlington. They actually went and said, "I have reduced the probability of this accident by an order of magnitude." It was low before, it's lower, that's good, but that's not saying this is dictating how you operate the plant. For those improvements to work, they must have operating conditions. The operation conditions around those improvements, any improvement, any system, is set by the deterministic analysis.

MEMBER HARVEY: Thank you.

THE PRESIDENT: Ms Velshi...?

MEMBER VELSHI: Thank you.

Before I get into my question, I just wanted to confirm what I thought were just some inaccuracy in dates in the anonymous letter and just for the record we can get that right.

So case number 3, the Bruce Power one, it just says the issue was not raised at the 2014 day one licensing. It is 2015. And I know in your report I don't

think you mentioned it and I think it's important to get those two dates right because they were all after the PSA had been submitted; is that correct?

MR. ELDER: Peter Elder for the record.

I actually read that differently, is that there was a licence amendment done in 2014 for Bruce Power --

MEMBER VELSHI: Okay.

MR. ELDER: -- where it asks for --

MEMBER VELSHI: Well, there wasn't a day one, though?

MR. ELDER: It wasn't a day one.

MEMBER VELSHI: Right.

MR. ELDER: It was an abridged hearing --

MEMBER VELSHI: Okay.

MR. ELDER: -- where they asked for extension --

MEMBER VELSHI: So either was the day -- okay.

MR. ELDER: No, they asked for extension, they asked for their licence to be extended by 6 to 9 months.

MEMBER VELSHI: Okay.

MR. ELDER: And that's why I looked at the analysis, was this relevant, because if you look at the

recommendation, the whole thing said, well, you may have added a licence condition. Well, the actual decision was done in May -- between April and May. All the material was submitted in July.

MEMBER VELSHI: Yeah.

MR. ELDER: So I don't -- you know, it was on its way, there was a commitment and they were meeting their commitment. So I interpreted the most sort of I guess conservative way as possible to say --

MEMBER VELSHI: Okay.

MR. ELDER: -- they were talking about that amendment, which was their abridged amendment.

MEMBER VELSHI: So one of the biggest concerns, besides what the President has raised around are there any safety issues, for me was the allegation that information is being kept away from Commission Members. Information that we need to do our jobs is being kept away from us and your review has not shown that or at least that's what you have concluded.

Where there has been dissension when you looked at when -- regulatory positions in preparing the CMDs, in whatever that documentation was, in your opinion, where there has been dissension, say on the level of reviews of PSAs, do you think that should have been presented to the Commission?

MR. ELDER: I guess if -- it's a difficult question in terms of how much information you present to the Commission and that's why I pointed out that this is one of 82 areas that we go through. We try to be very comprehensive. We are very systematic in our CMDs and there's always the question of how comprehensive you need to be.

In this case, I didn't find anything that concluded that there was a disagreement in -- okay, there was a staff who -- the disagreement around Bruce was we haven't had the time to determine whether they are in compliance with this document or not. That was the initial position by some of the staff members. The other position was, yes, you do, because you have approved the methodology, you've looked at this, you should be able to draw that conclusion.

What happened in the end was the people who felt they needed more time were given more time, they were given the tools to go and draw that conclusion by themselves. So in the end, the people that were raising the concerns about needing more time were allowed to have that more time and drew the conclusions that are presented in the CMD. So I don't think there was ongoing debate at that time. There was a debate, it was raised up and a solution was put forward that actually made sure that the

appropriate information review was done.

THE PRESIDENT: But when you keep talking about them, they were given the time, are we talking about our expert specialist in PSA?

MR. ELDER: Yes, the expert specialists in PSA, and there may even be independent opinions within the specialist group about how much review needs to be done. But certainly the ones who are leading the review around Bruce requested more time and requested that they be allowed to do a more thorough review.

With the inspection and some other reviews, my determination is that they were allowed -- the specialists were allowed to do that review.

THE PRESIDENT: Mr. Jammal.

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

Your question is very valid with respect to should it have been referenced in the CMD to what depth the PSA was going to be reviewed or the dichotomy that exists in-between individuals. Well, I mean, I was -- when the issue was raised to my level and to Terry's level, I called in for a meeting. This is our normal CMD process. We are a scientific organization and debate will always continue. So if I was going to make a reference in every CMD to the debate that occurs externally, I'm pretty sure

our CMDs would be much thicker.

The key point here: for my job, as the CRO of the organization, is to provide you with a solid recommendation. So when the issue was being raised at my level with respect to this agreement on the depth what's being done, I was in the room and I'm the one who directed staff, in order to come up with -- to give me the decision and the recommendation with respect to: do we pull the whole licence application? Do we proceed with a CMD? That's on the three questions.

And I said, the methodology has been approved, so we will put in place a SWAT team, literally, that -- and there is a reference in your document that Mr. Elder has presented where our specialists, on their own, went and inspected -- inspected -- the Bruce Power PSA itself and wrote the report.

The majority of the inspectors who did, and verified, were our specialists from the PSA -- and they are in the room. They can answer your questions. At no time there was an influence with respect to what the outcome would be of the inspection. I empowered staff -- and I always empower staff -- to tell me if we need to tell the Commission that either we don't have enough information to render a decision then we will not come forth with a recommendation. So the debate is healthy.

There was a disagreement. Our CMD process itself allows for the resolution with respect to this agreement. We have an open-door policy, again in addition to the process mentioned by Mr. Elder through the whistleblower and so on and so forth, but we have the internal discussion that takes place.

For me, when staff raised it to my level, and to my colleague, Mr. Jamieson, we called in a meeting, everybody was around the table, and I gave that direction or order to conduct the inspection and make the recommendation with respect to: does the PSA meet our requirements or not?

MEMBER VELSHI: Thank you.

THE PRESIDENT: Mr. Jamieson.

MR. JAMIESON: Terry Jamieson.

If I can just add some reinforcement to Ramzi's statements, I want to make it categorically clear that within the Technical Support Branch I have many times communicated to my management team, and directly to staff, that we have a no-omission rule. We will never, ever, mislead the Commission by omitting facts, and I want to get that on the record.

