Canadian Nuclear Safety Commission	Commission canadienne de sûreté nucléaire

Canadian Nuclear
Safety Commission

Commission canadienne de
sûreté nucléaire

Public meeting

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Le 5 février 2014

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
Dr. Moyra McDill
Mr. Dan Tolgyesi
Dr. Sandy McEwan
Ms Rumina Velshi
Dr. Ronald Barriault

Commissaires présents

M. Michael Binder
Mme Moyra McDill
M. Dan Tolgyesi
Dr Sandy McEwan
Mme Rumina Velshi
Dr Ronald Barriault

Secretary:

Mr. Marc Leblanc

Secrétaire:

M. Marc Leblanc

Senior General Counsel:

Mr. Jacques Lavoie

Avocat général principal :

Me Jacques Lavoie

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Ottawa, Ontario

--- Upon commencing on Wednesday, February 5, 2014 at 1:32 p.m. / L'audience débute le mercredi 5 février 2014 à 13 h 32

14-M1

Opening remarks / Ouverture de la séance

M. LEBLANC : Bon après-midi, Mesdames et Messieurs. Bienvenue à la réunion publique de la Commission canadienne de sûreté nucléaire.

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

Les appareils de traduction 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 as possible.

La transcription sera disponible sur le site Web de la Commission dès la semaine prochaine.

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.

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 et 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 who are here with us today. On my right is Dr. Moyra McDill and Monsieur Dan Tolgyesi.

On my left is Dr. Sandy McEwan, Ms Rumina Velshi and Dr. Ronald Barriault.

We have heard from our Secretary

Marc Leblanc and we also have with us here today Mr. Jacques Lavoie, Senior General Counsel of the Commission.

MR. LEBLANC: So the *Nuclear Safety and Control Act* authorizes the Commission to hold meetings for the conduct of its business. Please refer to the updated agenda that was published on January 30th for the complete list of items to be presented today and tomorrow.

The minutes of the December 9 to 11, 2013 Commission Meeting will be presented to Members for their approval tomorrow morning.

In addition to the written documents reviewed by the Commission for today's 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.

We also have some representatives from licensees to make presentations before us today and other organizations.

Mr. President...?

14-M2.A

Adoption of Agenda / Adoption de l'ordre du jour

THE PRESIDENT: Okay. With this information, I would like to call for the Adoption of the Agenda by the Commission Members as outlined in CMD 14-M2.A. Do we have concurrence?

For the record, the Agenda is adopted.

14-M4

Status Report on Power Reactors /

Rapport d'étape sur les centrales nucléaires

THE PRESIDENT: I would like now to proceed to the Status Report on Nuclear Power Reactors which is outlined under CMD 14-M4.

Mr. Rzentkowski, I understand you are going to make the presentation. Please proceed.

MR. RZENTKOWSKI: That's correct. Thank you very much and good afternoon.

Mr. President and Members of the Commission, I would like to take this opportunity first and introduce or reintroduce to you Mr. Ken Lafreniere who has returned to his substantive position as Director of the Bruce Regulatory Program effective yesterday, as a matter of fact.

Ken is sitting right behind me.

And regarding the status report, I have no further updates for today on the status report on power reactors presented in the CMD 14-M4.

However, I would like to bring to your attention the following two items mentioned in the CMD. The first item in section 1.1 is an event notification regarding a mineral oil leak from a transformer's cooling heat exchanger of Bruce A, Unit 1 that took place on January 31, 2014.

I would like to point out that the mineral oil contains no PCBs or radioactive material. This was the main reason why we concluded that there was no impact on the environment.

The second item I would like to bring to your attention is the current status on an action stemming from the Commission Meeting that was held on August 21st, 2013. More specifically, CNSC staff was tasked with providing the Commission with an update regarding the Bruce B, Unit 5, heat transfer system leak after reviewing the Root Cause Analysis Report.

CNSC staff are currently reviewing this report which was received on January 15, 2014 and will provide their conclusions at the March Commission meeting.

This concludes the status report on power reactors. CNSC staff are now available to answer any questions the Commission Members may have.

Thank you.

THE PRESIDENT: Okay. Thank you. So let's start with Ms Velshi.

MEMBER VELSHI: Thank you, Mr. President.

I have a question on the Bruce A elevated iodine 131 levels. At our December meeting I think we were informed that the likely contributor for that was probably fuel bundles that had been damaged and that Bruce Power was going to be identifying the channels and take whatever corrective measures were necessary.

So why are the levels still elevated? Has that happened or is that still work in progress?

MR. RZENTKOWSKI: It's my understanding this is still work in progress.

Regarding Unit 2, the situation returned to normal, but Unit 1 still requires some operational attention and a representative of Bruce Power is present here in the room and I hope he is in a position to provide more details.

MR. SAUNDERS: Good morning. Frank Saunders, for the record.

Yes, so in this case there is some debris left over from the refurbishment is what was causing the problem and, in a few cases, there was some erosion on a few bundles -- sorry, not bundles, really on the pencils in the bundles and that's where the iodine comes from; if you get a leak on a pencil, then the iodine raises and we have a delayed neutron system which allows us to track where those -- where the bundle is and then de-fuel it from the reactor.

And that's in process and we have taken a number out and that's why you see the iodine levels are down. There is a certain length of time for the clean-up circuit to remove the iodine as well.

So it's an ongoing process. We will continue to remove them of course if they leak, but the system is at very low levels now and moving in the right direction.

MEMBER VELSHI: Very good. Thank you.

THE PRESIDENT: Can I follow up on this. So I'm trying to understand. So are you eventually -- do you now consider to have the root cause of this?

MR. SAUNDERS: Yes. There is no indication there is anything other than the debris and the debris is being cleaned up at its reducing rate, so it's coming out both by our own clean-up circuit and, to some degree, it comes out as you de-fuel the bundles here if you are taking out the debris as well --

THE PRESIDENT: So, it's the debris that's causing this elevated --

MR. SAUNDERS: Yes, that's right. In the ones that we have looked at, they were clearly debris frets, so we pull out -- we can actually identify the bundle that had the material and we examine it in the bay, not quite a microscope but the same idea, we can look at it very closely and we can identify where the leak was and the nature of the leak.

So a debris fret looks quite

different from a cracked end plate or something of that sort.

THE PRESIDENT: Is that unique to Bruce, or is it likely to happen anywhere else?

MR. RZENTKOWSKI: It's likely to happen anywhere else because, of course, the flashing of the heat transfer system takes place after refurbishment activities, but very often it's difficult to remove the fine debris which may be present. And even this fine debris could eventually lead to some scratches on the fuel channel pellets or pencils, strictly speaking, which in turn can lead to some elevated iodine readings in the heat transfer system.

THE PRESIDENT: So is that a part of OPEX that you share with everybody?

MR. RZENTKOWSKI: We don't share it per se because, as you know, up to this point in time there was only Bruce Unit 1 and 2 which underwent refurbishment and previously Point Lepreau. I am not aware of this problem at Point Lepreau and I know that we have a representative for Point Lepreau present in the room as well, so it would be probably worth to ask this question.

THE PRESIDENT: I'm just curious

about the process, the procedure is. When you have an event or incident, I assume that you automatically -- all the CANDU players at least share information.

MR. RZENTKOWSKI: The industry shares this information on a weekly basis among all CANDU Owners Group members.

From the standpoint of regulatory exchange, we bring the issues to the attention of other regulators only if they lead to something that is of safety significance.

In this particular case the reading was significantly below that what normally would be considered as dangerous or posing some risk to the operating staff. From that standpoint we decided not to share this experience.

THE PRESIDENT: Ms Velshi...?

MEMBER VELSHI: I have a few questions around the Darlington incident on lead exposure and whether it is CNSC staff or OPG that can provide some light into this.

I know the incident happened in August, 2011, so perhaps the Commission had a chance to discuss it at some length then and, if that's the case, then that's fine.

But I wondered if you could share some more insight into the adequacy of the program that would allow an unplanned exposure of lead to occur? I know the Ministry of Labour's -- the penalty is around notification only, but I wondered more around the overall programmatic side, whether it was on hazard identification what the likely exposure may have been and also some insight as to why there was a delay in reporting and whether the CNSC had been notified of this incident as well?

MR. RZENTKOWSKI: I will ask Mr. François Rinfret, Regulatory Program Director for Darlington, to respond to this question.

MR. RINFRET: Good afternoon, François Rinfret speaking.

This event -- we became aware at CNSC of this event in 2012 when charges were laid. Before that we had not been made aware formally of this event at the CNSC. It was below what we would call reporting requirements in the licence at the time. Since then the requirements have changed and evolved, I would say positively.

So the other part of your question is whether OPG had taken precautions to prevent recurrence and OPG has taken precautions across the nuclear field, but also across OPG, all OPG activities. You have a number of those ranging from information of the employees to training, to toolkits to analyze lead presence, to a review of the materials -- hazard materials at the company level and the sort of things which look reasonable from the protection point of view.

The Darlington Manager of Convention Safety is supposed to be online, or was supposed to be online -- I'm not sure if this is the case -- to be able to answer some more specific questions on that subject. It's not the case.

THE PRESIDENT: I think we have OPG people online. OPG, can you hear us?

MR. AXLER: Hello, it's Craig Axler. Can you hear me?

THE PRESIDENT: Yes, we can. Do you want to add any comment to that?

MR. AXLER: Sure. It's Craig Axler, Senior Manager of Health and Safety for the Nuclear Business Unit, for the record. Thank you.

Obviously with respect to Ms Velshi's questions, the fact that this event occurred demonstrated some gaps in our program and we have taken steps since that event to ensure that recurrences are prevented.

We have obtained tools to analyze if there is lead content in surfaces that we may be working on. We have rolled out several communications across our nuclear staff as well as the rest of our company and we have conducted a comprehensive review of our hazard recognition with respect to hazard materials and to ensure that our program is robust and complete in that regard.

I think another question spoke to the notification. Obviously there is evidence from these charges that our notification of this event was insufficient at that time and an exposure claim of an active employee at OPG is something that happens infrequently and, therefore, our procedures did not sufficiently address the scenario at that time.

This is something we have also taken measures to address and we have been executing an updated process or procedure for several months now, possibly even more than a year, and have had opportunity to ensure that notifications are sufficiently and promptly processed in accordance with the regulator's requirements.

THE PRESIDENT: Thank you. Ms Velshi...?

MEMBER VELSHI: What is the likely exposure of these two workers?

MR. AXLER: The workers' blood levels were analyzed for lead content and the results coming back from those blood tests was there was no elevated lead levels in their blood.

MEMBER VELSHI: Thank you.

THE PRESIDENT: Thank you. Monsieur Tolgyesi...?

MEMBER TOLGYESI: Merci, Monsieur le Président.

I have two questions to Bruce. You know, when you are talking about this tracking of I-131 you are saying that the Unit 1 levels are significantly below the shutdown limits and there are no longer elevated levels in the Unit 2.

What it means, it's below the shutdown, it's below the regulatory limit and, if it's no longer elevated, how elevated is that? It's below the limit, it's above the limit but, you know, not dangerous?

MR. SAUNDERS: So Frank Saunders again, for the record.

Yes, I'm afraid I don't have all the levels with me, but I can explain to you how the process works. There are some low levels of iodine that are natural from some small leakages from fuel that operate and those are what we track as normal levels.

So Unit 2 is now at the level we would expect during normal operation, which is quite small. We have a variety then of action levels up to and including shutting the reactor down and Unit 1 is not at any of those action levels other than us to go find out the action level it's in, find out what the cause is and return it back to normal.

And there is a level at which point would suggest a fairly large leak at some point where you take the reactor off-line. We never actually reached those levels because we de-fuel first the fuel a long time before then.

So that's what those levels mean. It's really no different than any other chemical control, you will have what you would prescribe as a normal standard level that is acceptable, any increase in that level results in a variety of actions starting with investigate all the way up to stop doing whatever you are doing to stop the escalation rate.

And that's all that means in that iodine 131.

MEMBER TOLGYESI: Also, according to this status report, the Unit 1 heat exchanger oil leaks, which you said it is a mineral oil, has no PCBs, and you are saying that it was in order of 50 litres and the leak was isolated and stopped.

Usually what we are saying, it's isolated, stopped and recovered. To what extent it is important to recover this 50 litres? Was it or it's not necessary?

MR. SAUNDERS: For this one I brought you a picture so I can kind of give you a quick view of what's what here.

THE PRESIDENT: Are you putting it on? Is somebody putting it on?

MR. SAUNDERS: Yes.

THE PRESIDENT: Okay.

MR. SAUNDERS: There we go. I

will see if my mouse will work. So this here is your unit service transformer right here, that's only a piece of it, this is filled with mineral oil and the mineral oil both acts as a coolant and as an insulator for the transformer.

There are actually two of these, there is a unit service transformer and a station service transformer, they both operate at about 50 percent capacity, or can.

This little yellow thing out here on the side is the cooler that we are talking about. Normal operation here is, you can just barely see a yellow pipe in there, normal operation is the warm mineral oil from the top of this heat exchanger, or top of the transformer falls down to the heat exchanger back to these two pipes and in the bottom, right, and so it's just a natural circulation going on in here all the time.

In here are the cooling water lines, so the tubes in this heat exchanger have process water flowing through them, at a relatively low rate, it's about a gallon a minute, and that water flows in one end and then into a tundish and out into the main station output as it goes. So both very low pressure systems.

What we discovered on last Thursday I guess is, we did see some increased gas accumulation on the transformer. It doesn't show the tanks here, but there's tanks at the top where we look at any off-gassing, which would suggest there is some kind of impurity.

So we pulled samples both of the oil in the water on the Thursday, there was no evidence of oil in the water on Thursday, but we did in the oil samples see some additional chemicals that we didn't expect. So on Friday we pulled another sample and we did see some oil in that water, a very small amount, just a light sheen on the surface. And so at that time we decided to take the transformer off-line and shut it down.

The issue then -- and then we isolated the low-pressure service water so that the leak couldn't continue any farther. So whatever water was there would have already went down the drain into the outfall.

We can't tell you exactly what it was yet. We know it is a fairly small quantity because it would have only leaked over an hour or two while we were doing that isolation, because typically it leaks the other way around when you are operating.

So when the system is pressurized it is water going in the transformer; when you shut the system down to isolate it, there is some hang-up in the pipes which then run out to the drain and that's when the leakage to the environment would have occurred. But until we can drain that transformer down and find out how much water is in there versus how much oil, we won't be able to give you a significant quantity, we just know it's not a very large quantity at this time.

We could not see any sheen on the outfall. There was no evidence in the outfall or in the outfall samples that there was oil present. So that the quantities were small, but I can't be much more definitive until we finished disassembling the thing and actually measuring the quantities that are there.

THE PRESIDENT: So there will be a follow-up? You are doing a Root Cause Analysis?

MR. SAUNDERS: Yes, that's correct. So the usual S-99 reports are filed. Right now this thing is all surrounded by scaffolding as people start to disassemble the heat exchanger and drain out the oil and we will look at the oil we drain out and separate water and oil as much as is possible to do to give a pretty reasonable estimate.

Obviously whatever water was in there instead of oil, is how much oil we lost. So we will be able to -- we will be able to estimate it. We don't estimate it at a very large quantity. We do think the only time the leak occurred was just while the isolation was going on, so a pretty small leakage rate.

MEMBRE TOLGYESI : J'ai deux questions, Monsieur le Président, pour Gentilly-2.

Est-ce que les travaux progressent conformément au plan?

M. RZENTKOWSKI : Je pense, oui. Mais M. Benoit Poulet, le directeur du programme de réglementation de Gentilly-2, va répondre à cette question.

Benoit.

M. POULET : Merci, Dr. Rzentkowski.

Benoit Poulet pour l'enregistrement.

Jusqu'à présent, toutes les

activités qui ont lieu en centrale sont faites selon des procédures qui ont été revues et discutées avec Hydro-Québec, dont, qui suivent leurs encadrements, et nous sommes au courant de toutes les activités qui ont lieu.

Le plan final d'exploitation qui est requis dans ce cas-ci, nous avons reçu le plan final qui partira... qui décrit les activités qui auront lieu à partir d'aujourd'hui jusqu'à l'état de stockage sûr combustible en piscine et l'état de stockage sûr combustible dans les modules de stockage CANSTOR à sec.

Donc, ce plan est présentement sous la révision du personnel. Nous planifions une réunion de travail avec les gens d'Hydro-Québec dans environ deux semaines pour regarder les activités, clarifier certains points, et puis ce qui nous permettra de planifier nos activités de conformité pour les activités.

MEMBRE TOLGYESI : Et ma deuxième question, aussi pour Gentilly-2 : Quelle est la situation en ce qui concerne la main-d'oeuvre? Est-ce qu'on a du personnel technique qui a quitté ou est-ce que la main-d'oeuvre nécessaire est là pour assurer les opérations sécuritaires ou le shutdown sécuritaire?

M. POULET : Oui. Benoit Poulet pour l'enregistrement.

Effectivement, c'est sûr qu'il y a beaucoup de personnel technique qui a quitté le site. Présentement, l'effectif est entre 350 et 400 employés en tout, qui est une diminution assez importante sur les effectifs qui étaient présents dans le passé. Ils sont encore sous le permis qui a été émis par la Commission.

Donc, tous les effectifs qui doivent être là sont là, tels qu'ils étaient lorsque la centrale était en pleine puissance. Donc, les équipes de corps et tous les techniciens qui sont requis selon un permis qui a été accordé pour une centrale en exploitation sont toujours là.

LE PRÉSIDENT : Quand est-ce qu'on va voir le plan de démantelation? Le plan de démantelation.

M. POULET : Le plan de démantèlement, je ne pourrais pas répondre précisément. Nous avons le plan de mise en retrait qui amène la centrale à l'état de stockage sûr combustible entreposé à sec. Pour procéder au déclassement, au démantèlement, il faudra... ça sera une activité séparée sous un autre permis qui sera émis par la Commission. Pour le moment, nous n'avons pas ce plan-là.

LE PRÉSIDENT : Mais ils sont en train maintenant... ils organisaient une étude qui était dans les États-Unis. Comment est-ce qu'on va voir les résultats?

M. POULET : Je ne pourrais pas répondre à cette question, et je crois qu'Hydro-Québec m'a informé qu'ils ne seraient pas ici aujourd'hui, donc, je n'ai pas la date précise pour répondre à cette question.

Je vais regarder pardessus mon épaule, mais je ne crois pas qu'Hydro-Québec sera ici aujourd'hui.

--- Discussion officieuse / Off-record discussion

M. POULET : Mon premier vice-président m'informe que...

LE PRÉSIDENT : Monsieur Jammal, vous pouvez répondre directement.

M. JAMMAL: Je lui ai donné la réponse.

M. POULET : Depuis la mise à l'arrêt de la centrale, la haute direction d'Hydro-Québec et la haute direction de la CCSN, incluant monsieur Jammal qui est présent ici aujourd'hui, nous avons des rencontres mensuelles, et monsieur Jammal m'informe que nous aurons une date précise dans environ deux semaines.

LE PRÉSIDENT : Merci.

Dr. McEwan...?

MEMBER McEWAN: Thank you, Mr. President. Just a very simple naïve question.

In the Pickering report it says that Unit 1 tripped because of ice formation. Wouldn't this be a common happening in a Canadian winter and shouldn't there be something in place to stop it -- couldn't there be something in place to stop it?

MR. RZENTKOWSKI: I would like to try a simple answer to this simple question, which is not as simple as it sounds.

Yeah, it should be a common problem, but of course it depends on the specifics of the design of the intake of the service water. And in this particular case, Pickering sometimes experiences this particular problem, which may lead to the reduction of the intake of the service water. As a result, the temperature of the secondary system may go up, which in turn causes the temperature of the primary transport system and the pressure to go up, and this is the reason for the trip of the reactor.

In terms of the specifics of the design of the intake to the Pickering Station, I know that we have a representative from OPG on the line who is prepared to provide more details if you wish.

THE PRESIDENT: OPG?

MR. GILBERT: Ken Gilbert, Pickering, for the record.

So it's true, you know, we do operate the power plant in Canadian winter conditions. This winter has been colder than other winters but not the coldest on record. The plant has operated successfully with the current intake structure for 40 years. We have provisions in place to help manage cold winter conditions.

So how that operates is we take surface water in off the lake. We screen that water to remove debris through two sets of screens. There's a set of bar screens and a set of travelling screens. Both of these, you can imagine, have relatively small grating in order to remove debris.

While we get very low temperatures there's something that can form called frazil ice and there's some specific scientific parlance around that, but the real issue it's essentially slush that's coming in can cause blockage of the screens and the system is designed for it.

There's a couple of features designed into that. One is we can divert some of the steam to the upstream side of the screens to melt the ice. And the second is simply that the screens are designed to go out of service if this forms and there's automatic trips of the screens and automatic trips of our CCW pump to protect the equipment. When this happens, you know, we have other automatic systems designed to shut down the reactor.

So it's recognized that you can get very cold water and ice formation. The frequency is very low and the system is designed to manage that.

MR. RZENTKOWSKI: Thank you.

THE PRESIDENT: Thank you.

Dr. McDill.

MEMBER McDILL: Thank you.

My question is concerning Point Lepreau. I wonder if either staff or Point Lepreau could give a timeline for the finalization of the design change with respect to the sumps.

MR. RZENTKOWSKI: We just received this information, which is now reported in the status report. So I think a representative from New Brunswick Power would be in a better position to answer this question.

MR. THOMPSON: Good afternoon. For the record, my name is Paul Thompson. I'm the Manager of Regulatory Affairs and Performance Improvement for the Point Lepreau Generating Station.

The request for design services for that change has gone in and I don't know the exact date for when the design change is going to be. It's going through a prioritization process.

What we can say, though, is until that design change is implemented, we have taken additional measures, which is to modify the manner in which the condensate polisher is valved in so that it will be valved in in a manner which effectively is a much softer transition. We should avoid the lifting of the relief valve. So that is a compensatory measure that is in place until the design change can take effect.

MEMBER McDILL: When was the change made? I think you may have said it at the last meeting but --

MR. THOMPSON: Sorry. The change that --

MEMBER McDILL: The soft change, the temporary fix if you like.

MR. THOMPSON: Oh, the temporary change. The documents now have been modified, are in Document Control. So if we had to have a shutdown, those documents could be used.

MR. THOMPSON: Sorry, Paul Thompson again.

And also, the other thing that was done is if you recall the discussion about how the sumps cascaded, sump number 8 has been redirected from -- it was going to the drainage ditch, as you recall, and it is now directed to the wastewater lagoons.

So again, should the valve open for whatever reason, then the sumps would be directed into the lagoons, which are designed to deal with that, and our operating permit allows for a specific concentration of hydrazine.

MEMBER McDILL: So you wouldn't hazard a guess as to when the final permanent change will be in place?

MR. THOMPSON: Paul Thompson for the record.

No, I'm afraid I don't have that information at the present time to give you, Dr. McDill.

THE PRESIDENT: Thank you.

Dr. Barriault.

MEMBER BARRIAULT: Thank you, Mr. Chairman.

My question is to Darlington if you're still online.

I'm wondering what happened with the lead. Is it a problem of identification that it wasn't lead?

And the next part to that question: Was it a thermal cutting or was it a mechanical cutting? In other words, was it vaporized with torches or whatever, or was it just a mechanical cutting of the lead?

MR. AXLER: Craig Axler, Senior Manager of Health and Safety for Nuclear, for the record.

The second question, it was torch-cutting --

MEMBER BARRIAULT: Correct.

MR. AXLER: -- which resulted in both molten lead and vapour, and I'm sorry, I can't remember the first part of your question.

MEMBER BARRIAULT: That's exactly it. I was wondering really if it was -- if the lead was vaporized as you do with torches or was it mechanical where you just wind up with lead.

And my next part to that question then would be: Is it standard proceeding not to wear respirators when you're cutting with torches or do you wear respirators when cutting with torches?

MR. AXLER: We wear respirators when cutting with torches. Unfortunately, in this instance, there was insufficient identification of the fact that lead would be involved in this operation.

MEMBER BARRIAULT: I guess the next part is how long after the exposure were the blood lead levels taken and did you take urine levels also?

MR. AXLER: I'm sorry, I don't have exact information on those timelines. I have no record that urine levels were taken, so I believe I would have to report that those did not happen, but I am not certain of that.

MEMBER BARRIAULT: I'm just trying to zero it down really as to why these workers decided to raise this issue with Workers Comp.

And I guess the next question really is: How long after the exposure were the lead levels taken?

MR. AXLER: Once the work began and the molten lead and vapour arose, it was immediately identified at that time that lead was involved --

MEMBER BARRIAULT: Okay.

MR. AXLER: -- and at that point then workers were immediately aware that a potential exposure had occurred.

MEMBER BARRIAULT: Okay.

I guess my next question would be to CNSC. What rating did they get in traditional occupational health and safety in that year?

MR. RINFRET: It's François Rinfret for the Darlington Program.

This event didn't make it to the rating of 2011 or 2012 since it was not reported initially during that year.

The circumstances of the lead -- I digress for a while -- are that lead shots or lead weights were included in some tubings. So that's the reason why it was not predicted and it was not protected for.

Coming back to the reason for this event, it was not taken into account and it was not reported, which is why it doesn't make it to the result of the occupational health and safety rating. I can only presume that it would have made it as a finding.

On the other hand, looking at the quantity of corrective actions that were pulled together by the Corporation, it would have served, I think, as a positive, I'd say, consequence and sort of to put some equilibrium on this event.

MEMBER BARRIAULT: Is there a mechanism to go back and put an addendum to that rating or you just leave it as it is?

MR. RINFRET: The event itself I'm not sure would have enough weight in order to be able to change a rating. We would have to look at the number of findings, positive and negative, during that year. So there is no straight answer to that question, Dr. Barriault.

MEMBER BARRIAULT: Thank you.

Thank you, Mr. Chair.

MR. RZENTKOWSKI: I would like to complement his response.

The event happened in 2011 and in that year we still didn't have a memorandum of understanding in place between the CNSC and the Ministry of Labour. So the exchange of information on the events, which were not safety significant, was very limited.

So now we have this memorandum of understanding in place, so roles and responsibilities have been very clearly established, and in particular the communication path established as well, so that we get all the information which is relevant to our mandate.

MEMBER BARRIAULT: Thank you.

Thank you, Mr. Chairman.

THE PRESIDENT: Just as a follow-up, staff are trying to promote -- in fact, there's a discussion paper talking about a safety culture. So in future, is a concern -- obviously the Ministry of Labour considered this to be a serious non-compliance because maybe $75,000 is not a hefty fine here but it sounds to me like a hefty fine for an incident like that. So they consider it to be serious.

So my question is: In future, when we are looking at compliance with a safety culture concept, are all of those labour-type, conventional labour, occupational safety occupations and safety will be factored into our assessment of the rating of occupational health and safety?

MR. RZENTKOWSKI: Yes, that's our intention.

As I indicated in my previous response, we have this communication channel now fully open, we are well informed, and if there is any inspection conducted by the Ministry of Labour at the licensee sites our site staff is involved as well. So we also learn firsthand of the status of the implementation of occupational health and health measures at the sites.

And also, another aspect is that we are trying to establish a very integrated assessment of the safety performance of the facilities, and occupational health and safety is a part of this assessment.

In short, my answer is yes.

THE PRESIDENT: Okay, thank you.

Mr. Tolgyesi?

MEMBER TOLGYESI: You know what? I am going back to this cutting, torch cutting.

Mr. Axler, you said that there was no protective equipment used because there was no indication of lead while cutting. Now, what's your practice and working standards regarding torch cutting because when you cut a torch there is smoke? There are particles.

So independently, if it's lead there or it's not, I think that some kind of equipment should be worn.

MR. AXLER: Craig Axler, Senior Manager, Health and Safety, for the record.

I apologize if there was any confusion around previous comments.

With respect to welding it is standard practice to wear appropriate personal protective equipment but personal protective equipment specific to lead was not utilized. So to clarify, personal protective equipment for standard welding, torch-cutting operations was utilized but not specific to the lead hazard.

THE PRESIDENT: Okay.

Anything else? Any other questions?

Well, I have just, I think, one question still on Bruce B and it's the language being used in the comment. Just I don't understand it so please explain:

> "The full licence power for Bruce B unit is 93 percent of normal unit power due to the large loss of coolant accident safety."

So every time you use the word "large loss of coolant accident" I get goose bumps.

--- Laughter/ Rires

THE PRESIDENT: So please explain this.

MR. RZENTKOWSKI: So I would like to state that this sentence, as a matter of fact, has been repeated since five years. So there is a lot of goose bumps we had.

--- Laughter / Rires

THE PRESIDENT: Well, I guess we may have missed it.

--- Laughter / Rires

MR. RZENTKOWSKI: And I think it's very important to realize that the full licensed power for Bruce B units has been reduced by 7 percent in the mid-1990s. It has been reduced because of the safety concerns related to large LOCA which eventually could lead to the flow reversal in the heat transport system.

As a result of this flow reversal a fuel channel string could be pushed to one end of the channel causing a significant power pulse in the reactor core. That's why the power was reduced or the licensed power was reduced by the CNSC by 7 percent.

In the meantime, this problem has been resolved to the satisfaction of the CNSC staff. But there are other issues, related in part to aging, which affect the safety margins related to LOCA. That is the reason why this penalty of 7 percent is still in place for Bruce B reactors only.

THE PRESIDENT: So I would suggest you find different language that doesn't -- could in layman's language like "incapacitation " that large LOCA could happen or that's what we are talking about here.

MR. RZENTKOWSKI: I see.

THE PRESIDENT: I'm not sure that's the right language.

MR. RZENTKOWSKI: Yeah. The licensed power was reduced to prevent not the large LOCA but to mitigate the consequence of the large LOCA.

THE PRESIDENT: I just gave you my advice here about the language.

Anybody else? Okay. Thank you. Thank you very much.

I'd like now to ask are there any further updates?

MR. JAMMAL: Yes, sir.

THE PRESIDENT: Mr. Jammal.

MR. JAMMAL: Thank you, Mr. President.

It's Ramzi Jammal, for the record. Good afternoon to you, Mr. President, and Members of the Commission.

I'd like to bring to your attention of an incident that occurred last week on January 29th that involved Cameco Corporation at its Port Hope Conversion Facility.

The CNSC was informed on January 29th that Cameco performed a manual shutdown of a critical process uranium hexafluoride conversion. This manual shutdown was necessary due to a potentially unsafe valve configuration.

Our CNSC onsite inspections that was conducted by staff have confirmed that no employees were impacted and there was no release to the environment. However, as this incident had the potential to create unsafe conditions -- again, it's potential to create unsafe conditions -- staff requested through a 12-2 directive to Cameco to conduct a root cause analysis and to identify and put in place mitigation measures to the satisfaction of CNSC staff prior to restart of operations.

The CNSC did post -- and we did post on our website information pertaining to this incident and so did Cameco post it on their own website.

We will continue enhanced regulatory oversight and we will provide to the Commission updates as appropriate.

And the reason I'm giving you this update is staff is meeting with Cameco in order to come to a conclusion and put the measures in place.

Thank you.

THE PRESIDENT: Okay. Just as a clarity question -- no one will go on a hypothetical situation before we get the facts.

MEMBER BARRIAULT: It's a quick question. I'm sorry.

This failure to close a valve did it have anything to do with hydrogen fluoride acid?

MR. JAMMAL: Mr. Ramzi Jammal, for the record.

MEMBER BARRIAULT: Sorry, anything to do with the hydrofluoric acid.

MR. JAMMAL: Ramzi Jammal, for the record.

Sir, I'm not going to mislead you. I'll refer this question to my technical specialist. I don't have that information to tell you about it.

All I can tell you is at a high level there was -- a vacuum was created and a suction of the air did take place. But I don't have the precision yet to provide an answer.

MEMBER BARRIAULT: I'm asking that question because we had in the past some similar issues dealing with hydrofluoric acid and I'm just wondering if the two were related. But that's all.

MR. JAMMAL: To my knowledge -- it's Ramzi Jammal, for the record -- the two are not related. It's two separate issues.

One was required -- one -- briefly, there was an update to a software where it caused an intervention and we're getting to the bottom of the story.

MEMBER BARRIAULT: Thank you.

That's all, Mr. Chairman.

THE PRESIDENT: Okay. I guess we'll wait for the full details on this. Thank you.

I'd like to move to the next item on the Agenda which is a presentation by New Brunswick Power Corporation on the Fire Protection Program Upgrade to Standard CSA N293-07, as outlined in CMD 14-M7 and 14-M7.A.

And I understand that Mr.

Granville will make this presentation. The floor is yours.

CMD 14-M7 and CMD-M7.A

Oral presentation by

New Brunswick Power Corporation

MR. GRANVILLE: Mr. President, ladies and gentlemen, the Commission.

For the record, my name is Sean Granville. I'm the Site Vice-President and the Chief Nuclear Officer of Point Lepreau Generating Station.

We're pleased to be here today, provide a brief update on the Lepreau Fire Protection Program upgrade to the CSA standard N293-07.

So while New Brunswick Power has had a Fire Protection program that's contributed to the safe operation of the station since it started up in 1982, there has been considerable change to the standards related to fire protection for CANDU plants outlined in CSA N293 and the associated codes referenced in this standard.

Consistent with our commitment to

safety and continuous improvement, NB Power is committed to the implementation of CSA N293-07 by the end of 2014. N293 is a very extensive standard and impacts on many aspects of the analysis, plant design, operation, maintenance, training and emergency response related to personnel and nuclear safety and equipment protection.

I'll now turn the presentation over to Paul Thompson, Manager, Performance Improvement and Regulatory Affairs to discuss the project progress.

MR. THOMPSON: Thank you, Mr. Granville.

For the record, my name is Paul Thompson.

Due to the extensive nature of the standard the work to implement N293-07 has been underway for several years. Prior to return to service at the end of the refurbishment outage, the nuclear significant aspects were evaluated and, where necessary, clear actions raised to ensure mitigating actions were completed.

Where compliance could not yet be achieved, compensatory measures were implemented to meet the intent of the standard and to ensure an acceptable level of risk until permanent solutions could be implemented.

The resolution of all currently implemented compensatory measures is included within the detailed actions of the overall project and will ensure compliance with CSA N293-07 is achieved by December 31st, 2014 as per the conditions set out in the licence condition at hand.

In order to ensure this condition is met, NB Power implemented a detailed project which includes all necessary actions and detailed schedules to ensure that each requirement of CSA N293-07 has been evaluated and addressed. This also includes the many requirements contained in the reference codes and standards within CSA N293-07 such as the National Building Code of Canada, the National Fire Code of Canada and various national fire protection association standards.

All clauses of N293-07 have been assessed in detail and a report has been produced detailing the results of this assessment. For those clauses where compliance is currently achieved, the basis for that conclusion by referencing station documents has been recorded. Likewise, for those clauses where compliance could not be demonstrated an evaluation has been completed and clear actions established to ensure compliance.

The resultant compilation of the compliance assessment, actions and demonstrated evidence forms a closure report which will be used to track and ultimately demonstrate that compliance to CSA N293-07 has been achieved.

The project team is composed of a cross-functional team made up of senior leaders headed up by the Director of Projects at the Point Lepreau Generating Station.

Oversight of the project is provided by a senior level steering committee as well as other offsite oversight groups.

This slide identifies five key areas covered in the standard and, thus, included in the project.

The analysis aspects includes upgrades to fire hazard assessment and a new requirement 2007 version of the Code, a fire-safe shutdown analysis. Together, these analyses assess the consequence of potential fires and demonstrate the ability to maintain safe conditions.

Outputs from these analyses can factor into the need for additional design changes to the plant along with requirements that need to be built into the operational program and processes. Where necessary, specific technical assessments are also performed to demonstrate compliance with certain clauses of the standard.

With respect to design, requirements are either explicitly identified in the standard or are an outcome from the analyses identified above and address requirements for areas such as emergency lighting, power supplies, safety grassroots, alarms and notifications, barriers, detection and suppression systems.

These improvements can be as simple as adding additional sprinklers in a particular room to installing a state-of-the-art, very early detection and infrared smoke detection system in specific areas. In a number of instances the original systems in place to provide this protection do not meet the more modern requirements and needed to be upgraded.

With respect to the operational program, improvements have been developed in the industry to reduce or eliminate fire risk from combustible materials and required station activities such as welding, grinding and handling and storage of flammable materials. These improvements are widespread amongst station activities and processes and require assessment and development to ensure implementation and controls are thorough, consistent and effective.

Key upgrades to the process of impairment control, which is how fire systems are required to be taken out of service and managed and compensated for, are also included in this project.

The testing program for various fire system components also had to be extended to meet the current standards.

As many station activities have some aspects related to fire protection, the training needs assessment for these activities was required to ensure that staff have the appropriate training and/or qualification. The ability for effective manual intervention is an important element to the fire program.

Fundamental to success is the assessment and documentation of high challenge areas, having detailed fire plans and the appropriate equipment, training, drills and evaluated exercises. This forms the basis of an effective emergency response team with the necessary equipment to address each of the specific scenarios.

This is an extensive project involving over 50 plant modifications and over 150 documents that need to be revised resulting in an overall capital cost of over $95 million and an operating maintenance cost of over $16 million.

Some of the more notable items include the acquisition of two special fire trucks to be kept onsite, along with a corresponding storage facility.

There are also upgrades to a number of detection and suppression systems, emergency lighting and notification systems.

The replacement of the original part-time volunteer style emergency response team with a dedicated fulltime team was also a notable accomplishment.

As I discussed on the last slide,

the sheer size of the project poses a challenge for a small utility and some of the design activities were postponed until additional specialized resources could be acquired.

In addition, back-fitting an existing plant can be difficult as modifications require extensive use of staff holding which can impact on station operation. Nonetheless, the project is in full swing and is well supported across the station. The written submission lists a number of the accomplishments made to date.

Some of the operational challenges -- some of the operational changes, excuse me -- required a major change in the way the day-to-day work is carried out particularly in how material both combustible and non-combustible is stored and handled throughout the plant.

As requirements in the standard goes well beyond normal housekeeping this transition was initially challenging and took several months for staff to completely internalize and successfully comply with the program. The initial challenges in this area were observed by the CNSC staff during their field inspections. Similar to our observations, these have shown significant improvement with time. We will use the lessons learned in rolling out future program enhancements.