Also, as Ramzi has alluded to, on the case three allegation, it was exactly the opposite: management did not actively dissuade staff from doing further analysis

of the Bruce submission. In fact, management ordered that it be done.

THE PRESIDENT: Monsieur Tolgyesi.

MEMBER TOLGYESI: Merci, monsieur le président.

Mr. Elder, you said that there's about 83 methods what you're using to evaluate the risk.

MR. ELDER: So just to clarify -- Peter Elder, for the record -- you've seen -- you're used to seeing our 14 safety and control areas. Well, some of those are very broad topics. So what we do is we break them down into what we call "specific areas." And for NPPs, they have the most. There are actually 83 specific areas that we systematically go through, not only for licensing, but you'll see them all -- you can go -- if someone's bored tonight, they can count all the topics that are talked about in the NPP annual reports and you'll get about the same number.

So it's just to say each of them can be very important to a particular licensing decision, but not all of them are important to every licensing decision. We systematically go through and identify the ones that are important.

So when someone is saying this is vital, and this is what the letter said in some cases, that CNSC

must be able to endorse the PSA, well, I totally disagree with that type of statement. It wasn't how the PSA was being used in that licensing decision.

For Bruce, the PSA -- Bruce wasn't trying to use the PSA. It had to have a PSA to help manage its plant. That was the requirement. It met that requirement. It was not using the PSA to make any arguments around whether it should or it shouldn't do improvement. And so those arguments around what improvements are important really need to make sure that staff have confidence that those arguments are based on a solid basis.

I'm not in any way saying that these PSAs shouldn't be reviewed. It's a question of whether it's a compliance activity or -- and how much it has to do to support the licensing recommendation, and that isn't one answer. That depends on how it's being used. They're much more important when you're doing a refurbishment than if you're doing status quo.

THE PRESIDENT: So I have a question about how sensitive are the conduct of a PSA and our regulatory requirement to time? You know, like, all these issues come in at the licensing moment, but what I want to understand: if it's a tool, you can use it any time during the licence. And the CNSC has all the ability to stop action if they don't like something, so what is the sensitivity about when

you actually do the update or et cetera?

I know that in the new REGDOC it's required to have updates every five years. In the old one, it's every three years. So you guys complicated life anyhow because now they have to transition from three to five, but by doing all of this they still have to be compliant somehow, somewhere, sometime, and our people can force them to be compliant. So how important is the time element?

MR. ELDER: And my answer is going to be it depends. Again, it goes back into -- and I know this is the answer you don't -- you know, but it's not a simple "We must have it this day or that way." This goes back to when I said how the PSA and what the PSAs are useful for, and this goes back to what's the genesis of that requirement that they be updated?

So one of the things I've highlighted is the PSAs are being used to investigate events or to actually determine whether they're putting their plant during maintenance into a more risky configuration, to put it simply. To do that, the PSA must reflect the plant. It must be up to date. It can't be modelling a system that has been changed. So there is that need to make sure that your model reflects what the actual plant looks like.

Then there's the other use of the PSA that

comes around the saying: Are you using this PSA for refurbishment -- has been the big use in Canada -- to make your arguments around refurbishment? So if you look at this -- and going forward, if you're using the Periodic Safety Review, there has to be a good PSA to support your Probabilistic Safety Review. So the timing of when your PSA has to be done should be linked to the timing of your Periodic Safety Review absolutely.

Otherwise, yeah, you need a tool there all the time. And the requirements for that tool do not change. The licence doesn't -- you know, the standard doesn't change by the licence. The licence put the standard into the licence, but then once that standard is in the requirements are set for that whole licence period.

THE PRESIDENT: Okay, Monsieur Tolgyesi.

MEMBER TOLGYESI: So what will be the impact on the confidence in a risk evaluation with or without the PSA? In other words, by how much risk evaluation is more precise, more predictive because you are using PSA?

MR. ELDER: I think some of our PSA specialists may want to answer that question, too.

It gives you -- we were talking -- or there was talk a bit earlier about -- I'll start with what we call this -- excessively -- the previous discussion was

talking about excessively conservative assumptions in deterministic analysis. That's what you were talking about earlier. PSA helps you determine where you're being excessively conservative.

And why that's important is that sometimes deterministically you get stuck into this little -- I'll be very old-fashioned and say "Do loop", where you're trying to work your way out of something that you actually can determine isn't that important and you may not be working on something that is more important.

So it gives you that insight around what is important and what isn't important and where there are potential weaknesses.

The other thing it does very well is -- I mentioned before about defence in depth. The way you analyze defence in depth normally there are five barriers. So if you're -- the special safety systems are level 3 defence in depth. Deterministically you say, "I'm assuming levels one and two don't work. They aren't there. They failed." PSA may say, "Well, actually, you know what, the worse condition isn't that they fail. The worse condition is they don't work quite right and you may actually" -- so what you think is a conservative assumption may or may not be. And that's the insight you can get from a PSA.

So it's in combination with the two, and

understanding the limitations of both probabilistic and deterministic analysis, that you get a better picture of the overall picture of the safety of the plant.

THE PRESIDENT: Dr. McEwan.

MEMBER McEWAN: Thank you, Mr. President.

So I guess this is a two-part question. It seems to me that a PSA is effectively a model of...

MR. ELDER: It's a --

MEMBER McEWAN: Very simplistically.

MR. ELDER: Very simplistically, it's a very complex model, yes.

MEMBER McEWAN: Right. So with the increasing complexity, then it seems to me that what goes -- the assumptions that go into that model, the statistical basis for the analysis of that model, and the variable that go into that model, will very much determine what the accuracy of the outcome of the model is.

MR. ELDER: You've just described perfectly why regulators who have worked on deterministic safety analysis assumptions as bounding for 40 years have difficulty with PSAs.

MEMBER McEWAN: Right.