While one of our successes was the establishment of a dedicated fulltime emergency response team, we experienced some difficulties with the shift schedule that was adopted. We are in the process of establishing a new shift schedule that will provide for a regular dedicated training period. This will allow for more training and drill time and reduce the amount of extra hours the team is required to work.

To keep CNSC staff abreast with progress on the project, regular update meetings take place. In addition to these meetings and written submissions, the closure report will be updated on a periodic basis. This will link the completion of specific project activities to the closure of specific N293-07 clauses.

Final submission of the closure report is scheduled for later this fall.

I will now turn the presentation back to Mr. Sean Granville for some concluding remarks.

MR. GRANVILLE: Thank you, Mr.

Thompson.

For the record, my name is Sean Granville, Site Vice-President for Point Lepreau Generating Station.

We trust this update has been useful in providing update on the work to improve the fire protection program at Point Lepreau Generating Station. We are confident that we will achieve compliance with CSA standard 293-07 prior to the end of 2014.

We would be pleased now to take any questions from the Commission.

THE PRESIDENT: Thank you.

So I would like to open the floor for questions, starting with Dr. McDill.

MEMBER McDILL: Thank you.

My first question -- this is, as you say, an extraordinarily large undertaking. Is there a risk prioritization to this area of change is taking away priority from other areas?

I would ask both staff and Point Lepreau to answer.

MR. RZENTKOWSKI: Let me start. Greg Rzentkowski, for the record.

Definitely, the risk exists. The

overall cost of this project is currently estimated at $100 million. So there is significant expenditure over probably four to five years of attempts to make sure that all the improvements are in place to ensure compliance with this particular standard.

Prioritization becomes a very important issues. However, in the case of New Brunswick Power plant the situation is a bit better because the high priority items of course has been implemented during the refurbishment outage. And then a decision by, I think, management of Point Lepreau has been made to postpone fire-related upgrades for later for the time when the unit will be already in operation.

This proved to be difficult, difficult for a number of reasons: Qualified resources required and also the costs involved.

If there is any lessons learned for the regulator from all of this, I think we have to be careful how we implement new regulatory requirements. This particular standard implemented almost a step change in the regulatory requirements where -- it is very deep in both scope and depth in describing our regulatory requirements to ensure that the risk associated with fire at nuclear power plants is minimized.

The question is how to implement the requirements of that sort. We have to allow definitely the licensee for gradual implementation of this kind of a standard. From the onset, we have to decide on the implementation plan which will evaluate risk significant issues, and making sure that those will be implemented first, followed by less safety-significant issues.

We also have to establish a very good project plan and work it together with the licensees. Many lessons learned.

Thank you.

MR. GRANVILLE: So for the record, Sean Granville, NB Power.

So I'd like to agree with Dr. Rzentkowski's comments. We agree and fully support those comments.

This project has been difficult. There is obvious safety benefits that we are going to accrue from, you know, completing this project. One issue, you know, we have a finite project portfolio and fire and Fukushima are taking up the large proportion of that work.

So there are additional, you know, project capital -- capital projects that we would like to do that, you know, that we're going to not get done this year in terms of reliability, in terms of that.

But as to Dr. Rzentkowski's point, the high -- the safety items are coming first.

MEMBER McDILL: To follow up on that, and I think going back to licensing, you had a very concerned intervener community over this fire issue. How are you -- how are you explaining what you're doing to your community, particularly the intervener community which was very concerned?

MR. THOMPSON: Yeah. For the record, Paul Thompson.

I'm not aware that this was a high profile issue with the interveners. There are other aspects on the Lepreau file that did gather the attention.

Nonetheless, your question, I think, is very valid in terms of how we go out and talk to people. So we do have our regular community liaison group meeting, and we keep them updated to the overall progress and status of the unit and discuss very -- various issues of interest from both safety, environment and regulatory perspectives.

MEMBER McDILL: Maybe staff could follow up on that.

Are you following how this is being communicated to the surrounding community?

MR. RZENTKOWSKI: I will ask Mr. Ben Poulet to respond to the question, but I want to stress before I turn over to Ben that we manifest our presence quite frequently in the local community. So there are frequent meetings with the community which are being attended either by our site inspectors or Ben himself.

So I'll let him to explain it better.

MR. POULET: Ben Poulet, for the record.

Essentially, that's what I was going to add, is when the NB Power holds community liaison meetings or outreach activities either one of our inspectors from site or Dr. Rzentkowski or myself will attend just as part of the audience and perhaps just to answer questions that may be related to the regulatory activities we conduct in sites.

That's all I would add.

Generally speaking, we're satisfied that the community outreach for Point Lepreau is very effective and well received in the community.

MR. THOMPSON: For the record, Paul Thompson.

Maybe I'd like to just add as well.

In the local community liaison group, it -- we have two Chairs, one for the station and one for the community.

The community co-Chair is Wayne Pollack, who is the fire chief of the Musquash Fire Department, and we work very closely, as you'll recall from earlier hearings, with the Musquash Fire Department. Our fire response has us doing the initial response and then we're backed up by the Musquash Fire Department and then, later, by the Saint John Fire Department.

Chief Pollock has been very involved, has participated in the training of our new response team and there's a lot of training that happens jointly, of course, between Point Lepreau emergency response team and the Musquash

Fire Department.

One of the interesting things, as an example, that we're seeing spin-off benefits for is Mr. Pollock liked the way that there's group assessments and meetings held in terms of how the fire team would attack a fire in a particular area and what are the -- what are the specific equipment they need to protect or what some of the hazards are in the room.

And they've used this style in the community in Musquash for developing the fire plan and the attack plan for a fire at the local PetroCan station.

So at any rate, I guess where I'm heading with this is the local community is very aware in terms of where we are on the fire program because the community is very involved in terms of participating in the fire protection program.

MEMBER McDILL: Thank you for now.

THE PRESIDENT: But just to follow on what Dr. McDill started and Mr. Rzentkowski talking about the implementation, surely you're not spending more than $100 million without significant safety benefit to be derived here. It's not purely just a regulatory requirement to adhere to a new standard. There's got to be some cost benefit here, right?

MR. GRANVILLE: So for the record, Sean Granville.

Yeah, absolutely there are safety benefits. But some of the modifications -- we're spending $17 million on a public address system modifications, so -- but you know, it's to meet the requirements of this Code, so --

THE PRESIDENT: So are you suggesting maybe that's less than fully required?

MR. GRANVILLE: What I -- for the record, Sean Granville.

What I would suggest is that -- to Dr. Rzentkowski's comments, this standard took a very step change from the previous and implementation in the industry, right, we've learned some lessons from this.

THE PRESIDENT: We're going to have the standard people here before us very soon. It's the industry that normally create those standards, right, so --

MR. GRANVILLE: For the record, Sean Granville.

THE PRESIDENT: -- I assume those

needs were identified.

MR. GRANVILLE: That is correct. It's -- this is the industry. The standard is developed with -- you know, as part of the industry; correct.

THE PRESIDENT: Okay. Well, I guess there's room for further discussion on that.

Ms Velshi.

MEMBER VELSHI: Thank you.

Is Point Lepreau unique in this implementation? Are the other NPPs in compliance with this standard?

And I guess the hyphen 07 means that's when the standard was published, so it's seven or eight years since it was --

MR. RZENTKOWSKI: Thank you for this question. Greg Rzentkowski, for the record.

The standard has been implemented in power reactor's operating licences since 2007, as a matter of fact, just after it was initially published. And it hasn't been an easy process for our licensees.

For other, bigger licensees like Bruce Power or OPG it took almost five years to be in full compliance with the standard. If my memory serves me correctly, the full compliance was assured for both utilities by the end of 2012.

MEMBER VELSHI: Thank you.

For Point Lepreau, you mentioned that you have off-site oversight committees also as part of your project infrastructure.

Do you have third parties involved in this to provide you advice and make sure you're doing the right thing rightly?

MR. THOMPSON: Yes, Paul Thompson, for the record.

Yes, we do. We've -- have done benchmarking with the other utilities. We have frequent meetings with them. They're involved in some of the review of our activities.

We've also had the COG fire safety group come down and take a look at what we're doing and look at the program and provide us feedback and comments on the program.

So there is a lot of dialogue with the -- with the rest of the -- our peers.

MEMBER VELSHI: Good.

A question for staff more on the licensing process.

So Lepreau has this as a hold

point for the end of the year. And if new priorities came like Fukushima lessons learned, is this something that then gets revisited to say should the timing of this -- you know, should they be given more time because they have higher priority areas to address?

MR. RZENTKOWSKI: Those discussions, as a matter of fact, took place. So very often we meet with the licensees, in this particular case New Brunswick Power management, to discuss regulatory priorities.

We considered this to be the highest priority item simply because of the visibility of this problem and because of the fact that it resulted in the regulatory hold point in the operating licence. And generally, our licensee was in agreement that this is a high priority item which has to be resolved on time. That means by December 2014.

There was never a question around it: Should we, maybe, postpone implementation of all required improvements; should we, maybe, consider other paths. No, never a discussion like that took place.

MEMBER VELSHI: Lepreau is -- I

don't know. Did you ever thought that, well, maybe this is something we need to open up because we've got other, more pressing safety concerns to address?

MR. GRANVILLE: For the record, Sean Granville.

We're committed to implementing this standard by the end of this year.

MEMBER VELSHI: And my final question is to staff around acceptance of the closure of this project.

Lepreau has said fall of this year is when they're expecting to complete and they have until the end of year, I guess, for the staff to be comfortable that that has, indeed, been completed appropriately.

Do you review this on an ongoing basis and sign off, or is this you get the full package and you then confirm that all the requirements have been met?

MR. RZENTKOWSKI: CNSC staff has established a multi-disciplinary team which has been monitoring the progress on the fire protection program project through the regular document reviews, inspections and monthly updates and meetings.

So we are very aware on the status of the progress. And at this point in time, we have some concern, but we still believe that it can be -- it can -- the entire project can be finalized by December 2014.

And towards the end of the year, of course, we would have to assess operational and design compliance, and this is probably the biggest part of the project. So it will be a difficult task.

THE PRESIDENT: I assume there's -- we have inspectors in there that have spent a lot of time on site. They've got some selfish interests making sure that fire protection is best.

MR. RZENTKOWSKI: That's correct. Our inspectors are very active in this particular field and, very often, they come up with new findings. For example, it was reported by New Brunswick Power that there were some housekeeping issues last year, and it was brought to our attention by our inspectors, who are very heavily and very actively involved in resolving those issues.

But of course, also, we have a back-up of our technical specialists here in-house who also visit the site very frequently and take part in the inspections conducted at the site.

THE PRESIDENT: Thank you.

Mr. Tolgyesi?

MEMBER TOLGYESI: Merci, monsieur le président.

So my understanding is that since 2007, the licensing conditions are that CSCN in 293 standards are in force at Point Lepreau.

MR. RZENTKOWSKI: That's correct. The standard entered the licence in 2007. And I mentioned about the lessons learned from the project. This was one of the drivers why we started thinking about the Licence Condition Handbook which allows us to define implementation strategy for new standards and also to define the time line for implementation.

This was really a very big lessons learned for us.

MEMBER TOLGYESI: You were saying that regulatory hold points for Point Lepreau regarding full compliance with the standards is -- should be by December 31st, 2014. But you are talking about permanent solutions and also about compensatory measures.

To what extent -- does it mean that the compliance at -- on December 31st will be with all permanent solutions or there could be compensatory measures for some items and be comply like this?

MR. RZENTKOWSKI: Compensatory measures were required a few years ago to assure that, at least, New Brunswick Power meets the intent of the standard. But in December 2014, all design and operational improvements have to be in place in order to meet all requirements of the standard. No complementary measures any more.

MEMBER TOLGYESI: So that's what you will do.

MR. GRANVILLE: Sean Granville, for the record.

As I mentioned, we will meet the requirements of the standard.

One thing that the standard provides is it's not -- there's a suite of ways that you can meet the standard. You can do it in certain designs. You can do it in the operational side of the business, right.

So there is some flexibility built into the standard, and -- but to -- but we will meet the standard.

MEMBER TOLGYESI: When you're talking about these 95 or 100 million costs, those are costs to implement all these standards since the costs are for all actions and activities since 2007.

MR. GRANVILLE: So for the record, Sean Granville.

Since about 2009 is for the project -- we've gone back to the project, and that's the approximate costs.

MEMBER TOLGYESI: And you know, there are several items you were talking about like design modifications and training and operational programs.

I understand that design modifications are more complicated and take longer time, usually, and cost probably much more. But training, operational programs and emergency response are matters of short term, which should be implemented, and very fast because you are talking about emergency.

So how much of these costs --

these spendings, capital spendings, were for design modifications such and how much was for remaining part for programs and training, et cetera?

MR. GRANVILLE: So approximate cost of the project -- sorry. For the record, Sean Granville.

The approximate cost of the project is $95 million in the capital project portfolio. That's largely the design and construction of the modifications plus the analysis that supported those.

The operational maintenance budget is $16 million.

THE PRESIDENT: Thank you.

Dr. Barriault?

MEMBER BARRIAULT: Thank you, Mr. Chairman.

Just a few brief questions, really. The first one is to CNSC.

Are there any nuclear power plants that do not meet the standards of 293-07?

MR. RZENTKOWSKI: New Brunswick.

MEMBER BARRIAULT: That's the only one.

MR. RZENTKOWSKI: To the best of my knowledge, yes.

MEMBER BARRIAULT: Okay. Second question, really, is that accomplishment to date for NB Power, you state that 50 percent of your PA system is in place, the public address system.

What do you do to communicate with the remaining 50 percent?

MR. GRANVILLE: So for the record, Sean Granville.

We have a public address system already. We have had one since the start of the station that's still in place. This is the upgrades. This is an additional upgrade. Correct.

MEMBER BARRIAULT: Thank you.

That's all, Mr. Chair.

THE PRESIDENT: Thank you.

Dr. McEwan?

MEMBER McEWAN: Thank you, Mr. President.

In your -- in the notes, you comment on the cultural shift in handling materials. And how difficult was that to implement, how long did it take, and are you satisfied that it's been made?

In my experience, cultural shifts can often take a very long time to really take root.

MR. GRANVILLE: For the record, Sean Granville.

You're correct, it is a very difficult job to change behaviours of -- that have been learned over a 30-year operation of a plant. And add to that a refurbishment project that, you know, really put the focus on, you know, it's -- it essentially became more of a construction site.

The -- so we did struggle when -- as we were making these, you know, fairly radical changes in rules. But how we have achieved improvement is around transparency metrics and accountability.

We -- all the managers are measured every single week on their performance. And it's brought up at a routine meeting where we talk to it. And any work group that doesn't meet the standard gets to have a meeting with the station director and to understand why we're not meeting those requirements.

In terms of time, it probably took

six months of just every week focus to drive the performance.

We still -- you know, over Christmas we saw a little bit of a waiver in terms of performance back, so we have to -- it's basically relentless coaching and staying on top of it to drive the change.

MEMBER McEWAN: And you think sort of that shift will be complete by the end of this year?

MR. GRANVILLE: For the record, Sean Granville. We're going to continue. And yes, we believe we will drive the behaviours to the level we need to by the end of this year.

MEMBER McEWAN: Okay, thank you.

THE PRESIDENT: Anybody has any other question?

Just for my own kind of maybe lesson learned, just to try to understand if I've got it right, are you, both staff and NB Power, of the view that you should have done more during the refurbishment rather than delay it? It would make it easier?

The reason I'm also curious about is whether we're going to be facing application for two major refurbishment projects coming up very quickly in Bruce and in Darlington, and I just wonder whether -- it seems strange to me that you didn't do most of this work during refurbishment.

So now with hindsight, what do you think? It was a bad decision to defer it?

I mean, I don't want to put you on the spot here, but would it have been more efficient?

MR. THOMPSON: For the record, Paul Thompson.

I was very involved in the development of the refurbishment scope, particularly along the safety and licensing lines. And so I think I'll answer this question because I think I wear this.

Yes, in hindsight, I definitely would have included this within the scope of the refurbishment project. At the time, when we were determining the division of responsibilities, we looked at -- we looked at what would be done within the project versus what could be done from the operational side of the house.

Had I known the more extensive

nature of the amount of work that needed to be done, we would have definitely put it in the refurbishment project, so that definitely is a lesson learned for us.

As we say, though, the other utilities are in a different spot with regards to compliance, so it's slightly different.

But the other thing we do at the station is that we have a program where we look at upcoming CSA codes and standards and upcoming regulatory documents. We're much more involved now in terms of making sure that we have representatives on those committees to both understand and influence the developments in the CSA world and, of course, to provide comments on the regulatory documents and to do the GAAP assessments and look at implementation plans for those that we're going to adopt and put into our management system.

So we're much more involved on an ongoing basis of trying to understand potential gaps, look at what the implications into the long-term business planning is so that we're not caught with a huge gap after something's been implemented that we don't have an appreciation for what the potential magnitude would be.

So we think that, on a going forward basis, we shouldn't find ourselves in the situation again.

THE PRESIDENT: Staff, you want to comment on this?

Not only on fire, but any other system during refurbishment because maybe if they would have done it through refurbishment, it would have been implemented faster.

MR. RZENTKOWSKI: Definitely this project demonstrated that it is very difficult to superimpose any, let's call it, construction activities on normal operation on the site. And we have to keep it in mind when we will decide on the approach for implementation of periodic safety reviews, which will, of course, lead to the development of integrated implementation plan which is supposed to be scattered over normal operation of the plant.

So we are now in discussing -- in discussions with the industry trying to define the best approach how to deal with this problem.

But in the case of fire protection, there was something else which has been discussed here already. I think from the regulatory standpoint, we have identified this cultural shift as the single most difficult issue to overcome. And this, of course, is the same no matter it is refurbishment or normal operation of the plant.

I would like Mr. Ben Poulet to complement my response because I know he has his own views on this problem.

MR. POULET: Thank you, Dr. Rzentkowski. Ben Poulet, for the record.

It's always interesting to look back at decisions that were made at certain point in time and saying looking back now, would we -- was the decision the correct decision.

In this particular case, if you can imagine, simple things like rewiring of thousands of speakers running wires through the whole plant, it seems like an appropriate thing to do during refurbishment. But the focus of the activities were such that essentially the place becomes a -- the station becomes a construction site that was mentioned.

So perhaps it becomes a hazard to the people doing the work to have welding, grinding, movement of heavy equipment while trying to reach every single electrical panel or alarm panel or wire or speaker or any other system that's rated to fire protection.

These discussions were at the time held and also the schedule was different. The planned schedule was not exactly the same schedule that actually ended up being. So perhaps knowing that ahead of time would have maybe resulted in a different decision.

So that's all I wanted to add to what was said. The complexity of -- fire protection programs or systems are all over the plant. Every nook and cranny has a fire detector, a sprinkler head or a fire detection suppression system. It's a very complex thing to retrofit on any plant, never mind doing a refurbishment.

Thank you.

MR. THOMPSON: For the record, Paul Thompson. I'd like just to add another comment.

I didn't want to leave you with the impression that we weren't happy with the scope of refurbishment. I believe that we had a very comprehensive program for safety upgrades on that plant, well thought out, well executed.