MR. ELDER: Okay? So what we said is it's -- and this is important, and that's why I'm saying it's not the absolute number that it comes out to. It's

saying, "I'm here. And what if I change this? Then I don't care about the overall. It's the difference. It's the difference in the models that is very good. You know, I make an assumption that rather than this equipment working 50 percent of the time, it works 90 percent of the time, and the PSA will tell you what the difference in risk that comes out of that assumption is.

So it doesn't need to be the absolute, but it's very, very powerful to looking at changes in configurations.

MEMBER McEWAN: So therefore my question is, assuming I'm not wildly incorrect: is the PSA process or the PSA model therefore potentially either malleable or manipulatable by a licensee to try and derive an outcome that the licensee wants that may affect the overall safety determination?

MR. ELDER: Okay.

THE PRESIDENT: I think it's time to listen to some specialists here.

MR. ELDER: Sure, but just getting back in, again that's why in the standard it says we accept the methodology. And that's the purpose of accepting the methodology: so that you know it's how it's being done and that it's not, then, open to -- and everything else -- again, one of the things is you want it to be auditable,

right, but, you know, it's a question -- yes.

MEMBER McEWAN: So the risk is recognizable. The way of ameliorating that risk is the prospective review of the process and the model before it's applied.

MR. ELDER: It's one of -- yes.

MR. FRAPPIER: Gerry Frappier, for the record. Perhaps I'll just add a little bit, and then pass it on to Yolanda Akl, who heads up the PSA group.

So first of all with respect to PSA's overall role, I'd like to remind the Commission that Canada is one of the few countries that actually has PSA as a requirement for regulating. We believe it's a very important tool and that it can really add, as Peter has said, lots of different views of the plant, and in particular where vulnerabilities and safety improvements could make a big difference in the risk.

As you point out, what we would call the uncertainties associated with all the parameters are very important, and our specialists can explain how we handle those if you like. But I would suggest that, in particular for your question, that's why we -- we certainly review the PSA, and we don't review it in complete detail, but we review it, but we review the methodology quite a bit. So that's why, if you look at the standard, the requirements

are for us to accept the methodology.

And it's not just a PSA. There's several dimensions to the PSA, in fact, for several PSAs: for high winds, for seismic. I know you guys have seen all that.

But perhaps, Yolanda, you'd like to add to that.

MS AKL: Yolanda Akl, for the record, Director of the Probabilistic Safety Assessment and Reliability Division.

If you would just allow me, before I pass the question to one of our specialists to get into some technical details, I would like to put a little bit things in context, especially that we were talking about -- earlier today about what type of specialists we have and if we have experts within the CNSC.

So my division is responsible for the review of the PSAs to make sure of the quality of the PSAs, and also to review the results. And I have a team that I'm leading -- I'm very proud of that team -- that consists of experts in engineering and physics, and they are -- specialized in PSA, and some of them are recognized internationally.

They participate in and lead the writing of many of these IAEA documents that you see in that area or they are also -- sometimes they lead work with USNRC,

with other regulators, with the NEA. So they are recognized for their expertise.

Our reviews are based on a very rigorous and very documented process, CNSC process, that is in line with IAEA documents 11-29 and -- 12-29 and 11-35, which are for the review of PSAs. So they are based on these IAEA documents.

And they consist of two stages in this review. The first stage we want to make sure that the accepted methodology is followed during the study. So this is a high level first stage. We make sure that the models are implemented correctly. They look at if they follow exactly the methodology. But also I wanted to add that the reviews are not only done by PSA staff. We have experts from Human Performance within TSB. We have, from reactor behaviour, from physics, from engineering division. So this is a collective effort that is done. We also ask outside CNSC some experts from NRCan to help with this review. So these are extensive reviews.

If you allow me, I will just summarize, just to give an example, of what are these stages of review.

So stage one is a qualitative review. So it has quality assurance. We make sure if QA was followed by industry governing QA documents. We look for the

completeness and consistency and the results. So we check if all the PSA tasks are properly considered and if the PSA results are fully presented. So did they calculate the core damage frequency? Did they calculate large release frequency?

Then we look at the documentation. This is all in stage one. We look at the PSA documentation and we check if they describe the methodology properly and if it provides the information needed for the review. Because these PSAs, you know, have to be reviewed by other people other than the people who perform them.

Then we also look at the suitability of the methodologies for the use of the PSA. Check if the PSA tasks are performed in accordance with this accepted methodology, as I said earlier. And after that they identify key accident sequences and key areas for further reviews. They identify the dominant sequence, identify the PSA dominant sequence identified by other studies and other sequences that the viewer may consider potentially that are important. This is all done in the first stage of the PSA review.

Stage two is a more detailed review. We look at initiated event frequency, event tree, fault tree, how they are implemented during the study; we look at component reliability that review human reliability

analysis, this is where we get our colleagues from the Human Performance Division; fragility calculation, when we ask NRCan to look at this fragility calculations, and also our colleagues from eDAT(ph); and uncertainty analysis, sensitivity analysis, important measures. All this is done within our reviews. And all this was done. So stage one for -- just to give an example, for Bruce, when we did stage one, and was complemented even with this inspection, after that we completed all the reviews, and we finished it by the end of the year.

This is the process that we follow. Just to summarize, the first stage is to allow staff to have confidence that the quality of the PSA that was presented to us, was submitted to us, followed the methodology that we accepted, and then -- while stage two of the review allows staff to dig more into the details of the event tree and fault tree and so on.

So I will pass now the questions to one of the specialists, maybe to describe a little bit more.

MR. KAROUNI: For the record, my name is Jaafar Karouni. I am a reliability and PSA specialist within the Probabilistic Safety Assessment and Reliability Division. I am in the field of reliability since about 28 years.

I would like to add to what has been said,

because my intervention here is -- as I see, the subject has been opened in a quite open manner, many issues, many questions have been, but I will select just a few sides that I would like to talk about here, and then the same time I would be able to answer some questions.

First of all, I would like thank Peter for their presentation. I'd like just to add one thing about the issue of deterministic versus probabilistic -- just to add, not to -- really, because he approached the subject in a certain track to serve the purpose, which is to reply to the anonymous letter.

But I'd like to clarify here is that -- very simply that the deterministic versus the probabilistic studies, they go both hand-in-hand, and do we need really both of them now with the variety of opinions of people?

So the deterministic mainly deals with the system's effectiveness to be able to mitigate accidents, while the probabilistic deals mainly with systems availability, to be where they can be -- the system can be effective, but has also to be available.

So this is why we see in the probabilistic safety assessment we have event trees that describes the event unfolding and, at the same time, it looks at the mitigating systems intervening at every step, are these systems available, although we believe they're effective,

so the probabilistic view is deterministic here.

And by the end of the day, as Peter said, by the end of the probabilistic safety assessment, the PSA will be able to feed back into the deterministic. Some sides we find here there are some weaknesses and may not work also.

So this is a high level explanation here to -- just to show from this perspective how to put them versus each other.

Now, about history. PSAs, it's true, in its electronic -- full electronic scale capability, it's able to discover some combinations that deterministic are unable to discover, I mean combination of failures that can take people by surprise, and areas for improvement. So some sequences may come some things you can't find deterministically, but using the four tree technique and the -- I mean the PSA technique, you will be able to find some sequences that are interesting and -- anyway.

But in -- historically, a PSA was being done somehow. The probabilistic safety assessment has been done different way in the past in the form of safety design metric studies that were made by hand. And they were using about the same principle, event trees, and then probability of mitigating system failure feeding into it.

So this probably would just answer one

part of the question. They go both hand in hand.

Now, the other thing I would like to say here, I would like to thank Mr. Binder for his remark, is that is it really so crucial to have all PSAs reviews completely done and accepted before the licensing. That's really a good remark, and I would really ask question that sometimes it's not completely -- there is not -- there is no full satisfaction and that we need more to review in order to develop lessons and should not be a detrimental thing for the people to be granted, let's say, by licence.

And I'm saying this because I see like why -- why is that. I mean, so that could always be something that has to be done and completed and improved to our satisfaction, and not many that's the case. We don't give our blessings unless we are fully satisfied and we are given that chance to express our opinion on that in that way.

I will stop here myself. Thank you.

THE PRESIDENT: So you -- so I got two questions for you.

First of all, right now, as we speak, is Darlington, Pickering and Bruce fully compliant, Stage 1, Stage 2?

MR. KAROUNI: I will leave this to -- to the person who's responsible of the PSAs for these sites.

THE PRESIDENT: Because in my understanding is, if you're not satisfied, you can always get back and demand another review and another --

MR. KAROUNI: Normally -- normally, I would say in general not for this specific site. I would like someone else to take on this, but I would say what I observe, what I know is that we are -- we don't give our blessings unless we are completely satisfied.

MR. PRESIDENT: And while I get an answer to this, you ponder about the next question, both Peter and you.

So I'm listening to all of you and then the question is, was this letter written by our staff? Because the conclusion of Peter is completely diametrically opposed to anything in this particular letter, so PSA shop, if the letter was written anywhere in our organization, it logical should come from your shop, so I'd like your comment from you and from Peter on that aspect after I hear from.

MR. YALAOUI: Yeah. For the record, my name is Smain Yalaoui.

Your question regarding is Pickering and Darlington fully compliant with S. 294, the answer is yes. The Pickering A did the PSA in 2013, and we did go to the hearing. And prior to the hearing, we did what we called

Stage 1 review as Yolande has described the Stage 1 review. This gives us the confidence that the PSA quality is good.

We confirmed that -- because prior to that, as I think was mentioned before, in Canada we have a unique regime in the PSA. We say that the methodology to be accepted, the review accepted by staff before conducting the PSA, which is a big -- a big element in giving us the confidence that the PSA is built from the proper methodology.

So the Pickering A, as I told you, was done in 2013 and it was reviewed by staff. Pickering B was done in 2012, and it was -- and it was reviewed.

Darlington was done in 2010, submitted in 2011, and it was fully reviewed. And we confirmed that we had some comments, of course, but it doesn't affect the validity of the PSA results.

And the 2015 for Darlington, it's an update. We should put things in context. The first compliance was done in 2011, and 2015 is just an update.

Update, as Peter has mentioned before, you need the PSA should reflect the -- like the as built and as operated conditions because you are going to use the PSA -- if you did any design change or whatever, it should be reflected by the PSA.

THE PRESIDENT: But you have the power to

go in and demand an update on any particular subject or sub-component of a PSA any time.

MR. YALAOUI: Yes. For the updates, we have like a Reg Doc 2.42 or before we had S294 where we recommend the routine -- what we call routine updates every three years. Now it's five years to align with the safety analysis report, the deterministic side.

But the Reg Doc 2.4.2, we have a requirement saying that the update should be made sooner if there is a measurable change. So if there is just a slight change that doesn't affect the PSA, if you change any reliability, if you change the rate of a component which is not important for the PSA, we wouldn't ask you to update because we would know in advance that wouldn't have any impact on the PSA result.

But whatever the change is made, then we know that it would affect the PSA result, of course, we ask the licensee. And the licensee will come and say, "I'm going to do this change and I'm assessing what impact should have on the PSA".

THE PRESIDENT: Okay. Another question?

MEMBER VELSHI: Can we hear also from a Bruce reviewer?

THE PRESIDENT: Sure.

MS MORIN: Yes. Chantal Morin, for the

record.

For Bruce, as was discussed, we had a Stage 1 review. I think the question was -- at first, was the scope of the review, and then we went at site and did this focus inspection. And during that inspection, we did a focused Stage 1 augmented with Stage 2, but very focused on a few sequence and scenario.

And we went with the -- to go at site was very beneficial because we could have quick access to all the supporting information, so we were able to verify the assumption, as I said, in a focused manner for some scenario.

So -- and I can attest that we did the report openly. I mean, we were not restrained in our conclusion because we had many action notice, as you probably have seen on this inspection and recommendation, and we've -- right now, Bruce Power is following up on them.

So -- and then the detailed review was done and performed, and the letter has been sent in the spring, I think, to Bruce with all our detailed review, Stage 2, of all the PSA element. There's an extensive team to do that. It's not something you can do overnight.