A lot of people have been doing benchmark, come down to Lepreau to see what is it that went into our program and how. As you're aware, we made quite a number of changes that put us in good stead, you know, in light of Fukushima and those sorts of things too.

So I think there's only a couple of areas where -- you know, when people come down and they benchmark, we say from a safety perspective there's a couple of areas where we would have done a few additional things. Fire protection is one of them.

Thank you.

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

I'd like to move on to the next item on the agenda, which is a presentation by -- oops. People need a break?

--- Off-record discussion / Discussion officieuse

THE PRESIDENT: Okay. So it's a presentation by the CSA Group on the Nuclear Standards Program Response to the CNSC Fukushima Task Force Recommendation 9.4, as outlined in CMDs 14-M9 and 14-M9.A.

I understand that we have John Froats online. Can you hear us?

MR. FROATS: Yes, Dr. Binder, I am online and I can hear you quite well. Thank you.

THE PRESIDENT: Great! You're coming through loud and clear.

And I understand that Ms Cianchetti will make the presentation. Go ahead, please.

CMD 14-M9 and CMD 14-M9.A
Presentation by CSA Group
Nuclear Standards Program Response to the CNSC Fukushima Task Force Recommendation 9.4

MS CIANCHETTI: Thank you, Mr. President and Commissioners.

For the record, my name is Mary Cianchetti. I am the Program Manager for the Nuclear Portfolio at CSA Group.

With me today is Greg Orloff, Director of CSA's Energy Standards; Candace Sellar, Project Manager for CSA's Standard on Nuclear Emergency Management Programs; and via teleconference, John Froats, Chair of our

Strategic Steering Committee.

In May of 2012 we appeared before you to respond to the CNSC's Fukushima Task Force Recommendations, specifically our position on Recommendation 9.4. Today we would like to update you on the work we have completed.

For those of you who were not at our last presentation, I'd also like to provide a brief background on CSA Group.

CSA Group is a not-for-profit membership-based association serving business, government and consumers, with over 3,000 published codes and standards.

CSA's standards development process is accredited by Standards Council of Canada. Once published, our standards are living documents, continuously revised and refreshed to address changing requirements and emerging technologies. CSA standards must be reviewed and subsequently reaffirmed, updated or withdrawn at minimum every five years.

CSA Group's nuclear program develops vital standards to promote the safe operation of the nuclear power industry in Canada.

The program standards are

developed by over 400 expert volunteer committee members. Committee members are leading experts in their fields and are selected to represent various interest groups most likely to be affected by the standard. These interest groups generally fall in the categories of government, owner-operators, suppliers and fabricators, service industry and general interest groups.

CNSC staff participate on all levels of our committees within this program and they have a vote on all standards.

Oversight of this program is provided by CSA's Nuclear Strategic Steering Committee. This committee provides program direction on content and quality.

The Chair of this committee, John Froats, is an Associate Professor and Nuclear Engineer in residence at the University of Toronto Institute of Technology. He has 38 years of experience in nuclear reactor design, start-up and operation.

And in addition, the committee's Vice-Chair is Mark Dallaire, Director General of the Regulatory Policy Directorate at the CNSC.

Under the Strategic Steering

Committee's guidance, the program maintains a suite of over 40 nuclear standards, 31 of which are directly referenced in regulatory documents, including Licences and Licence Conditions Handbooks of nuclear operating facilities across Canada. These standards complement regulation and form part of the CNSC regulatory framework.

In addition, in response to CNSC's initiative for enhanced public transparency, all of CSA's nuclear standards are now available for view access by the public.

Shortly after the Fukushima event in March 2011, the CSA Nuclear Strategic Steering Committee met to share their perspectives on the Fukushima accident and outlined what steps they would take in response.

In May 2011, this committee's approach was presented to CNSC management.

By November 2011, this committee had completed an initial review of the existing suite of CSA nuclear standards against CNSC and WANO action notices and subsequent industry response. This step confirmed that the current set of standards was robust and that opportunities to enhance the program existed.

In May 2012, CSA presented their nuclear program's approach and findings at a CNSC Commission meeting. At this point CSA committed to complete their review and provide the CNSC with an action plan by the end of 2013.

Since then, the nuclear program, under the guidance of its Strategic Steering Committee, has developed an action plan identifying Fukushima-related emerging opportunities, those requiring the development of new standards, as well as issues to be included in upcoming updates to existing standards.

Many elements of this action plan have already begun. Others are planned for.

All identified actions are planned to be completed within six years of the event and are running to schedule.

This action plan was submitted to the CNSC this past December and includes a detailed description of what will be addressed within each identified standard and will be outlined later in this presentation.

This slide is an excerpt from the CNSC Staff Action Plan on the Fukushima Task Force Recommendations. It highlights Recommendation 9.4

which calls on CSA to provide an action plan on how it will address lessons learned from the Fukushima event.

The following slide indicates which existing standards already have been or will be updated during the revision cycles.

Our action plan includes the revision of seven existing standards. One of these standards has already been published; two projects have begun and are on schedule; the remaining projects will begin later this year.

The next slide indicates which new standards will be developed. The timing for many of these standards projects has been chosen to complement the CNSC's regulatory framework plan and international standards work.

Development of our nuclear standards normally follows the establishment of a Canadian regulatory policy decision on a given topic. In our written submission you will note that we've indicated which projects rely on the establishment of a policy approach or an international alignment.

Our action plan calls for the development of five new standards.

One of these projects, which is on emergency management, has already begun and is running on schedule for a June 2014 publication.

Two others will begin this year and the remaining will start the following year.

In conclusion, we have completed the work needed to satisfy the identified CNSC recommendation and action. The work plan outlined in our submission to the CNSC shows how the CSA nuclear program has responded to the Fukushima event and how we plan to address identified issues and opportunities.

The CSA nuclear program has and will continue to work with all industry stakeholders as well as the CNSC to review its suite of standards against emerging changes to regulatory framework, lessons learned, technology and leading industry practice.

We welcome further dialogue on our submitted plan.

This concludes my presentation.

THE PRESIDENT: Thank you.

So I would like to open the floor for questions and we'll start with M. Tolgyesi.

MEMBRE TOLGYESI : Merci, Monsieur

le Président.

I have only one question, is that when you are looking, the CSA standards are establishing design, technical, operational specifications and framework, it will be for nuclear power plants and also for nuclear industry.

Should, would or will these standards consider all or provide guidelines also for some other subjects? Like we were discussing when it happened in Fukushima, was there evacuation, what conditions are and to what extent the evacuation zone radius is required?

Should it be a standard or should it be discussed in other forums or will these new standards include provisions or a request for a public relations or communication program and guidelines? What should be in it because when we are talking about standards, the standards serve as a measure for the public also, this should be done, or should these things be part of a policy or conditions of licence or it should be contained or anchored in a CSA standard?

MS CIANCHETTI: For the record, it's Mary Cianchetti.

I don't have the right answer for you. I can tell you that we discuss this all the time. We meet -- CNSC forms part of our Strategic Steering Committee and all of our committees, and when we discuss opportunities -- and we have a 10-year outlook plan of what documents we're going to work on -- we often discuss is this better in regulatory space, is this topic better covered within an industry document, and the answer is different for every topic.

But that debate comes up with every emerging opportunity. We have lists of opportunities and we prioritize what we're going to work on. Some, the CNSC feels is in their mandate and they would like to take the lead. Others, CSA goes first. There's no set way one way or the other.

MEMBER TOLGYESI: It goes to what extent there will be higher public acceptance of the conditions or situations when it's part of a standard or it is part of a licence?

MS CIANCHETTI: Yes. And normally a regulatory document will say what requirements are necessary for a licensee and the standard will describe: well, how can you meet that requirement.

It will provide further guidance on how to meet it.

I can tell you -- thank you, because Candace just informed me -- that some of the items you just brought up are being covered in our new standard on emergency management.

But, like I said, I think the division between regulation and standards, regulations says what needs to be done and a standard will tell you how to achieve that.

THE PRESIDENT: Do you want to talk?

MR. MOSES: Colin Moses, Director of the Regulatory Framework Division.

If I could just add, Ms Cianchetti is correct in that. The regulator, as a regulator we establish the general requirements that need to be met, but we rely heavily on the CSA Nuclear Standards Program to explain the specifics of how to meet those requirements.

We are actively involved in the work of the Nuclear Strategic Steering Committee in setting a general program direction for the Nuclear Standards Program and, as well, at each meeting provide a general update of the activities of the CNSC's own regulatory framework program and a key focus of that is ensuring that both programs complement each other and are well aligned.

THE PRESIDENT: Thank you. Ms Velshi...?

MEMBER VELSHI: Thank you, Mr. President.

In your Nuclear Strategic Steering Committee, is there any participation of people from outside Canada?

MS CIANCHETTI: No, there isn't. We do have international participation on our technical committees and the groups that draft the documents, but not on the Steering Committee.

MEMBER VELSHI: And I know in --

THE PRESIDENT: So how do you make sure that you harmonize with the international codes or standards?

MS CIANCHETTI: So we do have members heavily involved in the IAEA in the international world involved in WANO and other industry groups and we liaise with them.

We have a formal communication with the ISO world and what they are doing in nuclear. So we have liaisons, we just don't have an international person sitting on the Strategic Steering Committee itself.

Every time we develop a standard, the first thing we have to do is benchmark against what already exists in international work. So that's the first step before we begin drafting anything.

MEMBER VELSHI: And once you have a draft standard, does it go through some kind of a peer review where you may have folks from outside Canada review it?

MS CIANCHETTI: Sorry. Again, it's Mary Cianchetti, for the record. We do have a mandatory 60-day public review for every single document, open to anyone. Sometimes before we even get to that stage, we will send the document out for international peer review, but every document at minimum would have a 60-day, open to anyone, to public comment.

MEMBER VELSHI: Your standard development process is quite drawn out and earlier on we also heard that sometimes when reaching compliance with this could take a number of years.

So do you have something like an interim guidance document, you know, while you are developing a standard to provide some guidance to the power plants or whoever in industry that the standard is targeted to, as opposed to having to wait for six or seven years before there is any standard available?

MS CIANCHETTI: For the record, it's Mary Cianchetti. We don't. I think one of the big lessons learned from the Fire Protection Standard was that there wasn't enough communication between the work going on in CSA and industry and the public, that because it takes several years to develop a document or it can take up to two years for a new standard, people aren't aware of what we are doing within those two years and then the document is out.

And that we deemed was too late, we really had changed since 2007 to be more communicative, more open to -- we are now actually broadcasting we have documents out for review through the CNSC so we can get out to a larger audience space for more proactive and soliciting response, so people know what's out there.

I think industry also learned that when they put a representative on the committee that they need some kind of communication all the way up through management on what's going on so it's no surprise when the document is published.

MEMBER VELSHI: And with the lessons learned from Fukushima and the list of standards that you have come up with whether to revise or to develop new ones, as new learnings are made, has your list changed? Has your scope changed from 2011?

MS CIANCHETTI: Yes. We revisit -- we have a 10-year plan, but it's an evergreen plan. We revisit it every six months and constantly revise it. So the priorities -- 80 percent of the plan may stay there, but priorities will change and that's continuously changing.

MEMBER VELSHI: Thank you.

THE PRESIDENT: Thank you. Dr. McEwan...?

MEMBER McEWAN: Thank you, Mr. President.

I think I'm sort of following on from Mr. Tolgyesi. One of the things that struck me about Fukushima was the sense that there were gaps, real gaps in information transit and communications, both to the international community and also to the local community in Japan and the broader Japanese community.

Are those communications something that you can build into standards, the expectations of communications, the expectations of a rollout of information in the event of something like this?

MS SELLAR: Candace Sellar, for the record. The N1600 standard which is currently under development entitled: "General Requirements to Our Nuclear Emergency Management Programs" has two extensive sections, one on communications and one on public alerting and notification.

Both of those sections comprehensively address alerting during an incident as well as the continuation into the recovery phase, as well as prior to an incident education and notifying your surrounding communities and stakeholder bases on what your plans are and how they are going to be implemented. There is even pieces on communication regarding protective measures during an incident.

So the document isn't out yet, it will be out at the end of June, but you will find that it is -- there is a very good start in there.

Is it perfect? I don't know, but it's going to be a living document and a new edition is going to be under development almost right away to incorporate lessons learned, just even during the last year that have been coming out of Fukushima.

MEMBER McEWAN: So to go back to your earlier comment about communication, if I am a member of the general public in Pickering or in one of the areas around one of the plants, how do I learn that you have published a draft standard and how do I learn how and when I can communicate back to you on it?

MS CIANCHETTI: So we have recently at CSA established what we call interactive communities, they are online web spaces where we post everything we are currently -- so for the nuclear program we have a nuclear community, we post every document we are currently working on, we post every milestone.

So for each active project we let you know when public consultation will be, we let you know when a formal ballot and vote will be on the document and we let you know when it is going to be published. So to give people a heads up, because we work on over 25 -- 20 documents at a time -- on when they can comment and they can plan for that.

We then, through the CNSC's website, broadcast when a document is available for comment. You have a broader end user base than we do in nuclear and anyone who submits a comment, every single comment must be addressed by our technical communities.

So if you want to know what the response is of that committee to your comment, we will give that to them as well.

MS SELLAR: Candace Sellar, for the record. I would just like to add on to what Mary said, specifically with respect to the emergency management standard.

The utilities have, within their organizations -- and they have a different name for it within each group -- but basically a community liaison group. And at the time that we pushed the document out for public review, we did ask the utilities to get in touch with their stakeholder bases with which they communicate regularly out in the community and let them know that the document was out as well.

So that was an additional measure.

MEMBER McEWAN: And you had confirmation that they did that?

MS SELLAR: I can't say for sure whether or not they did. They were asked to do so.

MEMBER McEWAN: Because it seems to me that particularly the emergency response document is a really important document for the communities and there needs to be some active outreach.

A lot of what you have described is quite passive, I thought.

THE PRESIDENT: Go ahead.

MEMBER McDILL: Let me ask a specific follow-up. Have you received feedback from the communities in which -- for example, recently we have been hearing a lot of, "I don't know what the emergency plan is" communities. Have you received feedback from them?

MS SELLAR: Candace Sellar, for the record. We received a large amount of public review commentary from a variety of groups. We also have records of who accessed the documents but did not necessarily submit comments.

So, for example, there may have

been NGOs or certain individuals in the public who actually got online and read the document but didn't put in any feedback.

This is like information that traditionally CSA keeps confidential, it's just part of our process, but we do track these things and keep records of them.

MEMBER McDILL: Maybe I can ask staff if they follow up on that kind of -- I understand the need for -- I understand that there may be confidentially involved, I understand that NGOs in particular are likely to do something and probably the scientific technical communities will be active, but I don't know whether a community group that sits in a small community somewhere in Ontario or New Brunswick or maybe previously in Québec would try and access this.

MR. MOSES: Colin Moses, for the record. Maybe if I could just mention that Ms Cianchetti made reference to the CNSC subscriber list and, as part of our practice, we push out all public comments on CSA standards, referring them to the CSA website to access the draft standard. That subscription list includes over 2,600 individuals, which includes all active NGO community -- NGO groups, community associations, licensees, members of the media, public and so it reaches out to a very broad stakeholder group, though it is a passive reach-out. It's one of the ways that we try and promote the standards and ensure that they get a broad audience during a public review.

THE PRESIDENT: But the real questions is, could you get CELA to participate in N1600, right? You saw -- you were there when Pickering was there, you saw the large document that CELA put on the deficiency and emergency management. In fact, your standard N1600 was being advocated as the solution to all the problems.

So were you able to engage with some of those people to actually participate in developing a standard? The other thing is, OPG itself to develop some household, if you like, information base that will deal with, "I don't know what to do in case of an emergency," and I think they are working on one.

MS SELLAR: Candace Sellar, for the record. I can't comment necessarily on the OPG piece.

With respect to the CELA recommendations which I believe were presented at the August meeting of last year, those recommendations were brought forward to the technical committee that was drafting the standard. They treated it as though it was actually public commentary, so every recommendation was actually reviewed by the committee in its entirety and considered.

They read through it, they looked at the current draft to determine whether or not they felt they had adequately addressed the concern, if they needed more content. So they actually looked at each and every individual CELA recommendation that came in at that previous meeting and did disposition them and consider them in the development of the draft.

THE PRESIDENT: But NGOs cannot be members of this?   Can they become members of the steering committee or the working group?

MS SELLAR: Candace Sellar, for the record. Yes, they very much can. When we established N1600 we actually did active outreach to quite a few NGOs.

The response we received was they

would like to participate, however, the predominant response was because of financial considerations they weren't able to participate actively and they opted to participate through other means such as public review.

MR. MOSES: Maybe if I could just add -- Colin Moses, for the record -- CELA did provide feedback on the draft REGDOC that we had out for consultation that addresses emergency management and that was developed in concert with the CSA standard, so they are well aligned.

I don't know whether or not they commented on the CSA standard specifically, but I can tell you that OPG -- or Emergency Management Ontario hosted a stakeholder meeting involving the CNSC as well as other OPG and Bruce and other organizations involved in emergency management and specifically invited both CELA and Greenpeace to deliver presentations very similar to what were delivered to the Commission so that they could receive that feedback directly.

MS CIANCHETTI: Just for the record, if I may, it's Mary Cianchetti. NGOs can participate on CSA committees, they are welcome to.

The nature of the standards development is that you volunteer time to develop the draft and I think that's where it becomes hard sometimes for these groups to participate. As long as they can show that they understand the technology, they are an expert in the field and they are willing to sit around the committee table, they are welcome.

THE PRESIDENT: You're sure it's not a perception that if you are party to developing the standard you cannot then shoot at it later on?

--- Laughter / Rires

MS CIANCHETTI: One of the reasons why I think our public review is confidential is so that anyone is free and welcome to make a comment without worry, and that's part of the reason we do keep it confidential. So even if you did sit around the table and help participate in the development, you are still free to submit a public review comment and the technical committee has to address it.

THE PRESIDENT: Dr. McEwan...?

MEMBER McEWAN: Sorry, can I go back to this communication with the wider public.

If I walked through a community that is host to a power plant and knocked on every door, how many people would know that you had released draft standards?

MS CIANCHETTI: For the record, Mary Cianchetti. I couldn't answer that. CSA is unique in that we cover 57 different technology areas, not just nuclear, so it's very hard for us to broadcast to all these different groups.

We are well known for hockey helmets because it's very well known in Canada on your helmet, but not for much else, or safety footwear.

We are trying to be more transparent, but I do recognize that within nuclear it is not well known that CSA has been developing standards for 30 years in this area. That's where we are trying to work with the CNSC to up the profile and be more transparent, but it is a work in progress and I understand that it is not where it should be at the moment.

MR. MOSES: And just to add, I don't think we should underestimate the reach of our subscriber list, it does include all the stakeholders who actively participate in the

Commission meetings, for example, so those interested stakeholders, so those who have a voice and are interested in participating in the process.

And we follow a very similar process for our regulatory documents and do receive valuable input.

THE PRESIDENT: But there is also, I understand, an outreach requirement for the question to Dr. McEwan is: the licensee has an obligation to actually make sure that every household knows what's involved on this particular subject.

Somebody is raising their hand.