There was 14 people and many division in the many specialist division, so like -- yeah. So

basically, that's -- so that's all done, so the review is to be followed up.

THE PRESIDENT: So that's back to my second question. So how do you explain the anonymous letter?

MS MORIN: I cannot explain it myself.

I just want to add something. I'm very -- I'd like to comment that I like the points that Peter Elder made about the PSA.

Personally, my opinion is that, right now, the intervenors have taken these PSA at face value with a number at the end, and I don't think you can use a PSA like that. PSAs are huge, very strong model.

It's very valid to look at the complexity of the plant inter-dependencies and relative importance of scenarios of equipment. To use it and say this is the number I plan to say, that's a little bit of a stretch.

I mean, it's a lot of -- there's a lot of science behind it and it doesn't summarize itself in one number. That's what I'm saying.

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

You asked the question --

THE PRESIDENT: (Indiscernible)

MS AKL: I just wanted to answer your

question because you asked if it is a staff member from PSA.

Just the way this letter is written and focusing so much on PSA cannot be written by a PSA specialist because PSA specialists know very well we don't do risk base. Risk base is when we only focus on the PSA.

We do risk inform, so we look at defence in depth, we look at safety margin, we look at requirements and we look at PSA.

So it cannot come from a PSA professionals because they know that the PSA, as much as it's a very powerful tool, it has also its limitation. And who knows the best about the limitation are the PSA specialists, so they can never say, "Oh, the decision was made without the PSA, then we should shut down or don't give a licence".

THE PRESIDENT: So if you're correct, we are into conspiracy theory here.

--- (Laughter/Rires)

THE PRESIDENT: Mr. Elder.

MR. KAROUNI: I'd like to say something here.

Really, whoever I believe wrote this letter, okay, this is -- is not taking into account the reality.

The reality is that why -- why should a

plant have a PSA fully accepted and fully done and accepted to get a licence to be -- to get his licence. That's not true. It is -- it can happen.

If we are lucky, we have a PSA completely accepted, completely done, or the review of the PSA or the update. Why -- the author assumes that, hey, they didn't get their PSA completely accepted, then why do we give them a licence.

This is not necessarily the reality. There is always something that's not completely done sometime. What the CMD is saying, they say that they are -- either they obtained the PSA or they are toward achieving the PSA or they completed most of the PSA and I don't see that the question that yourself you have phrased is right, that why is this raised and they have to have it accepted before they are licensed.

I don't know that. The person doesn't know that, doesn't understand that, so this is not -- I'm really just read for what I do have as I understand to believe that someone of our team did that.

THE PRESIDENT: Mr. Jammal.

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

I'm pretty sure someone's been exploit the declaration of our specialists here and with respect to the

letter, so I will let that take place. But in conclusion, a couple of things that really confirm that our specialists do contribute with respect to the complementing the role of the PSA as a tool in deterministic and in a decision, at no time we withheld any information from the Commission and at no time the public, nor the reactors, were in unsafe or we made any contribution in withholding information from the Commission.

There's one thing here, we're talking about PSA as a number, PSA as a tool, but the letter demonstrated -- are multiple things being alleged in the letter.

Doesn't know who wrote it at this point. The key point here is there's a fundamental lack of understanding what PSA is. Second is a critique with respect to the safety culture at the CNSC.

We have a very strong union that is very, very active. And with respect to the whistle-blowing process, we have very extensive processes in place such as the open door policy that you, Mr. President, people can write to you as both President of the CNSC or CEO, and that is -- the letter was addressed to you. And that is a -- probably a point and a proof that there is an open-door policy.

We have the informal ICMS conflict

management in place so that the staff at their own level can look at how they can do about being coached, how to come to resolution for understanding what the process is.

We have the DOPO, which is Difference Of Professional Opinion. And we are improving with respect to what we can do.

So we have multiple avenues from the office of audit and ethics. As our staff fully aware, I am the internal safety culture champion. And yes, when I had town hall discussion with staff, we reminded them of the tool that currently exists.

The office of audit and ethic actually protects the identity of the individual who wants to raise the issue. There is the whistleblower process, internal and external. And in addition, we have the union.

There is the full union behind and supporting our staff from the union steward and taking it all the way up with respect to the grievances if there are any alleges being made that staff are being muzzled or are being told not to present their information to the Commission.

THE PRESIDENT: Okay. We need questions.

More questions from -- Ms Velshi.

MEMBER VELSHI: So let me follow up on the whistle-blowing side of it. And you've given us a quick

rundown of the different mechanisms that are available.

Do you have a sense of how often they're used? How often does someone come to the office of audit and ethics with concerns and they want to remain anonymous?

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

I cannot answer that question because I do not know what the data is, but I have to refer to Mr. Marc Leblanc, who's the -- in charge of the secretariat as an independent. And this is the key point when I say I do not know because there is an independent -- I do not know.

All I hear about things to deal with, but Marc will answer that question.

MR. LEBLANC: Well, I know about the ICMS. Not the names, just the numbers. And we have reporting on an annual basis, and that is made available.

So there were about 70 interventions. The one that would count, though, in this would be with respect to coaching. There's about 40 per year, so that's 40 individuals or groups that would go and seek advice on how to better address issues and to resolve.

It's not always negative. It's often positive. It's to get reinforcement and somebody's willingness to approach.

With respect to the whistleblower per se

and the formal process that exists within government, that I know. It's zero.

Again, we publish those results every year. But a lot of the work is done informally, and that is what I don't know, how many people go and see and decide whether to file formally or not.

So formally, it's zero, but I know there's a number of people that will meet our ethics specialist to get advice on how to proceed.

MEMBER VELSHI: And you are the office of audit and ethics?

MR. LEBLANC: Yes. I'm the champion of the informal conflict management system, and I do have the team of the audit and ethics team that reports indirectly to me, directly to the President.

THE PRESIDENT: But they don't share with him.

MEMBER VELSHI: No, but just numbers. I mean, I just wondered if it's -- if that mechanism has ever been used.