MR. SHIN: Yes. For the record, Ted Shin of the Regulatory Framework Division. I work with Colin Moses and Brian Torrie.

We are discussing communications in general. One of the action items from the Fukushima Task Force Recommendations was the development of RD/GD and the publication of RD/GD-99.3, which is for public information disclosure programs.

And it should be mentioned that that document was published last year or the year before and it has been issued. It provides requirements for a public information disclosure for licensees, taking your point, and I believe now it is a licence condition for the various nuclear power plants.

So that is one of the projects that has been on the go for several years now, but it was identified as being an important element of the Fukushima Task Force Recommendations, that public information be put out there for the licensees and for the public.

THE PRESIDENT: Dr. McDill...? Okay. Dr. Barriault...?

MEMBER BARRIAULT: Thank you, Mr. Chairman, all my questions have been answered. That's the beauty of being last, thank you.

--- Laughter / Rires

THE PRESIDENT: Thank you. Well, first of all, I would like in many ways to thank you. You are doing a lot of good work that I think is really helpful to the regulatory activities.

I was just wondering, in your list of projects that you are doing here we talked about emergency planning. There was another subject that really got a lot of attention at Pickering and that was probability safety analysis.

Are you working on this? When are you likely to -- and are you going to look at the so-called new requirement to do site-specific probabilistic safety analysis?

MS CIANCHETTI: John, do you have anything to add to that one?

MR. FROATS: Yes, John Froats, for the record. Currently all the licensee sites are required to do a probabilistic risk assessment. I think part of RD-310 and certainly part of RD-337, so I believe that is already addressed in the area of the extent of the site-specific analysis.

The requirement to do a review and update of external conditions around the plant, you know, traditionally the changes of environment are already addressed in regulatory documents with a frequency of update I think currently at every three years. I think there is discussion to move Canada to an every five-year cycle and typically internationally that is done as part of the periodic safety review which has a 10-year cycle.

So I believe that Canada stands

very well when compared internationally and the focus of our work currently is to look at what the appropriate set of work is for -- some countries use jargon 'design extension conditions', some countries use jargon, you know, 'beyond design basis conditions', that will certainly be one of the things that will be discussed at the Convention on Nuclear Safety that comes up in March and April.

And one of the projects that is on the list for CSA is to progress that once the international and regulatory direction on the requirement for that is put forward.

THE PRESIDENT: Mr. Froats, I wasn't actually asking about all the things you just enumerated, but most of the PRAs that are being done are done with single plant. The big issue that came in was, that doesn't take into account the Fukushima-type multiple plants in one site. And I discovered, to my surprise, that the industry has not done a lot of work in this particular area.

I hear some of our staff raising their hand.

MR. FRAPPIER: Yes, Gerry

Frappier, Director General of Assessment and Analysis.

So, as you mentioned, I would say a couple of things. One is, the PSA or Probabilistic Risk Assessment, Probabilistic Safety Assessment, same words, are taking a lot of attention right now, both from ourselves as regulators, but also from industry in two fronts.

One is, as a regulator that requires PSAs to be done at all sites through our regulations, in our regulatory documents, industry has noticed that there is a need for a little bit more detail on how some of these are done. Some of them can be quite new and innovative requirements that the industry has different approaches to analyzing and they are trying to pull all that together into a CSA standard that would allow everybody to use common methodologies.

There is also going to be -- whether it is going to be in the standard -- the first edition or perhaps a follow-on edition, all the work that we are doing right now, both internationally and between ourselves and industry to address the issue that you are talking about, which is the site that has multiple reactors on it, how should a PRA/PSA address that problem.

So those are early days though with respect to exactly getting the confidence to put that methodology into a standard, but eventually that's where we would want it to be going and we are working with industry in that direction.

THE PRESIDENT: So just so I understand, so you are planning to use the CSA process to eventually get up with methodology?

MR. FRAPPIER: Correct. So as was stated earlier, from a regulatory perspective, we have some strong regulatory documents that say what we want to have achieved, what we need now is a stronger set of standards to say how to reach that.

THE PRESIDENT: Okay, thank you. I have two quick other questions.

On your interim dry storage, one of the issues that has come up is, is there a definitive number like seven years, 10 years. Is that issue going to be addressed or is that too detailed; how long, you know, you keep the fuel in the pool?

MS CIANCHETTI: For the record, it

is Mary Cianchetti. I don't have -- that actually has been published, so I could get that information for you. I don't have at the moment.

THE PRESIDENT: Okay. So I wasn't aware it had already been published.

And I think when we mentioned the remediation return, you know, like post -- the Japanese are really struggling about when is it safe to go back to the community, you know, the 1 mSv versus 20 mSv. Are you working with Health Canada on this?

MS SELLAR: Candace Sellar, for the record. The N1600 addresses recovery, it's at a pretty high level at this point. It does discuss establishing a process for determining endpoints and returning people back to their communities. It is not prescriptive in the baseline numbers.

THE PRESIDENT: Isn't your N288.2, is that not --

MS SELLAR: The N288.2, that's currently under development, it's out for public review right now. I'm not certain exactly what it says with respect to that particular issue. We can look into it and get you a response with respect to that though.

THE PRESIDENT: Fine.

MS SELLAR: Well, it's on modelling. I really can't answer that right now, I would have to pull up a copy of the recent draft and dig down into the weeds for you.

MR. MOSES: Colin Moses, if I could just add. I believe that standard is focused on the calculation of the potential doses from airborne releases, so I don't know that it would speak to sort of acceptable limits on those doses, but rather how to gauge following a release what the potential doses might be to the public.

THE PRESIDENT: It would be strange I thought if you were calculating and you don't explain the meaning of the impact, so what.

Okay. I will leave it up to...

The last question is on N290.5. Is that also something that will deal with off-site assets in case of an emergency?

MR. MOSES: Colin Moses, maybe if I can answer. I believe that is focused on design basis equipment, so I don't know that it would touch on the off-site.

But there is a CSA standard that

was just approved by the Nuclear Strategic Steering Committee to look at beyond design basis accidents and that may touch on some of that, the off-site equipment and the other supporting equipment for those types of events.

MS CIANCHETTI: Mary Cianchetti, for the record. I can confirm that too.

THE PRESIDENT: Do you want to add anything to this?

MR. FRAPPIER: Gerry Frappier. I was just going to mention that, yes, it is going to take a look at those. It is going to look at both the qualification and the analysis rules that need to be used, or should be used for various types of equipment that are going to be used -- or that are needed for beyond design based accident mitigation, including the off-site ones.

THE PRESIDENT: Well, I was just trying on my little hot files post-Fukushima that I sort of remember coming to a head all the time in every hearing that we are dealing with.

Anybody else have any -- well, okay. Any final words?

MS CIANCHETTI: No, I just think -- I just want to reiterate that, you know, we do look at this every six months. Our plans do change, we look outwards 10 years and with certainty we know it's going to happen in the next two and the next three, but it's constantly evolving and as new lessons learned, and I believe they will continue to come out of the Fukushima that will affect our programming.

We work very closely with the CNSC to make sure we are aligned with the regulatory framework and that what we do is complementary and that we are now both working at cross purposes.

So I thank you for your co-operation.

THE PRESIDENT: Okay, thank you. Thank you very much. We are going to break for 15 minutes.

--- Upon recessing at 3:40 p.m. /
Suspension à 15 h 40

--- Upon resuming at 4:02 p.m. /
Reprise à 16 h 02

THE PRESIDENT: The next item on the Agenda is a presentation by CNSC staff on the Evolution of Nuclear Reactor Technologies as outlined in CMD 14-M8 and we have in attendance Mr. Soulard --

MR. SOULARD: Yes, very good.

THE PRESIDENT: -- from CANDU Energy Inc. and we have also the staff who will make the presentation.

We also have Mr. Lee from CANDU Energy online. Can you hear us?

MR. LEE: Yes, I can hear you.

THE PRESIDENT: Okay, thank you. So I understand that Ms Tadros will make the presentation.

MS TADROS: That's correct, sir.

THE PRESIDENT: Please continue.

14-M8

Oral presentation by CNSC staff

MS TADROS: Thank you. So good afternoon, Mr. Chair, Members of the Commission.

My name is Haidy Tadros, I am the Acting Director General of the Directorate of Regulatory Improvement and Major Projects Management. With me today are Doug Miller, Acting Director of the New Major Facilities Licensing Division and Marcel de Vos of the same division.

Behind us and supporting us are

Gerry Frappier, Director General of Assessment and Analysis and Robert Rulko, Director of Assessment Integration Division.

The purpose of our presentation today is to provide information on three topics with evolving technologies as a common theme and to answer any questions you might have.

This slide identifies our proposed outline for the presentation today. You will note again that the presentation is composed of three parts. The first part provides an overview of evolving technologies; the second part focuses on small modular reactors, what they are and what this means to regulation; and, finally, the last part provides an update on the CNSC's pre-licensing vendor design reviews.

This last part is a follow-up to CMD 10-M14 presented to you in 2010. As per the outline, we propose to take questions at the end of each part as the presentation as a whole is quite lengthy and a break is a natural transition from one part to the next.

So with your permission, I would like to pass the microphone on to Doug who will walk us through the first part.

MR. MILLER: Thank you very much, Ms Tadros. For the record, my name is Doug Miller and I represent the New Major Facilities Licensing Division.

So in the first part of this presentation I would like to take the next half-hour -- it might be a little bit more than that -- to explain how reactor technologies have evolved since their inception in the 1950s.

We will then bring some of his higher-level information back into the Canadian context, not only in view of new build, but also in view of the existing Canadian fleet of nuclear plants.

The last part of this will turn our attention to the future, to the types of reactors on the horizon typically referred to as Generation IV reactors.

The first part of this trilogy serves to provide you with some information that will be useful in parts two and three of the presentation. So you may have heard at times generations of technology, so for the first part of this presentation I would like to walk you through a story to clarify what Generations I, II, III and IV are and what they mean.

Broadly speaking, Generations is an industry term used to describe vintages of reactor technologies. We will discuss each generation in turn and give you an idea of why it emerged and what informed its thinking at the time.

As we go through the presentation, I would like you to keep the following in mind. Reactors have been evolving over 60 years and will continue to evolve. Older generations designs still in operation have proved themselves to be safe and they have been upgraded over time to safety levels comparable to those found in new build designs.

The newer designs themselves integrate lessons learned from existing designs, whether they be safety or performance improvements. So starting with the first nuclear power plant starting in the 1950s, these are commonly understood to be Generation I plants, so the early days.

It was a period of experimentation with many different ways to achieve and control efficient chain reaction. Many were being designed to produce power, electricity, because of the large amount of energy contained in a very compact fuel. The early designs produced power on a small scale between 50 and 300 MW electrical. Proof of concept was the main goal and economics was a secondary consideration.

Research efforts focused on producing concepts that worked with the state-of-the-art at the time; i.e. knowledge of materials.

These first plants had inherent safety features and they were being considered where possible for design. However, what you will see when we come back to the Generation IV discussion is that many concepts were ahead of their time and could not go forward because of materials limitations or lack of analytical tools.

So there is a bit of a back-to-the-future theme here.

Most of the light water fleets plants around the world can trace their ancestry back to the first US and French light water designs. So at the time the development was based on domestic capabilities.

So in the UK there was the gas

cooled Magnox reactors; in Canada they went towards the development of pressurized heavy water reactors with our abundant natural uranium in Canada; in the US they focused on pressurized water reactors, both land and marine-based, boiling water reactors for land-based and the research continued into the 1980s on gas cooled, liquid metal and molten salt reactors.

In the USSR they focused on light water cooled graphite moderated reactors, pressurized water reactors, marine-based, and liquid metal reactors, and there was also a boiling water reactor variant.

These champions set the stage for evolving technologies in each country. So, just for illustration, there are a couple of first-generation designs in Canada was the nuclear powered demonstration reactor up in Rolphton and it operated from 1962 to 1987. It was a small reactor, 22 MW electric. You can see there the traditional field channels and feeder pipes.

Douglas Point was built just after that, operated from 1968 to 1984, and 10 times bigger, so a scale up, 220 MW electrical and it's the forerunner of the current fleet of CANDU-type reactors in India.

Other reactors is the Calder Hall Magnox reactor in the UK and decommissioning is in progress. It ran for quite a long time, 47 years, four units at 60 MW each, so they are relatively small by today's standards.

And the drawing on the right is the early boiling water reactor, the Dresden reactor, and it is in a safe storage state. It is one of the first boiling water reactors.

Safety was originally built into these designs. Safety features were being engineered into the designs, but operating experience was in its infancy around the world. How you could say that over engineering was common in the face of uncertainties, they knew the technology was a challenge and they provided appropriate engineering.

The early designs were also being informed by earliest incidents and prototypes such as NRX where there was lots of reactivity, a fire at Winscale and in SL-1 in the U.S. an improper withdrawal of control rod.

It was recognized that defence in depth was important, but it was an early concept that had focused on the layers of physical barriers to protect failures.

Okay. Some of the first-generation plants are indeed still in operation around the world, they are subject to the same safety security, safety scrutiny, including post-Fukushima as any of the other operating plants in the global field. They need to continually demonstrate safety and adapt the design to changing conditions and safety requirements.

And, for example, there is Atucha 1 that started operation in 1974 and is still operating and it's a pressurized heavy water reactor developed by Siemens. And we will talk a little bit more about post-Fukushima improvements later.

The message here is even old plants have been updated and can still operate and meet modern-day safety requirements.

Moving along, then there was the initiative to commercialize nuclear power plants and that's the 1960s to today. These are commonly understood to be the Generation II plants, so these are the larger plants and there's been --

it's the majority of the 300, 400-plus that are in operation around the world.

So at the request of large utilities that existed at the time, power production economics became the major consideration for operation. Bigger is better, but its lower electricity cost or electricity price.

The champion designs that we talked about in each country were scaled up to produce power on a bigger scale and to take advantage of economies of scale for power production. The focus was on optimizing the first-generation designs based on the lessons learned from operation of those facilities, hence; i.e., in CANDUs with the separation of safety and process systems in two separate shutdown systems was recognized early in the early CANDU designs.

There were stronger and lasting materials in the face of degradation factors, improving the fuel, better neutron economy, improvements to safety system reliability, improving operability and maintainability while reducing dose and to continue to evolve defence in depth.

Examples of these -- of two CANDU plants are depicted here. On the left is the Point Lepreau Generating Station and it is an example of a stand-alone CANDU 6, 635 MW. This design has also been successfully built and operated in China, Korea, Argentina, Romania.

On the right is Darlington. It is an example of the multi-unit CANDU 900 series and, as you know, there are three four-unit stations operating at two sites in Ontario, so that's Darlington, Pickering and Bruce.

Despite architectural differences, these designs are descendants of the NPP and Douglas Point reactors and have incorporated decades of lessons learned.

All Canadian power plants have evolved to have a safety comparable to the Generation III designs that we will talk about in a little bit, and we will come back to that illustration with some discussion on the CANDU fleet.

This kind of evolution and designs has happened in other countries. Speaking of other countries, looking at other parts of the world we have selected two plants out of the global fleet. The first example on the left is the Borssele plant in the Netherlands. It is the Netherlands only large NPP and has been in service since 1973.

What is worth noting is that it has been through a full periodic safety review and has undergone significant upgrades that make it comparable to a Generation III plant. It is licensed to operate until 2033.

In the second example on the right we show the turbine Hall for the Three Mile Island Unit 1. TMI is an example of applied lessons learned from the Three Mile Island 2 unit next door, as well as the Chernobyl accident. It is also an example of the evolution of materials, knowledge and maintenance optimization.

There has been significant upgrades to the facility that has been performed near the end of its 40-year licence term and the unit was granted a licence extension by the U.S.NRC to operate to 2034.

So now we come to near-term new reactor designs that have started in the 1990s. These are commonly understood to be Generation III plants and there are three distinct types that are performing, which is the very large plants, that's 1100 MW and higher, and the French EPR might be one of the largest at 1650 MW for developed countries with bulk grids. So you need the grid capacity to handle such a large reactor.

Medium-size designed, the 500 to 900 MW range still have a place in countries that could not support the large designs and discussions beginning on the designs to address smaller developing grids 300 MW.

So, once again, there is a wide range of technologies. Okay.

So the focus was on optimizing the second-generation designs based on lessons learned from operation of Generation I and II reactors.

The improvements made to existing plants are now being integrated into the basic design of new plants; i.e. -- there are a couple of examples, containment venting and hydrogen mitigation, practical elimination of severe accidents is a goal.

The core damage frequency and large release frequency, which are design metrics, are set an order of magnitude lower than in the Generation II plants and there is greater use of passive safety features where you require no external power or even operator action to perform its mission to safely shut down the reactor and keep the fuel cool.

And these Generation III plants are being built now. We will come to that in a little bit.

So examples of the Generation III CANDU reactors are shown here. There is the enhanced CANDU 6 and the advanced CANDU reactor ACR 1000. The CNSC has completed full vendor design reviews on these two next-generation CANDU designs. Both of these designs were targeted to different types of markets, which I'm sure CANDU Energy could speak to. Both designs have different operational approaches to address their potential customer needs and, as a result, they apply different safety approaches based on their operational characteristics. In the end both sets of approaches can result in the same long-term operation.

Speaking specifically to the enhanced CANDU 6, it remains in the detailed design phase and represents the next step in CANDU 6 evolution. Upgrades were made to the existing fleet of CANDUs and have been built into this design while retaining many of the safety features of the existing design.

Examples of this are heavier pressure tubes or thicker pressure tubes, modernized digital instrumentation and control and updated reactor core control.

To continue with a brief discussion of Generation III designs, a summary is presented here. So there is the EPR reactor that is being developed in France. That is a very large reactor and it is under construction in Finland, France and China.

The AP 1000 and its cousin, the CAP 1000 in China is an 1100 MW reactor, it is under construction in the U.S. and China. Russia has evolved their pressurized water reactor technology into the VVER 1200 and is under construction in Russia, India, China and Bangladesh. Korea has taken their version of the PWR and is under construction in Korea and United Arab Emirates, and then there is the advanced boiling water reactor in Japan is under construction in Taiwan.

Okay. So that's a bit of an

overview of Generation I through III. And a theme in this that we are hoping to illustrate is that there is continuous improvement and learning from major accidents.

So over the decades of plant operation there has been continuous improvement in the safety of CANDU reactors. This has been achieved through licensees operating experience, sharing programs and self-assessments, industry peer reviews, ongoing CNSC regulatory oversight, integrated safety reviews supporting facility return-to-service and life extension projects and addressing lessons learned from major accidents.

We will touch on each of these in this next section. Now, in particular with regards to OPEX, the existing fleet around the world had been heavily affected by three major accidents, unfortunately; is TMI, Chernobyl and Fukushima. Three Mile Island in 1979 and Chernobyl in 1986 all but stopped new build dead in its tracks around the world and forced existing plants to reinforce key safety principles throughout their organizations. These principles continue to dominate the discussions today.

These accidents introduced

concepts such as safety goals, probabilistic safety analysis, periodic safety review and also brought stronger discipline to the defence in depth approach. They resulted in a global discussion on new terminology called safety culture that is developed into a host of industry and regulatory concepts and tools used to this day. Human factors has become a major component of the safety discussion affecting everything from control room and field design to training programs and fitness for duty considerations.