MR. LEBLANC: The formal mechanism through the Commissioner has not been used in the last four years that I'm aware of.

THE PRESIDENT: But the Commission --

MR. LEBLANC: (Indiscernible)

THE PRESIDENT: (Indiscernible) public service wide.

No, no. The audit and ethics --

MEMBER VELSHI: Ethics.

THE PRESIDENT: The audit and ethics I can tell you, they are people who are using that office for harassment, civility issues, et cetera, and they audit -- the audit and ethics will give me stats, okay, but they will not disclose to me.

MEMBER VELSHI: It's not the names. I just --

THE PRESIDENT: So it's being used.

MEMBER VELSHI: Yes. And has it ever been used for differences of professional judgment or muzzling?

THE PRESIDENT: That's the DOPO process, and that's, again, require further work, I understand.

MR. JAMMAL: Well, there are a couple things. The discussion of staff level is taking place all the time, so there is -- there is the discussion that takes place.

If there is disagreement between two staff members from different branch members or within the same division, then the -- they will discuss the issue and raise it up to the management level, which the management discuss with staff. Then it goes up to the DG level and then it

comes up to my level and sometimes it goes up to the President level if it's required. So the escalation process is taking place.

A lot of times, the issues are resolved at the operation level within the trenches of the staff and, again, we have the multiple processes in place.

So have I ever heard a grievance myself with respect to -- because I am level 3, so the highest level at my level would be with respect to difference of opinion or a safety issue. I have not heard. It's mainly issues of -- common issues relating to labour relations.

But with respect to Difference Of Professional Opinion, we have leadership committees in place, we have fact teams in place, so there is always ongoing discussion between our specialists, our operations group and the rest of the branches.

So it hasn't come up to that level, no. It's very few numbers. But a lot of discussions taking place at the working level and they're coming to a resolution.

MEMBER VELSHI: So I've read in the media recently, and I don't know whether it's as a result of this anonymous letter, but from the union -- the union leadership about collective agreements enshrining something in there.

Maybe you can talk a bit more about that and what's triggering that, and how is that to complement the internal processes.

THE PRESIDENT: I'm going to put you on the spot. We have the president of the union sitting there. I can actually see you in my failing eyes.

If you want to add something to the conversation, feel free.

MS McLAY: Hello. My name is Anne McLay. I'm a CNSC employee and also NUREG president.

And I understand the question is about the collective agreement having scientific integrity incorporated into our collective agreement.

This is a wide issue. It will help, I think, our position in that we are -- the scientific integrity group is looking at putting science policy together, so a policy in science, and if we have it in our collective agreement, then it'll be enshrined in there.

Policies can change, but in our collective agreement it's fixed.

THE PRESIDENT: But there is a task force now which is union and management looking at what we can do in -- with the union or independently of government-wide because we will have a science policy, CNSC policy, being developed together.

Mr. Jamieson.

MR. JAMIESON: I just wanted to add in response, Dr. Binder, to your question, do we know who wrote the letter, it's almost immaterial. As a learning organization, we're going to take Peter's recommendations and we're going to implement them. And we're also going to stand back and ask ourselves why the roughly dozen mechanisms that we have in place that we put in place deliberately to try to act as relief valves and safe spaces for staff to discuss concerns -- I mean, stand back and ask ourselves why, in the end, even though we have those dozen processes, a brown envelope resulted.

MEMBER VELSHI: So I'm sure you've done that reflection, so why do you think that has happened?

MR. JAMIESON: So today has been full of very tough questions --

THE PRESIDENT: Wait a second. I'm still not -- it's an unsigned, anonymous letter. I'm not yet -- even though it says it's a CNSC staff, I just heard from our expert that they say it can't be our staff or it cannot be a professional -- not from that shop.

Well, if it's not from that shop, then I'm really at a loss as to who can actually write that stuff with that great detail.

So look, I think I agree with you, it's

irrelevant who wrote it. And whenever we get such letters, we have to do the due diligence anyhow. So we have done this and I think there's some good value, some lesson learned, and we are -- you know, we always promoting ongoing improvement.

And to your point, we'll try to improve our processes internally.

MEMBER VELSHI: But I do want to come back to this question. I'd like to hear why you think, if it is a bona fide letter from one of the staff or a group of folks from the CNSC, when all these mechanisms are available and we do have a strong regulatory framework around PSA, why would someone write this letter; any thoughts?

MR. JAMIESON: I think you get down to a human nature issue that in the end you can layer in 20 more processes and you may not just get the exact one that that particular individual with that particular topic is looking at. But we are going to have that hard look.

It's very hard to explain. The letter itself, while it does have some -- I'll describe them as insights into internal discussions, it's also just full of mistakes as well. So we don't know. We don't know where it's from, but we will take Peter's recommendations.

MR. JAMMAL: If I may add to what Mr.

Jamieson is saying, it's Ramzi Jammal for the record.

Regardless of the letter, but the letter is probably highlighting if there is any truth behind it, that there is an issue with respect to highlighting what processes does exist for staff.

So we are going to continue to work with respect to enhancement associated with the processes in place, formalized and disseminate the processes in place for stuff to feel comfortable to raise the issue, let it be through the union or through the management.

And so the letter is highlighting multiple things. You asked me a question. It unfortunately is anonymous because we cannot go to the individual and say "How can we help you?"

But regardless, we were going to continue to improve our communication to staff and promote. It's a promotion. It's a communication issue entirely to say we are a science-based organization and they have multiple processes in place.

In addition to it, our colleague from HR is not here, but we are formalizing policies so that they are policy-driven more than just a process. So the key point here is we can have all the ink on paper but if the staff do not believe in it, and we have to communicate to staff and give them a safety net and assurance they can use

these processes.

THE PRESIDENT: Any -- Dr. McEwan...?

MEMBER McEWAN: So I just got a couple of, I think, really simple questions now, that I think I understand the role of PSA.

So if we look at case one, the third bullet, the letter says "isolating the single units constitutes a major change in the facility". So you said earlier that the PSA is really important in the development of a refurbishment plan.