Fukushima in 2011 showed the need to pay even more attention to extreme external events, the need to assume the worst will happen and discuss what mitigation measures are available or needed. Multiple-unit sites need to consider simultaneous multiple-unit accidents involving major fuel damage, the need to reinforce the existing practice of periodically and systematically reviewing the plant safety case while asking tough questions has become apparent, and through this existing plants continue to evolve over their lifespan.

Okay. There is continuous improvement and a key part of this, as well as improvements in industry, is the evolving regulatory requirements and guidance. Since the onset of Canadian nuclear industry, nuclear research in the 1940s, the regulatory involvement in industry has evolved over time. In particular, with the CNSC regulatory framework we focused on assuring requirements and guidance take into account operating experience, ongoing research and development, industry best practices and lessons learned from accidents. We try to ensure that they are as technology neutral as possible and are being developed to anticipate new technologies and approaches to the extent possible and can be applied in a risk-informed manner.

The philosophy behind our regulatory requirements at high-level requirements are principles-based, are performance-based and they can apply to any technology, although currently written based on experience for water cooled reactors, lower-level requirements such as the CSA standards that you have just heard about, lean towards water cooled technologies but are useful in regulatory discussions around other technologies. However, it is important to note, the more novel the technology, the more the design will need to be proven through R&D efforts.

That's a lead-in just to keep it in mind for Generation IV discussions.

The requirements and guidance that we are talking about, as in our current regulatory framework, are not only used for new build, but also used in assessment supporting facility refurbishment where licensees analyze and address potential gaps between plants' existing status and modern requirements.

Now, the licensees are doing their part. They have programs to conduct self-assessments and peer reviews and share and review operational experience. And, in fact, some of the incidents that we have talked about have led to development of organizations like The World Association of Nuclear Operators and the Institute of Nuclear Power Operators and those organizations perform peer reviews of the licensees where, in some ways, it is, I would say self-regulated, but there is certainly extensive peer pressure on the licensees to improve without having the regulator come in. It is a very effective process.

Another aspect in Canada of continuous improvement is license renewals where the licensees take stock of their past performance and look forward over their next operating cycle and beyond. As part of the licence renewal process, the CNSC assesses licensee past performance in a systematic manner evaluates their improvement plans over the proposed operating period and also discusses implementation of new regulatory documents, industry codes and standards.

Through the work of the licensee and the CNSC, there is a comprehensive update of the licensing basis of the facility.

So while the industry is -- and the licensees are assessing their safety case and proposing improvements and making improvements, the CNSC has ongoing regulatory oversight to maintain an open dialogue with licensees and, as part of this, we have a comprehensive compliance program which includes well-structured baseline compliance program of inspections and desktop reviews, on-site surveillance and monitoring and requirements for regular reporting and event reporting.

Taken together, this provides a very solid regulatory oversight regime, and that's complemented by the very healthy safety culture by the licensees in carrying out self-assessments and peer reviews.

All this contributes towards continuous improvement.

Continuous improvement in the CANDU fleet safety has also been driven through life extension projects.

CNSC Regulatory Document RD-360, "Life Extension of Nuclear Power Plants", sets requirements for life extension. The underlying principles of RD-360 are, is the right work being done in view of the proposed extended operating life and is that work being done properly.

So the main tool that's used in RD-360 to address those two questions, in particular is the right work being done, is an integrated safety review, and that identifies the improvements to be made to resolve safety issues, to address gaps identified through the comparison of requirements in place at the time of plant construction with current requirements, assessed the adequacy of the arrangements that are in place to maintain plant safety for long-term operation.

As a result, the ISR process can

validate the existing plant safety features and programs and result in some changes to plant systems and programs to improve safety. So it's a systematic, comprehensive review. It's quite a large review, but it can be very effective in indicating areas for improvement.

Safety-related improvements planned and implemented for life extension are changes have been made to existing plant systems to supply water to support cooling of the fuel during events such as in Bruce with the moderator makeup. Upgrades to containment-filtered venting systems. Improvements to hydrogen mitigation, which is hydrogen recombiners. And also, there's been improvements to severe accident management strategies, processes and components.

We've alluded to improvements from the Fukushima lessons learned and, in particular, the Canadian industry has been very active in implementing the actions from the CNSC's post-Fukushima action plan.

So the CNSC action plan addresses the requirements to be taken by licensees to handle severe accidents, has improved the capabilities to withstand prolonged loss of power and heat sinks, improved the response to containment challenges and performance.

There is provision of additional emergency mitigating equipment and resources. And there's also automated real-time station boundary radiation monitoring systems.

Taken together with the OPEX sharing of information, lessons learned from accidents, our regulatory oversight, evolution of the regulatory framework and lessons learned, life extension programs, and activities such as the post-Fukushima safety improvements, Canadian power plants are comparable in safety to third generation designs.

There's been tremendous effort over the decades to improve safety, and you heard about one today with fire protection improvements at Point Lepreau. That's one example of many.

Now for something a little bit different. Now we'll turn our attention to long-term new reactor designs, some that are under development now.

There are many vendor initiatives in progress around the world, but they all have the same goals. These are actually referred to as

Generation IV Series plants, and their implementation horizon is longer than that for the Generation III plants.

The goals for these Generation IV reactors is improved safety and reliability, so a larger push for passive and inherent safety features wherever possible, eliminating reactor core damage also where possible, and reducing or even eliminating the need for off-site emergency response.

So in this case, if there's an issue with the reactor, it shuts down safely and stays shut down.

For sustainability, it's to get more efficiency out of the fuel using -- or using alternative fuels such as thorium. They're looking at minimizing nuclear waste and reducing the long-term stewardship burden.

There's also, of course, the focus on economics to have a life cycle cost advantage over other energy sources and to have a level of financial risk comparable to other energy projects, so I might be simplifying the design. And also, of course, proliferation resistance and physical protection is to make that as safe as possible.

What stands out, though, when you look at the Generation IV technologies, these emerging technologies, is that this generation of reactors are proposed to operate under conditions quite different than those for the traditional water-cooled reactors. And we'll get into that in a minute.

Really, as alluded to earlier, what's old is new again. The Generation I reactors, some of the initial experimentation looks very similar to what's being proposed today.

All of them had some advantages over the existing designs. By the time of development, they also had technological challenges.

Advances in analysis methods and material sciences means that these designs are becoming more achievable now.

What these -- what makes these designs different is that they propose different fuel types, whether liquid-based or pebble-based fuels, or even new fuel types like thorium.

They also take advantage of different reactor configurations such as graphite moderator or even no moderator at all in the case of a fast reactor.

There are also different ways to cool the core. Instead of water, you can use liquid metals like sodium or lead, or even gases like helium, nitrogen or carbon dioxide.

What we would like you to take away from this is that each technology does have its challenges and all innovative features need to be proven. Every one of these designs has to be well supported by an R&D program and, in many cases -- although in many cases there is also a fair amount of operating experience with the early prototypes that they can build on.

A specific initiative is the Generation IV International Forum. It's one of the largest international government and research-based efforts in the world to address evolving technologies.

The Forum is composed of a number of IAEA member states, so selected six reactor technologies for long-term intensive R&D efforts.

The types of technologies are the gas-cooled fast reactor, a lead-cooled fast reactor, molten salt reactor, sodium-cooled fast reactor, supercritical water-cooled reactor and also a very high temperature reactor.

All these efforts are contributing to a greater knowledge into materials behaviour and degradation effects in more aggressive reactor environments.

The next couple of slides provide a little bit of detailed information on the specific technologies, but they show the kinds of designs being proposed and the conditions that will likely exist for their operation.

For example, with gas-cooled reactors, you are operating with helium at very high temperatures compared to what we are used to in conventional plants.

On the other hand, with a lead-cooled reactor, coolant temperatures are also very high, but the coolant pressure is at atmospheric pressure instead of the nine to 15 mega Pascal range of a water-cooled design.

You may also note that very high temperature reactors can lend themselves to alternative uses such as hydrogen production and also, in the table, you can see that there's small reactors in the 20 to 180-watt -- 12o to 180 megawatt range that's almost like a nuclear battery.

What is also important to note is that some of these designs are intended to be large, while some might be better suited as small plants.

Mr. Marcel de Vos on my right here will discuss a bit more of this in Part 2 on small modular reactors.

As an example of the Generation IV reactors, we present three different types of lead-cooled designs. It's being looked at closely by many countries right now because the design has a number of major advantages once you get past chemistry and erosion issues in the material. So if you can improve the materials, then the reactor is operable.

Lead has a very high boiling point of 1,745 degrees Celsius, so will remain liquid even if the fuel temperature gets high. This means that cooling will be maintained.

A reactor can be run at higher temperatures. That means that plant efficiency will be higher and you get very high steam quality or heat that can be used for processes that conventional reactors cannot.

As I mentioned earlier, these reactors run at atmospheric pressure, which means pressure-based accidents can be eliminated. If the pressure vessel does leak, the coolant will freeze and plug the leak.

Lead does not react with air and does not help or interfere significant with the reaction. But using lead coolant means you need the right materials and chemistry conditions in the core to protect against corrosion and flow-induced erosion.

There are three designs being proposed for near-term construction. In Russia, there is the SVBR-100, which is a small modular reactor which will be the first of the kind for a future fleet.

In Romania, there is an advanced Lead Fast Reactor European Demonstrator, or the nice acronym ALFRED, which will be a prototype for larger production design.

And in Belgium, there is the MYRRHA accelerator-driven research reactor, which is also a proof of concept design that will double as a research reactor.

So there's an awful lot of innovation out there.

So in conclusion to Part 1, safety is deeply rooted in the Canadian regulatory framework. Lessons learned are continually being implemented by industry. Reactors have been evolving for over 60 years now and will continue to evolve.

Each generation has seen significant improvements in performance and safety over the previous generation.

Older generation designs still in operation have been upgraded to safety levels comparable to those found in new build designs. The Canadian regulatory framework itself has evolved with the state of the art and continuing efforts by the CNSC to keep the regulatory framework flexible and technology neutral is looking towards the future.

And that concludes Part 1, and I'd like to turn it -- oh, we're going to have questions before we go --

THE PRESIDENT: Oh, yes.

MR. MILLER: -- to the next part.

--- Laughter / Rires

THE PRESIDENT: Okay. I think it's an open forum here. Who wants to jump in, or do you want me to go through a list here?

Dr. Barriault.

MEMBER BARRIAULT: Just a quick question. How long before we see thorium being used as fuel in the reactors? Because the CANDU-6 apparently can be converted.

Any idea?

MR. MILLER: I think we'd like to ask CANDU that.

MR. SOULARD: Mike Soulard from CANDU Energy.

We're working with the Chinese right now on the fuel cycles that we've just -- are implementing. Not we, but the Chinese are implementing what will be called a natural uranium equivalent fuel, which is a mix of recycled uranium that mimics natural uranium neutronic characteristics. And that's been essentially done.

The next step for the Chinese is to then move up the fuel cycle curve, so to speak, and start looking at further levels of enrichment with recycled uranium with the intention of going up to thorium.

The time frame if you look at sort of the marketing discussions that are happening is sort of the 10 to 15, 20 year for the thorium.

I think we've got to move up to the next -- the RU fuel cycle over the next five to 10 years and then use those lessons learned before you jump into thorium.

Having said that, we're also working with the UK at this point in time on the initiative to disposition their plute, so we'll be burning MOX fuel in the CANMOX.

So it's not thorium, but it's a different animal from a fuel cycle -- a spent fuel cycle perspective, and so this reflects some of the adaptations that the CANDU design can accommodate.

Thank you.

MEMBER BARRIAULT: Thank you.

Thank you, Mr. Chairman. I'll move on.

THE PRESIDENT: Ms Velshi.

MEMBER VELSHI: Thank you. I've got a few fairly short questions.

Whether a reactor is a GEN II or a

Generation III, is that -- is there subjectivity or is it fairly clear-cut?

It's just that I've heard some called Generation II and some say they're Generation III.

MR. MILLER: It's a marketing term. It's subjective. It's more or less related to the vintage or era that the plant was being built.

What we were hoping to show is that what's -- can be referred to as a Generation II plant such as the currently operating CANDUs that were built in the sixties have all been upgraded so they're comparable to the -- quite comparable to the reactors that are being designed and constructed now through the various industry and regulatory initiatives.

THE PRESIDENT: There's -- the reason this comes up all the time in conversation is there is a public perception, right, that old is not as safe as new. And that's the issue here all the time.

When you keep talking about upgrading, you're talking about upgrading so to make sure that the safety is maintained. Let me put it that way.

That really doesn't come across in many of the discussions, is the difference between a II and a III or a I and a II and a III.

MR. MILLER: I think that's the story we're trying to tell, is that notwithstanding when the plant was originally built, there's continuous improvement looking at the modern operating experience that all leads to significant upgrades in the plant design and learning lessons on the performance side.

So if there was anything that we could say is plants that are in operation that are licensed meet the current regulatory requirements.

THE PRESIDENT: Mr. Jammal.

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

You're making a very good point. As Dr. Miller mentioned, it's the GEN labelling is more of a marketing issue. However, as we see from the intervention coming before the Commission all the time is the capitalizing on the time it was constructed or trying to fit it into a label.

The key point is probably we're not doing a good job to say the equivalents of safety, what it means. And that's where we will have to be much more less technical in our discussion and to be putting efforts on the messaging because safety is what counts at the end.

And it was mentioned with respect to the life extension. We are always, and Canada and the CNSC is one of the very few regulators that is always looking at approaching new requirements and new technology equivalent to the most recent generation.

But the key point here is the safety and the capacity for it to operate safely and shut down when it needs to shut down.

So all the life extension refurbishment, the integrated safety reviews, which result in integrated improvement plan, is approaching and comparable to the newest technology and newest standards that exist.

THE PRESIDENT: Ms Velshi?

MEMBER VELSHI: Thank you.

I saw the movie "Pandora's Paradox", and so many of the folks who have converted to becoming proponents of nuclear power, what they were really promoting is, I guess, Generation IV reactors.

And I know in one of your slides you say, you know, some of these -- the deployment of this is probably imminent in some of these European countries, but are we likely to see that in the near future, in the next decade, or is it going -- is that something -- like is this 20 years or 30 years away that we may see it?

MR. de VOS: Marcel de Vos, for the record.

Actually, in some countries, these are currently being constructed. In Russia right now, there's a sodium-cooled design. It's about 800 and something megawatts being built at this point in time.

In other countries, it could be coming within the next decade. And then you have other countries, again, that it could be 20, 25 years. It depends on their energy policies, the whole direction they want to go on nuclear.

MEMBER VELSHI: But with the Russian reactor, then, maybe in a few years' time people will see it really is delivering on all these promises and maybe then there will be a greater appetite for it because I wonder -- you know, we just recently heard about SMRs, and I know you're going to come back into that later, that there is some withdrawal from pursuing that because there just isn't the market for it.

And I just wondered whether the Generation IV reactors make all that same route as well.

MR. de VOS: Marcel de Vos, for the record.

I think that's ultimately a business decision that each of the vendors has to make. There's a market out there, and how they choose about competing for it is up to them.

MEMBER VELSHI: So shifting gears, on the CNSC's position of being technology neutral in your requirements, is there a downside in doing that? You know, I'm wondering if there is ever.

Do your requirements become too generic and vanilla just because it's not technology specific?

MR. MILLER: There is a challenge in making requirements technology specific, or technology neutral, but it certainly makes you challenge yourself on do you have your requirements at the right level considering we take a bit of a performance-based approach.

In this, this is where groups like the CSA come in and other industry groups in providing technology specific further requirements and guidance for specific technologies.

I don't see that there's much downside in making the framework technology neutral.

We've demonstrated, and we'll get to that in the vendor design reviews, that our regulatory framework works very well in assessing a range of technologies.

MEMBER VELSHI: And last short question. Is Canada part of this Generation Forum, this International Forum?

MR. MILLER: Yes, they are.

THE PRESIDENT: Dr. McDill?

MEMBER McDILL: Several questions.

A number of years ago when I visited Darlington, there was a sign that said -- actually, I think it said "Future site of ITER".

Where does that fit in this slide presentation?

MR. de VOS: Okay. Marcel de Vos, for the record.

The ITER is actually a fusion reactor, so GEN IV plus, maybe. I would say that's just a leap in technology in a whole different direction.

THE PRESIDENT: The story on this is just around the corner. Just a long corner.

MR. de VOS: And actually, they are doing construction on it in Europe, so --

MR. MILLER: Yes.

MEMBER McDILL: I just -- because you hadn't covered it and because it used to sit -- there was a big sign that you could actually see maybe even from the highway at one point, but certainly locally. So I thought that was something that was -- maybe it could be a tiny footnote in Canadian history.

Second question, let us suppose that a number of the intervenor groups that we have read this presentation.

Where would they see the progression of seismic design in this set of slides?

MR. MILLER: Doug Miller, for the record.

I'd like to pass this to Gerry

Frappier.

MR. FRAPPIER: Gerry Frappier, Director-General of Assessment and Analysis.

I think this presentation is intended to show, in general, where things are going, how things have evolved. There is a lot of very, very detailed specific issues that could be talked about in general, but that would take, you know, way too much time.

So for instance, in seismic design -- you mentioned that one -- it's an example of where the designs that were made for what's being referred here as Generation II have all been upgraded as part of the regulatory process where we require them to do seismic margin analysis, different things that have come before the Commission, and based on the results of those analysis, have design features that are upgraded.

I think the key thing here with respect to maintaining the level of safety that's expected by modern standards is that on old plants you have to do it in maybe a more awkward way and maybe a more expensive way than if you had a blank piece of paper with a new design.

But that doesn't mean that you

can't reengineer it and made the changes so that you get the level of safety that's needed.

We were just talking earlier today about the cost of putting in something maybe simpler than that, being fire standards. But if you want to maintain your continuous improvement and maintain your modern standards applicable to everybody then people are -- industry is going to have to be ready to invest. At some point that investment decision is, do you retrofit to meet the modern safety requirements or do you decide to build a whole new plant? That's, as Marcel was saying, more of a business decision.

MEMBER McDILL: But this presentation isn't just for us, is it? This is for the general public.

So in writing, I think it's very good and I'm listening and I'm enjoying listening to it and learning from it. But when you did it, did you sort of take a half-glance at what the intervener population is concerned about to try and cover off some of that?

You've talked about post-Fukushima so there is an element of it, obviously.

MR. MILLER: I'll be asking Mr.

Ramzi Jammal to also comment.

But in this we are very mindful of the message that we're sending that we'd like to tell the public, is that through an integrated continuous improvement approach the plants have been upgraded.

So it's mentioned through OPEX, through peer reviews with an industry, through the systematic approach to life extension, through a systematic approach in looking at modern standards, is that we work with industry and encourage the safety improvements that with more detail we could get into specific illustrations of improvements.

Seismic design is certainly one of them. Where there has been changes in seismicity assessments where clients have had to go back and say, "Oh, we need to do some upgrades in this area or that area" to reinforce it.

I'd like to turn it over to Mr. Jammal, though.

MR. JAMMAL: Ramzi Jammal, for the record.

Thanks, Doug.

A couple of things. This

presentation was a balance between the technical information to present to the Commission on what is upcoming, what's new, and definitely trying to clarify the fact that the labeling of a generation is a marketing labour rather than a safety issue.

To give you an example, people talk about the core catcher. Well, the CANDUs, as a matter of fact, they do have a core catcher that heats it. So how you cool the core in a case of progress of an accident.

So the intent is to balance through a technical discussion and keep providing messages to the public that continuous improvement is in the heart of the CNSC, you as a Commission decision-making and for us staff with respect to regulatory requirements.

So we don't have what we call a back-fitting rule or back verification rule. What we have in place is updated safety case and updated PSAs and updated requirements that we impose on our licensees through our regulatory process. So if we didn't make it proper messaging we'll take into account, so that we are -- we will be telling the public that it's continuous improvement.

As Doug mentioned, we will be addressing in the future, based on technical information, seismic qualification or seismic upgrades with respect to our regulatory oversight.

MEMBER McDILL: Thanks, Mr. Chair.

THE PRESIDENT: Anybody else?

Dr. McEwan?

MEMBER McEWAN: I was interested to see in the Netherlands and in the U.S. licences were given to 2033 and 2034. How do you build into that type of a framework the continuous improvement, the lessons learned, the quality changes that will occur over two decades?

I mean, if you look at where the regulations are now and the site requirements are now compared with 1990, they are very different. They have evolved. They have changed.

How do you square that circle?

MR. MILLER: That's a very good question. The answer can help to illustrate the differences in the Canadian regulatory process and regulatory approach with that in the U.S., for example.

And it may be the same in the Netherlands. But in the U.S. when they look at life extension their main focus is on the fitness for service system structures and components and particular passive components such as concrete, anything that's not replaceable.

So in their licence renewal process it's not so much on an overall integrated assessment of the safety case but very much focuses on if you want to run till 2033, will the reactor coolant system piping remain intact? Is the concrete good enough? Will it last?

For programmatic aspects they largely rely on the initial licensing basis from the time the plant was initially licensed.

To contrast that in Canada, there has always been continuous improvement through licence renewal, inclusion of new standards in the licence through the life extension process where you compare with modern standards and update your programs. It's more of continuous incremental improvements in operational programs such as training. It could be more fully integrating human factors. It can also be improvements in design or improvements in environmental qualifications.

So it's done incrementally over

time with the Canadian process which is the licence renewal and a more holistic review of the safety case.

MR. FRAPPIER: Maybe just -- it's Gerry Frappier, for the record -- just to add a little bit.

So from a regulatory perspective if you look at Belgium and more of the European countries, the type of review that we often do around licensing they don't really consider that part of the licensing process. They have what they call a periodic safety review. So even though you've been given a licence for 20 years or 30 years there will be typically a 10-year cycle where you are going to have to demonstrate that you meet the modern safety levels, if you like, and then propose how you're going to do upgrades over whatever period of time to get you to maintain that level that is comparable to modern standards.

THE PRESIDENT: Okay, look, I'm cautious of time. We've got two more parts to go. You'll be able to ask questions later on, Dan.

So why don't we move into the second part unless somebody really has a burning question right now?

Mr. Tolgyesi...?

MEMBER TOLGYESI: I have just one.

You know, there is the Olympic Games and such. And last week on the CBC in French there was -- during the news there was a series of reports on Trans Siberia and they were talking about not a Chernobyl nuclear power plant accident but another one which was quite important, quite big and kept in secret.

So my question was it was close somewhere to Yugoslav so I was -- I said, "Gee, I don't know anything about that". Is it true or what it is? Because they were measuring even now the radiation. It was quite severe.

THE PRESIDENT: I think it was just a secret to the television producers. We all know about some other Russian accident that has been reported. I can't remember the name but it came up just recently in fact.

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

After Chernobyl the Convention of Nuclear Safety became a legally-binding element to actually put in place the reviews of the country.

So even though at the time it was called "secretive" -- Dr. McEwan touched on it earlier -- is how do you communicate that you're having an accident taking place and how do you inform the public?

So one of the elements, lessons learned from Fukushima and, as a matter of fact, the Convention for Safety was established and put in place because of the accident that did take place in Chernobyl.

So the other enhancement did take place on the international scene that established the emergency -- I forget the technical terms right now, the exact terms. So there was the emergency notification, legally binding elements. Contracting parties were engaged. There were a whole bunch of legal tools that were put in place so that the communities and member states and the countries are engaged together.

So from early notification contracting to Convention for Safety, all those things were established post the Chernobyl accident.

THE PRESIDENT: Okay, let's move on to the second part, please.

MR. de VOS: Okay, good afternoon, Mr. President and Members of the Commission.

For the record, my name is Marcel de Vos and I work for the new Major Facilities Licensing Division and I will spend the next 25 minutes or so to give Doug a break on his voice, focusing on Small Modular Reactors or SMRs, explaining what are they and what it means to regulation.

So in this presentation, I will cover the following topics:

What exactly is a Small Modular Reactor?

If SMRs are deployed in Canada where might they be and why?

I will speak briefly on the CNSC's readiness to regulate SMRs.

I will discuss the progress CNSC staff is making in characterizing and addressing regulatory policy and technical issues.

And finally I will discuss international activities currently in progress around SMRs.

The concept of a Small Modular Reactor is really just, again, a marketing term used around the world for a reactor facility intended to be smaller than a traditional Nuclear Power Plant or NPP.

There are many different interpretations of the term SMR and some countries actually include medium-sized reactors as well and these could be in the range of around 800 megawatts electric which is actually quite large and would include the enhanced CANDU-6.

So we know that they are being designed to produce electricity and/or process heat. It could be both.

They most likely will be modular. That means that they will be constructed of factory manufactured pieces which are integrated onsite. This is actually a very common and old practice in both shipbuilding and the aerospace sectors.

They might be water-cooled but, as we've learned earlier, they might not be.

Vendors are also looking to target lower up-front capital costs to make them cheaper to construct upfront and make them more affordable in the long term than NPP designs. But I will stress they likely will be more expensive to operate on a day to day basis.

They're not necessarily competing with nuclear power plant designs either and I'll explain why later on.

In Canada all regulators or, sorry, all reactors are regulated within a continuum of requirements. "SMR" as a term actually has no regulatory meaning in Canada.

As you can see from the diagram, some SMRs will be large enough that common sense should dictate that they really be viewed as small nuclear power plants, whereas others are small to the point that certain risks may be low enough to for more use of risk informed decision making that might happen for larger units.

So on the left-hand side of the diagram we have the Babcock & Wilcox or Generation mPower design. It's an example of a small NPP but it's labelled as a SMR.

And on the far right-hand side is another design from Japan called the Toshiba 4S. It has two different versions, a 10 megawatts and a 50 megawatt electric version. Those are examples of a small reactor. Both in both cases are touted to be SMRs.

As an example, in the diagram we've indicated two regulatory documents applicable to design specifically; namely RD-337 which is applicable to NPPs and RD-367 which is applicable to small reactors.

The two documents are actually very similar and they show that there is really no special rules for small reactors. The approximate value of 200 megawatts thermal that divides a small reactor from an NPP was created to be a guideline only and it is based on the premise that for smaller core inventories, some additional flexibility in the use of grading might be possible in certain cases. So RD-367 for the small reactors simply reflects where this additional flexibility in the use of the graded approach exists.

So just for the note as well, RD-337 is actually being converted and republished as reg doc 2.5.2. I believe you had that presented to you a number of months back.

So it's important to understand that everything depends on the safety case put forward by a proponent.

As Doug discussed in part one,

many of the earlier reactor designs were in fact quite small and had a lot of fundamental attributes of an SMR with the only difference being that they were not only designed to be constructed in -- or sorry -- that they were not designed to be constructed in modules or for fleet deployment.

In this slide, I give you an example of a sodium-cooled fast reactor called EBR II that was run by Idaho National Labs. This particular reactor used a metallic fuel versus the ceramic-based fuels that we are used to in our designs.

It achieved first criticality in 1965 which meant it was designed in the 1950s and was capable of producing both heat and electricity on a small scale for the site that it was placed on.

One key design goal for SMRs is to have a reactor core with inherent safety characteristics. What this means is that off-normal situations cause the reaction to shut down with no human intervention.

EBR-2 actually demonstrated this type of behaviour in 1986 when under controlled experimental conditions the shutdown systems were blocked and the reactor coolant pumps were shut down with the reactor running at full power. This demonstrated that with a loss of shutdown and loss of coolant circulation capability, the reactor power dropped to near zero in approximately 300 seconds.

This particular reactor that's in this diagram is a forerunner of the GE-Hitachi Nuclear Energy's 300 megawatts PRISM Generation 4 conceptual SMR design. So although this design was a success, the use of sodium coolant still presents some hazards that need to be mitigated and all of the designers around the world are finding different ways to mitigate sodium hazards because exposure to air for sodium is an explosion hazard.

In this photo, you can see the world's currently largest nuclear icebreaker, part of a lineage going back to the 1950s. It contains a marine-purposed SMR. This vessel is powered by two 171 megawatt thermal pressurized water reactors utilizing fuel enrichment in the range of 45 to 75 percent.

What you might find amusing is

that this particular vessel also doubles as a polar cruise ship with 64 first class cabins and a heated indoor pool among other luxuries.

There is a much bigger icebreaker design under construction but it will use a different reactor design with Low Enriched Uranium fuel.

In this photo is another example of a Russian SMR being loaded into the first of seven planned floating power plants. The OKBM Afrikantov, which is the first floating power plant, is designed to use two designs called KLT-40S. They are pressurized water reactors that will supply upwards of 70 megawatts electric to coastal locations with no access to a regional grid. In this case, however, the reactors are not used for propulsion of the vessel itself. The vessel is intended to be towed to where it is needed and refuelling is done onsite.

The centre vessel in the contraption you see hanging from the rigging there is the reactor vessel itself which would be replaced as an entire fuel cassette. So you don't replace individual elements. You remove the entire cassette from the vessel.

The KLT-40S is the latest iteration of a reactor design that has been around for about 20 years in other Russian marine applications.

We are aware that SMR vendors who are interested in Canada are seeking to address the needs of two distinct markets.

In the far north currently, power is locally generated mostly by fossil sources and the cost of power is very high. We may see very small SMRs in the range of 10-25 megawatts electric per unit proposed for resource projects, mines, northern communities or even military use. In the south, however, we may see more traditional, what we would call normal sized SMRs like the B&W mPower I showed you earlier. I'll expand on these two markets in the following slides.

It is important as a regulator to understand potential changes in the industry we regulate in order that we can be ready to address the questions and issues that come with these changes.

In southern Canada, it is our understanding that, in many provinces:

- There is projected growth in industrial power demand such as increased interest in mining;

- There is a desire or mandate to gradually phase out coal generation;

- Grids are going through a renewal process at this point in time and decision need to be made on changes to grid architecture. Future facilities need to fit the capabilities of that architecture;

- They are looking at diversification of power sources is an overall goal to ensure a balanced power supply;

- And utilities are seeking the ability to export power between provinces and/or with northern U.S. states.

So in this slide here is a list of reactor vendors who have indicated interest in exploring deployment in Canada. And I will point out that the Westinghouse design which is second from last on the list as of yesterday have decided not to pursue this market as you're well aware.

The state of development of these designs varies from conceptual designs to certified and ready to build designs. All of these designs range in power output from 100 to 300 megawatts electric and they are all water-cooled. We would expect all of them to be licensed following the same approach that we would use for a normal nuclear power plant project.

We cannot predict if all of these technologies will compete for projects but, based on what we learned from the new build NPP experience to date, we believe it is likely project proponents will want to take advantage of the pre-licensing vendor design review to evaluate and short-list technologies for consideration.

Mr. Miller will be speaking to the Pre-Licensing Vendor Design Review process in the third part of this presentation.

Here is one example of a pressurized water SMR. This is, again, the Generation mPower design and its planned electrical output will be 180 megawatts electric per unit.

In the middle of the slide is the integrated reactor vessel and it will be located in a containment structure located either below ground (as indicated in this slide) or for other designs it could be located above ground as well in a more traditional containment vessel.

What we mean by "integrated reactor vessel" is that the reactor core, reactivity control devices such as shutoff rods and drives, steam generators and pressurizers are all located in a single vessel. One of the main reasons being claimed for designing a reactor this way is to eliminate the possibility of a large loss of coolant accident because you are eliminating all of the reactor coolant piping that you see in a traditional nuclear power plant design.

The vendor's intent is also to be able to factory mass-produce these vessels and transport them either by rail or road either as an entire one piece or in pre-packaged sections for faster installation at the site. This is part of an aim to reduce construction costs and time at the site.

So all of the designs I showed you on the previous slide use a variation of this integrated light water reactor concept.

One question that likely emerges in your minds is what interesting regulatory issues might these designs bring to the table?

Our understanding is that we need to be prepared for proponents to make proposals that take advantage of what these designs claim to offer, such as:

They are looking to have smaller emergency planning zones, claims of greater safety that preclude the risks of major releases.

They are looking to have smaller plant staff complements. In other words, a smaller number of operating and maintenance staff. The idea here is that they are making claims of greater plant simplicity coupled with increased use of automation, meaning that there is less staff needed to run and maintain the plant.

It's important to note that in some cases maintenance approaches have not been fully developed yet and that changes to some codes and standards may be needed, which speaks to some of the work that the CSA is doing where we are asking industry to speak with them.

They are looking to have reduced security staff with a greater emphasis on plant design features to increase security such as having the nuclear island located below ground where people can't get at it.

Acceptance of proposals of course is highly dependent on the facility safety case and we expect claims be supported by evidence.

All of these vendors are performing research and development activities in preparation to support future customers. A vendor design review would, if initiated, give us a good first indication of the strength of that R&D program.

So let's shift our focus now to northern Canada, where we have been informed that the business drivers for utilities are quite different from what we discussed -- what we've been hearing for more traditional southern-based utilities.

In the northern parts of most provinces grid reliability and access is a very big issue. Upgrading and expanding the existing grid network is very expensive because this means hundreds of kilometers of power lines need to be added and maintained for customers who are very far apart from each other.

Currently major customers like mines increase reliability by using local fossil generating sets. But this means delivering and storing large amounts of perishable fuel among other considerations.

In the far north, there is no grid at all. All power is currently generated locally using small fossil fuel sets and delivery and storage of fuel becomes even more of a challenge because the supply chain is easily interrupted by weather or refinery problems.

So what this means is that the electricity generation can cost anywhere from a dollar to two dollars per kilowatt hour as opposed to the roughly 10 cents that we pay.

CNSC has been contacted by four different vendors who are in the early stages of looking into how they might address this unique market. There are likely more vendors out there that we are not yet aware of.

Most of these vendors have indicated to us that mines and communities do not have the capability, nor do they want to become the licensee.

This means that a Vendor Build Own Operate fleet model with long-term power contracts for customers may become the business and licensing model for these types of projects.

The biggest design constraint that the north is imposing on designers of reactor technologies is that that no refuelling or storage of used fuel will be permitted on a site. This has been apparently driven by a lot of public input to the vendors.

Listed here are some of the companies who have contacted the CNSC asking for information about licensing and pre-licensing technical discussions. I won't read the list but I'd like to point out that all of these designs, with exception to one, are Generation 4 designs utilizing enriched fuel and alternative core coolants.

With exception to the Toshiba design, all vendors are looking at a vendor build-own-operate model, which means that they would be the licensee of not only the site but also the factory that will mass-produce the reactors and fuel.

To address the no-refuelling constraint I spoke to in the previous slide, one of the biggest differences between these designs and the larger ones I showed you is that the entire core assembly is designed to be factory fuelled and shipped to the site for installation.

At the end of the fuel cycle, which can range from 5 to 25 years, the intent is to load the used vessel into a large transport flask and ship it back to the factory of origin for refurbishment or decommissioning. That factory could be in Canada or it could be in another country.

All of these vendors are exploring the Pre-Licensing Vendor Design Review process as a planning tool for potential development.

This slide is an example of these smaller SMRs, and it's actually a big one for a smaller one.

This design is called the Gen4 Energy Module from the U.S. and it's is a lead-bismuth eutectic design. At 25 MWe (or 70 MWth) it would be a large plant for this type of application, so it might be proposed for a large remote mine for electricity production and simultaneous process heat.

The red circle indicates the actual nuclear island, which is actually quite small, and that has the replaceable reactor vessel in it.

For these designs and licensing scenarios, the potential regulatory issues become more complex and will have a longer time horizon. Some of them will be public acceptance issues as well, regardless of whether it can be done safely or not.

Proponents will be proposing concepts, such as:

- as I spoke to earlier, transportable nuclear cores;

- very small on-site plant staff complement coupled with autonomous operation and remote monitoring or intervention; there are technology claims that preclude any risk of fuel melt or need for short-term response to events because of passive and inherent safety features in the designs;

- they're looking to have potentially having no on-site security staff at all; vendors are designing plant features to take on the full role of onsite security through design features. In fact, in a remote region, they are questioning whether an on-site security force would actually be of any use at all.

It is very important to note that

in remote regions, emergency planning is more complex because:

- the infrastructure may not currently be present;

- you can have significant delays in response due to weather; and

- the sites would be very far apart, meaning that response teams would have to carry emergency equipment with them and transport themselves to the sites on short notice.

Vendors have indicated that most of these proposals would be rolled out over a very long period of time as part of the vendor R&D program. So, for example, the first plant would not likely use a transportable core.

We do note that further regulatory research is needed by CNSC to understand and regulate implications of these concepts.

It is important to point out that industry is expected to lead the discussion on what precisely their regulatory and licensing issues are and how they might be resolved. Some of these issues, which I discussed a few slides back, will need time to resolve. CNSC's role is to clarify our requirements to facilitate that conversation.

For example:

- How are they planning to prove some of the novel concepts that they're developing?

- How will the codes and standards be amended or created?

- What are some of the key public acceptance issues?

Some broader issues will likely involve discussions before you, the Commission, such as the idea of transportable reactors I'm sure will raise a lot of interest in the coming years after the steam-generator issue and there will be also a discussion on emergency planning in remote regions.

CNSC is encouraging the SMR community to participate in public consultations on REGDOCs as well as standards of the CSA and to ask themselves: Will the requirements and guidance work for SMRs?

One issue that I introduced earlier is the idea of autonomous and remote operation of reactor facilities. So the idea here is to have a very small on-site plant complement but you would be actually -- the reactor itself would run by itself, would be fully automated, but the idea would be to be able to monitor it from a distance and intervene in operation as they see fit.

So this approach might be used for very small SMRs in remote regions but is not likely for larger designs.

We are aware that it is technologically possible to develop and automate a facility based on what we've seen in other industries, but we have to better understand the state of the art and have it explained to us by industry why it's safe.

Industry needs to examine public acceptability, which I would argue is the largest issue, to develop a position and plan to show how confidence will be developed and do existing requirements, codes and standards need to be reviewed for applicability in this case? So this is looking at instrumentation and control standards. So, are there any additional human factor requirements or guidance needed? So just a few of the questions that we have.

Looking at the Act, the

regulations and the licensing process, CNSC staff can conclude that:

- the existing regulations under the *Nuclear Safety and Control Act* are already suitable for regulating activities involving SMRs;
- the licensing process is risk informed and independent of reactor size;
- licence applications can be reviewed in series or in parallel depending on the needs of the licensee and their readiness state.