Where does the isolation of the units fit within that assessment of risk associated with refurbishment in the design of the refurbishment? If you do isolate -- it seems intuitive that if you isolate one unit there would be a change in perhaps the configuration of what the PSA might determine or look at or the flow chart that will come out of it.

MR. ELDER: Peter Elder for the record.

I did look into this one because it comes in questions and is -- the emphasis is -- and one of my recommendations is they vary around what we exactly mean by a major change because you can walk through -- and it wasn't just me. I actually talked to a lot of specialists who understand the system -- is that you can walk through what happens when you do this isolation. Is it a change?

Absolutely it's a change. But when you walk through it and said, okay, what actually physically is going to happen? What are the risks associated with that system? Where are the reliability issues with the containment system? And you find that you can quickly come to a conclusion that it will improve the reliability of the system.

So I am just going to explain. A containment system when you look at the reliability, and this is one of the things that PSA looks at, is the major problem with a containment system is not a huge problem but when you look at how it can be compromised it's the fact that it's got airlocks. People go in and out so there are airlocks. So they are mechanical and they open. So they are subject to mechanical failures and human errors. And if you look at reliability of a containment system, it's dominated by those types of errors.

When you are isolating the system, you are actually -- they are doing this because they want to have those airlocks open all the time and people don't have to worry about them. So you are doing actual testable -- a physical barrier that is tested and put in place. So they put it in place. They pressure tested it and said, okay, this is no longer connected. You are actually eliminating in the whole system 25 percent of the total number of potential failures which is the airlocks, okay.

So you can walk through that logic and say, okay, you can do the PSA study but it's not a major change. It's not going to increase the risk. It's just going to confirm that the risk is going down.

And this is where you have to look at -- and we've had this debate or we had this on some -- on what is a change, an important change? And really it's the changes that can increase risk that you need to assess. So I think this is one where we are saying we need to clarify that language because in my mind it's those changes that can increase risk.

If you can walk through argument that says it's highly likely it's going to decrease risk, then it isn't worthy of a whole update. That's the logic that went through. That seemed very consistent with the opinion that was the PSA specialists were looking at: Is it something OPG should be looking at before they get into their actual refurbishment? Yes, and they are doing that. But is it something that was fundamental to deciding whether refurbishment was safe or not? The answer, we know, because we have lived in this configuration and it doesn't change the actual overall reliability. It may prove the liability a bit.

MR. FRAPPIER: Perhaps I could add a little. Gerry Frappier for the record.

So the configuration of refurbishment is something that had been done before. So we certainly did it at Bruce and at Pickering. But it is something that the PSA would be expected to be updated for.

And what I thought we could do is ask Samain who did that review and he can tell you exactly what was done for that aspect.

MR. YALAOUI: Samain Yalaoui for the record.

So the question is about the unit in isolation and the PSA, what the link with the PSA space. So PAA, as mentioned before, REGDOC 2.4.2 says that you need the PSA to reflect the plant as built and as operated. And we have another requirement which says that you need to do the PSA for different operational states if these operational states are for extended periods of time, and for this refurbishment outage it's about 25 months.

But the thing is like this is a refurbishment project which is a full scope and extensive work to be done. So OPG, they did the PSA part but the isolation -- the isolation, the work has been done deterministically and to check compliance with the licence conditions for the pressure bandage, because as Peter Elder has mentioned before, that putting a temporary containment boundary -- so the deterministic analysis was done to see

what would be the impact, for example, for lots of coolant accidents on the pressure of this temporary containment boundary and what would be the pressure. They are going to do some tests and things like that. And this part has been reviewed by the CNSC staff to check compliance with the pressure boundary is CSA standard and things like that.

But on the PSA part -- and OPG had committed to give us in the 2016 an interim PSA update, though I am not expecting to see any major changes in the risk, but they have committed to give us an update on what we call the interim PSA update in 2016 to give this representation of the unit in isolation and because they are going to implement safety improvement opportunities. They are going there. So too, like before they used just the sensitivity case, but now they are going back to evaluate what would be the risk reduction due to this risk improvement opportunities.

So the PSA plan, OPG has provided an extensive work and it's an ongoing plan. So unit in isolation is already within the licensing basis. It's been used by Darlington during the construction. We already had three units in operation and one unit in isolation. So this is all the elements, different elements that comes up with the unit in isolation.

MEMBER VELSHI: A comment and a question.

The comment really is I do want to acknowledge what Mr. Jamieson, followed by Mr. Jammal said, that this is a learning organization. It doesn't matter who wrote that letter. For a while I was getting very uncomfortable with how the conversation was going there.

So Mr. Jammal, you said you are the champion of safety culture for the CNSC. When was the last time you did a safety culture assessment and did you look at the areas of transparency, promoting diversity in opinion? And I'd like to hear what the results are.

MR. JAMMAL: The safety culture and the assessment, we have not carried out a process with respect to the safety assessment. But we have done a lot of -- we are not an operator.

So what I am trying to say here is we conduct quite significant numbers of internal, what we call a poll survey. We've conducted multiple poll surveys and one poll survey was addressing the safety culture for staff: Do you understand what safety culture is all about? How do you go about raising issues? Is there a -- is the organization -- and we are dealing and behaving against each other in a civil manner?

So all these things came back positive results and the information is readily available on our board's web page. That really indicates the response and

the engagement of staff in that response.

So we are not an operator to conduct a full assessment. We are progressing with respect to the safety culture which is embedded in our management system.

So when I say I am the champion, I am the champion with respect to lead a lot of changes. We are establishing several improvements and metrics in place from an electronic in-box where our staff will just put comments; will make suggestions.

So it's ongoing work. It's never a one key will fit all or not one size will fit all. So it's ongoing improvements.

I personally go on videoconference with staff without any management present. They can raise any issues they want. The President does the same thing. So we have the open door policy.

So it's a combination of multiple things, the safety culture; from our staff capability to refuse to do work, for us to providing all the avenues for staff to take the proper safety training, let it be from defensive driving for our inspectors and so on and so forth.

So it's a whole full package that we have in place. We are going to continue to improve and that's what we have.

THE PRESIDENT: Okay. All right. Thank

you.

You have a question?

MEMBER MCEWAN: I have one more question.

THE PRESIDENT: Go ahead. You have to raise your hand.

--- Laughter

MEMBER McEWAN: So again, this is -- this may be a rhetorical question but if I go to case four, it seems to me that this does raise a modestly important issue on how information gets into and what information gets into the CMD. This was obviously a -- I think -- and there are two separate questions here.

One is the NRCan report on the underestimation of the seismic hazard and the second was the impact on the PSA. If we assume that the impact on the PSA and the outcome of the PSA was that the risk was -- the findings had no impact on the regulatory position, is it important though for the Commission to actually have some insight into the discussions around that that there was this seismic review that there was a full discussion around it and that when the numbers were crunched it did not have any impact?

I would argue that it may have been important in hindsight, a paragraph in the CMD to say that that discussion had taken place, that the review had been

done, the NRCan members have come out. We discussed it internally. We don't believe that it has any impact on safety or on the outcome of this review.

I just perhaps wonder if there would be value in that type of approach to some of these very difficult -- and recognizing you don't want to present a 500-word -- a 500-page document.

MR. ELDER: Okay. I'll start because I actually did consider that when I was walking into this. So maybe a little context on this one and this is why -- how I looked at this one.

If you look at the NRCan review it's not actually reviewing the PSA. It's reviewing models that into a support document and it's actually discussing one model and the conclusion that the hazard is underestimated by a factor of two isn't even what the NRCan report says. It sort of compares directly the two models, so there is a table. And then he says, "Are the changes justified or not?" So if his model is 100 percent correct and OPG's is 100 percent wrong in the differences, yes, it is a factor of two. But as an expert reviewer, he said in half the cases OPG had actually justified the differences.

But the point would be, this is one model that is one input into one of seven PSAs. We are fairly far down in our review terrain. And this is going back in,

yeah, you could say if it was fundamental to the decision, I think you would have said, yes, it could have been in there. But if we were going to do that level of detail, even a paragraph, you know we are multiple levels down, you would still get a 500-page document if we did that on every single area.

And there is a judgment call. In this case I looked at it and said if I were -- had to sign off; if I knew about this issue what would I have liked to see done as a regulator before that CMD was written? And everything, all the checkmarks I expected to see were done.

So, yeah, there is a judgment. But in this case, and having done CMDs for a very long time, I also know that you guys do ask us, "Why are you telling me this?" And in this case I don't see any reason why I would want to tell you that fact other than it may be an interesting fact to say, "Hey, we really do a thorough review". But it's interesting -- at the point it got to the CMD it was just an interesting fact. So I am fine with that.

THE PRESIDENT: So remind me, though, doesn't -- in the hearing wasn't NRCan one of the intervenors?

MR. ELDER: John Adams who was the author of the report did intervene at the hearings, yes.

THE PRESIDENT: So he would -- if there was some significant issue he would raise a hand and say, "I don't agree with this model"; would he not?

MR. ELDER: I can't --

THE PRESIDENT: Stop right there. I have an answer from the back here.

MR. YALAOUI: Okay, just to add a little bit clarification, like the letter says that NRCan stated that we underestimate by a factor of two. This is not true, as Peter has mentioned. Like, when we did the first PSA for Darlington it was done in 2011. So they used the data from the Geologic Survey of Canada 2005. But when they did for the ISF purpose in 2015 update, they did it in 2011, it was expected -- NRCan was expecting that the hazard will decrease. But when we received the two we know that the first one and the second one there is a factor of two. We asked NRCan and say, "Give us your professional advice on that".

So NRCan came up with this conclusion although they -- like although the decrease is large but this is justifiable. This is their cost. But they say, however, "We think that the way it was portrayed by OPG there may be a slight increase for what you call high frequency domain". But like the increase from NRCan, we were pushing -- giving -- John Adams to give us a number.

He says about 20 to 30 percent. So we did ourselves an estimate on the impact on CDF and we asked it. We sent a letter to OPG saying, "Tell us if there are any impacts from this seismic PSA".

And OPG did a comprehensive work and they came up with a difference of 19 percent in the CDF. Just to put the numbers in perspective, the seismic PSA number is 2.6 in -5. Otherwise, 2.6 in 100 years, 100,000 years and then we take into account this 20 percent it came up to 3.1 in 100. It's just a small -- a small decrease -- increase in the risk.

So now the question do we report it to the Commission who have not maybe -- I'm just a specialist -- but just for internal events, for internal events we have 120 initiating events for which we assess the frequencies. So every time we find a frequency of this initiating event has gone up 20 percent down or up and we -- I think, maybe at one point you tell us stop giving us these frequencies.

THE PRESIDENT: Okay.

MR. JAMMAL: Mr. President, I would like to complement what our specialist is saying. I'd like to complement the fact that we went back to Mr. Adams, Dr. Adams as a matter of fact, and we said here is the value that came back from OPG. What's your opinion?

So the key point here, it was a trigger as

an independent review for our staff to challenge the licensee and the licensee responded accordingly with respect to the values and then we went back to Dr. Adams to seek his opinion.

So the key point here is it required? Well, if it would require the licensing action, definitely it would have been in a CMD that we are recommending to you either a licence condition or a whole point or any other regulatory oversight that is specific to that element.

So we have a lot of examples where we come before you on major issues, let it be the pressure tubes or any other element that we put a whole point in place and then you will accept it or not.

THE PRESIDENT: Okay. I think we have to get some sleep for tomorrow. So this concludes the meeting for today and the meeting will resume tomorrow at nine a.m.

So thank you for your patience and we'll see you tomorrow morning.

--- Whereupon the meeting adjourned at 7:21 p.m., to resume on Thursday, August 18, 2016 at 9:00 a.m. / La réunion est ajournée à 19 h 21 pour reprendre le jeudi 18 août 2016 à 9 h 00