As Doug explained in Part 1, our regulatory approach in Canada means that an applicant can propose to address requirements in a risk-informed alternative manner.

So in view of the potential challenges, if we look at the first group -- these are water-cooled reactors, the SMRs would be the larger ones -- the existing requirements and guidance apply in technical and licensing discussions; most existing codes and standards are applicable but some may need revision to reflect new and alternate methods being proposed by these technologies.

And then if we look at the second group of reactors, the non-water-cooled or transportable SMRs, some new requirements and guidance are likely needed to supplement existing ones that we have in place and many new codes and standards will need to be developed because of new approaches, technologies and materials.

A few years ago, we started looking into potential regulatory issues around SMRs by looking at what was going on in the United States. The U.S.NRC produced a paper to their Commission that spoke to the fundamental issues that SMRs brought to the table. For example, SMR owners would likely seek to operate their facilities with lower staff complements but staffing numbers are actually written in law or rules in the U.S.

From this report, we were able to show that a large number of U.S. issues are not the same issues in Canada here because of our more flexible approach. A few issues raised by the NRC, however, will need to be looked into in a bit more detail by us.

We are attempting to identify major issues roughly by Safety and Control Area for all SMR types and we expect this will take about 8 months to a year to complete.

The intent is to take a first cut at documenting issues and estimating the effort needed to resolve them. Any issues of course will be risk-managed.

We are aware that some issues such as emergency planning will involve a very wide group of stakeholders at multiple government levels.

On the global stage, there are a lot of industry-led efforts such as by the World Nuclear Association that are examining SMR licensing and safety issues.

Regulators are starting to discuss organizing a common forum to discuss SMR regulatory and policy issues on a global scale.

The IAEA is actually taking a first step with a consultancy in February of this year, actually this month, and this forum will involve the Multinational Design Evaluation Programme, who is doing similar work on the nuclear power plants and has been operating for years now via the Nuclear Energy Agency. So CNSC will be participating in this forum in February.

So to conclude Part 2, SMRs should be thought of as "just smaller reactors" with different configurations. Some designs will have characteristics and deployment timelines of a GEN III design and others will have characteristics of a Gen IV design.

The Canadian regulatory framework is flexible and technology neutral, but in some cases we still have to develop additional requirements and guidance for emerging technological approaches. We can already license SMR sites with existing processes.

Industry is expected to lead the discussion, but CNSC staff are working to anticipate the regulatory questions that need to be resolved. And of course, the Commission will be kept apprised of ongoing efforts and consulted on key issues.

And with that, I'm opening the floor to questions.

THE PRESIDENT: Okay. Thank you.

Questions? Go ahead.

MEMBER VELSHI: So when do we expect the first SMRs to come into service? What would be your best guess?

MR. de VOS: That actually depends which country you're talking about.

In countries like India, they already have 220 MWe small Candu versions, which are arguably SMRs already, and they've been in service for quite some time.

There's also, for example, a high temperature gas reactor in China that's been running since 2000. So some have been built and operating.

In the U.S. they're looking at having the first mPower plants approaching the U.S.NRC for construction licence application in a matter of months to a year and there will be more coming.

THE PRESIDENT: I think I would make a distinction between the U.S. who are truly putting some serious money into this and actually approved two designs, are being built. Nobody will buy this machine without demonstration. Nobody is going to be the first one. So they're all waiting for the demonstration here.

MR. de VOS: That is correct.

THE PRESIDENT: I don't know why you didn't actually use this because it is well known that they are actually building it, are they not?

MR. de VOS: Which one are you talking about? I'm sorry.

THE PRESIDENT: The two that are being built, have already been approved.

MR. de VOS: Oh, the mPower is not being built yet.

THE PRESIDENT: No, no, but I mean they're already approved by DOE, right? The money has been allocated and there's newScale, right, the two?

MR. MILLER: You're correct that the mPower newScale, the continued design and R&D support has been funded by the DOE and that the intent is to build an mPower at Clinch River in Tennessee.

THE PRESIDENT: They already have the location and all that.

Okay.

MEMBER VELSHI: In one of your slides, you say that SMRs would not or do not compete with NPPs. I can understand northern Canada and the small size, but for southern Canada, wouldn't jurisdictions actually see this in lieu of NPPs as part of their energy supply mix?

MR. de VOS: That's certainly possible. That then becomes an economic discussion. But there are certain provinces where the grids just don't lend themselves to anything bigger than 300 MW at a time. So that would preclude an NPP unless you open the grid up to other provinces and significantly strengthen the gridlines.

So in other areas, you could in fact propose an SMR in place of a nuclear power plant but then there's economic considerations over the long run to think about and you're comparing apples and oranges.

THE PRESIDENT: Dr. Barriault.

MEMBER BARRIAULT: Thank you, Mr. Chairman.

SMRs have been used by the military for quite some time. Do we know a whole lot about their use and controls that they've had with the military and incidents that they've had?

MR. de VOS: Marcel de Vos for the record.

We do know of the past history of SMRs. I can't speak to them here but we are aware of things that have gone on and there's a lot of

OPEX that has been carried forward by the different vendors down in the U.S. in developing the next generation designs. So they are learning from those previous incidents.

MEMBER BARRIAULT: Thank you.

Thank you, Mr. Chairman.

THE PRESIDENT: Anybody else? A quickie? Okay. I'm sure they will have lots of other questions at the end of this presentation. So I would like to move on to the third part and then open up the discussion.

MR. MILLER: Okay. Thank you very much, Mr. President. It's Doug Miller for the record.

So we've just gone through a discussion of the evolution of technologies and looking at small reactors. Now, I'd like to talk about the Pre-Licensing Vendor Design Review process and an update on an evolving tool.

So in this we'll give an overview of the pre-licensing process, an update on the status of completed reviews, some lessons learned from the Pre-Licensing Vendor Design Review activities, and finally, conclusions.

Back a couple of years ago, staff

gave an overview of the process. That was in the previous CMD 10-M14, and in that one it talked about the objectives and review phases, benefits, technical review areas, review criteria, communicating findings and a little bit of discussion about the Multi-national Design Evaluation Program, and we presented the status of reviews for four vendor designs ongoing.

This presentation is an update to that one plus additional thinking and new information.

A Vendor Design Review is a tool for reactor vendors and it's to determine whether the vendor is ready for potential deployment in Canada. So often, they will have an interested customer with them but they are choosing to go through a Vendor Design Review process.

It's a proven and standardized process to evaluate, in principle, whether there are fundamental barriers to licensing the vendor's reactor design in Canada. The process should not be triggered unless the vendor's conceptual design is essentially complete and the basic engineering program has begun and design requirements are being established.

The outcomes of the process help the vendor have discussions with potential future licensees interested in their technology and often there is an applicant in support of the project.

A Pre-Licensing Vendor Design Review, importantly, is not a licensing discussion. It's a technical conversation between the CNSC and the vendor. It's an optional process and not a prerequisite to licensing.

We have described the objectives of the pre-project reviews. We also wish to emphasize what the reviews are not intended to do -- they do not provide any assurances with respect to cost or schedule, economics, operability, maintainability, capacity factors and finally they do not guarantee that design changes that may be required as a result of future findings, for example during further more detailed reviews or as a result of commissioning.

A Vendor Design Review enables vendors and utilities to communicate, identify and address regulatory issues early enough so that delays in licensing and facility construction can be minimized.

This can be of benefit to

Canadians in terms of higher quality licence applications; efficient and effective licensing processes, which means an overall cheaper project; and assists decision-makers in quantifying project risks, informing cost and schedule estimates, and making the right decision, which ultimately, when it comes to electricity, is for the public.

In this process you've identified and resolved key issues before building, reducing costs and time risks, and ensuring public safety and there's high confidence that regulatory requirements will be met.

We also wish to emphasize what the reviews are not intended to do. They do not provide any assurances with respect to cost or schedule, economics, operability, maintainability, capacity factors, and they do not guarantee that design changes may be required as a result of future findings, for example during further more detailed reviews under, say, a licence to construct application or the results of commissioning.

As we mentioned, it's an optional standardized technology-neutral process.

We use a managed process:

- to evaluate, in principle, whether there are fundamental barriers to licensing the vendor's reactor design in Canada;

- to ensure that the vendor receives a fair and consistent review;

- to standardize review topics and drive the review using a combination of documented internal work instructions and specialist expert judgement;

- but we also provide schedule flexibility, within reason, to take into account a vendor's desired submission schedule.

The outcome of the review process is not a detailed review of the entire design. It's a broad sample of key safety-related topics and, importantly, no approvals of designs or technical approaches are permitted. We'll give an opinion but it is not an approval. So they'll have a heads-up of maybe these are some things that you need to work on or to address before you enter into an application review.

The process is documented in regulatory document GD-385, the Pre-licensing Review of a Vendor's Reactor Design, and that was published in May 2012.

The process preserves vendor proprietary information while giving the public information through an Executive Summary.

The review is solely intended to provide early feedback on the acceptability of selected aspects of a nuclear power plant design based on Canadian regulatory requirements and CNSC expectations. It is certainly not a certification of the design and does not fetter the discretion of the Commission in the licensing process.

It's understood by vendors that the CNSC will undertake a far more detailed review of the design at the time of review of a licence application where the technology is targeted for a specific site.

One of the lessons learned is for the vendors not to come in too early. If the design is not complete, it's incomplete, partial documentation, we will give our opinion and it will be maybe not a favourable opinion. It will indicate the status of the design and the status of the project. So it's a heads-up. Come with a suitably advanced design and ready for regulatory scrutiny.

You may be wondering what the link

is between the Vendor Design Review and licensing.

The results from a Vendor Design Review process can be used to inform licensing activities. It can inform the licence application and give a head start.

It assumes that the vendor shares the results with the interested utility, and the utility can shape their own licensing submissions with the information obtained from the Vendor Design Review process. And importantly, this information is part of the public process. The volume of information, the record is publicly available.

Understanding the results of the Vendor Design Review process can help a utility understand where project risks may emerge and also to identify where the design may need adjustments to meet requirements or where extra utility scrutiny is needed over the vendor so that the design is appropriate and meets requirements.

There are other similar pre-licensing processes in other countries.

So, in Canada, we have our Vendor Design Review process. It's not binding but can be used to inform licensing reviews.

In the U.K. they have a generic design assessment. It is binding and used in staff licensing reviews.

In the U.S. there is pre-licensing discussions similar to the Vendor Design Review and then the certification process. The pre-licensing discussions are non-binding but certification is binding and a rule is actually written so that certification is in law.

In Korea there is a standard design approval process and it's binding.

And interestingly, in France there's an opinion on the review of safety options and that is non-binding and is used to inform staff licensing reviews.

So what you see is that in some countries there's a practice of early opinion, a heads-up, are we on the right track. In other countries, when you enter into this, it's essentially part of the licensing process where it's an early review of the design.

So, as you're aware, as we pointed out earlier in the first part, some of the new technologies such as EPR, AP-1000 -- I'm throwing out a lot of acronyms but newer pressurized water reactors and boiling water reactors are under construction in some countries.

So, a good question is: What happens if a design is already certified or reviewed in another country?

The CNSC will not rubber-stamp a design. The design must meet Canadian requirements. We will go by the policy, the principle of "trust but verify."

We recognize that certification in another country is informed by that country's laws and regulatory requirements. However, other countries' requirements may be different than ours and the differences need to be understood.

So, we will certainly consider other regulators' findings and conclusions and will discuss with them to understand the basis for their conclusions.

We'll illustrate that a little bit with the AP-1000 review when we turn to the results of Vendor Design Reviews, but it's really important to understand the similarities and differences in regulatory approaches between countries, and if they're similar then you can spend less regulatory effort looking at those areas. But I don't think there's any two countries that have exactly the same regulatory framework and approach.

A Vendor Design Review has three phases increasing review depth.

So there is a Phase 1 which is approximately 5,000 hours of staff time. We can carry out this review in one year or less. The key objective is: does the vendor design intent show an understanding of Canadian requirements -- we look at 19 technical areas, we call them focus areas, we will describe those in a minute -- and: does the vendor understand regulatory language in Canada?

From our reviews that we have performed for ATMEA and AP1000 we found this was very interesting that the Canadian framework is unique, it's not the U.S. or any other country, there are specific requirements for Canada. It was very valuable to go through the Phase 1 review just to learn how to talk to each other.

In a Phase 2 review, it's approximately 10,000 hours of staff time and can take up to two years to perform and it can be done quicker. There is a Phase 1 follow-up and assessment of the design for fundamental barriers to licensing in the 19 areas.

So in there we do red flag if there are minor issues, areas for improvement, key issues where significant effort is needed or a fundamental barrier to licensing. And the key issues are documented in our external summaries that are posted on our website.

A key consideration: is the vendor addressing Canadian design and safety analysis requirements for the design? So it's a real test of our regulatory framework and their understanding of the Canadian requirements.

Then after Phase 2 the vendor may elect to go into a Phase 3 review where they will choose the topics and there will be further discussion on regulatory issues. There is sometimes some difficult ones; we have gotten to the end of Phase 2, but the path forward still needs to be worked on, so there's issues for resolution that are usually the focus of a Phase 3 review.

You can stop between the phases, depending on whether you plan to proceed with a project or even deployment in Canada. You could go right from a Phase 1 into a licensing review or you can choose to go into a licensing review after a Phase 3. We do not put any restrictions on that.

As we mentioned, there are a number of topics that we look at, so we have a standard set of 19 focus areas that are applied to any reactor technology. So we would apply these to the little 20 MW battery or to a 1600 MW plant. These topics equally apply. It is a broad review to get an indication of how the vendor is addressing Canadian design and safety analysis requirements.

The focus areas reflect topics that contain one or more of the following attributes, they span many technical areas; i.e., human factors engineering, have long lead times to develop and implement the programs. So, for example, management system, especially in particular design management where it will take time to understand the Canadian requirements and design governance processes, where changes to an approach by the vendor may require time before the vendor can proceed with the detailed design, so that might be related to instrumentation and control.

There may be substantial R&D effort to demonstrate technology and methods, the use of novel features, or have been typically found to be problematic in past licensing discussions and from worldwide experience. Two good examples of that are safety classification methodology and instrumentation and control.

I could read the 19 topics, but some key examples are, defence in depth, classification --

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MR. MILLER: -- classification of systems, structures and components, reactor core design and emergency core cooling.

Okay. So as we mentioned, we would like to reinforce: the process should not be triggered by a vendor unless the conceptual design is ready, the management system process is for the control, the design and safety analysis are in place. If you do not have that, then do not start a vendor design review or else you may not like the report that you get.

So I will turn to the results of the vendor design reviews that we have done. So in the last year and a half we were very busy, we finished a Phase 3 review of the enhanced CANDU 6 reactor. It was completed in a year.

We completed the review of a Phase 2 review of the AP1000 reactor and that was completed in a little bit less than a year. Information from these reviews was used by the vendor companies to support their bid submissions to the Ontario government.

In addition, we were also performing a Phase 1 review of the ATMEA reactor. ATMEA's technology is the ATMEA1. It's confusing, but ATMEA is the company which is a joint venture between Areva and Mitsubishi Heavy Industries and their technology is an ATMEA1 reactor and that started in July 2011 and finished in June, 2013 and that is available for deployment in Canada.

The results for all these reviews are available in the form of executive summaries posted on the CNSC website. So enhanced CANDU 6, we have carried out the three vendor design reviews, there is a conceptual drawing. I am sure Mr. Soulard could tell us much more about it.

So the overall conclusion for the EC-6 review is that CANDU Energy has taken the

CNSC's regulatory requirements expectations into account and there are no fundamental barriers to licensing the EC-6 design in Canada. However, the key findings for Phase 3 are as follows: that the design provisions applicable for the generic design are already included or under development for the EC-6 take into account the lessons learned from the Fukushima Daiichi accident.

Regarding classification of system structures and components, progress has been made but further discussions will be needed during the construction license application review. There is some discussion to follow on the classification of key components. Additional work is needed by CANDU Energy to classify the exemption from the single failure criterion for the ECC or emergency core cooling system heavy water check valves, and there is also some debate on test pressures for containment leak rate testing. And, finally, CANDU Energy has been -- it has been highlighted that more detailed information is needed on radiation protection and design and that would be looked at under a construction licence.

So of the review in Phase 3 those were the key findings and where there is additional work.

Turning our attention to the AP1000 design, a Phase 1 review was completed in January, 2010 and the Phase 3 was done in June, 2013. The overall conclusion is that the AP1000 design provided a further level of assurance that Westinghouse has taken the CNSC's regulatory requirements and expectations into account and that there are no fundamental barriers. These conclusions are subject to the resolution of key findings from the Phase 2 review regarding the performance of the plant under beyond design basis accident conditions and severe accidents, there are some specific technical issues that need to be further discussed. There is more evaluation in the area of robustness and physical security and, lastly is: Westinghouse has committed to a design upgrade for the control systems and facilities to meet the requirements of RD-337 for the means of reactor shutdown.

There is an agreed-upon path forward in resolving these main technical issues.

However, we would like to illustrate the AP1000 review as an excellent initiative in international collaboration. To meet Government of Ontario bid timelines, the full review needed to be completed in 10 months rather than our normal 18 to 24 months. We use the following resources to inform the review activities for many of the Phase 2 topics.

We held discussions with the U.S.NRC who had participated in the certification of the AP1000 design. This helped CNSC staff to identify areas where there were similarity or divergence of respective regulatory requirements.

So understanding our framework, which I hope we do, but also understanding the U.S. framework, we know what the difference is and similarities are and we knew where we could leverage the U.S.NRC work and that turned out to be very beneficial in saving time.

We also looked at the results of the U.K. generic design review of the AP1000 and we know again where the similarities are between the U.S. and -- or between Canadian requirements and the U.K. and were able to leverage those results. And this work was done under MDEP using information in the MDEP library and through collaboration with both the U.K. and the U.S. regulators enabled us to carry out this review very quickly. We had tremendous support from the other regulators and were able to do a complex review in a short time.

The ATMEA1 review was completed in June, 2013 and again we found that the design intent was compliant with CNSC regulatory requirements and at the level of a Phase 1 review meets the expectations for new nuclear power plant designs in Canada.

The conclusion is subject to the successful completion of ATMEA's committed activities on the design, in particular, those related to Canadian codes and standards. So that was an example where, in the beginning of the project ATMEA understood Canadian requirements, that we were not the same as U.S. requirements, we have our unique requirements and framework.

Key findings from the Phase 1 review for ATMEA was with regards to instrumentation and control, additional evidence needed to demonstrate the safety approaches for sharing of instrumentation between safety functions, sharing measurements between safety and control systems and addressing common cause failures and a little bit of work with regards to mitigation and prevention for mitigation of beyond design basis and severe accidents to show how the core catcher worked and whether or not they needed containment venting, and a small amount of work on out-of-core criticality. But those were the key findings from the ATMEA review.

We are in the home stretch. So lessons learned from all of this work is that in Phase 1, in particular it's very valuable for vendors to understand differences in the regulatory language from that of the vendor's country of origin. Each nation's regulatory perspectives, although informed by IAEA principles, are shaped by their laws, experience and cultural attitudes and attributes.

Vendors need to be prepared to take the time to understand and adapt the regulatory language used in the country of interest and a vendor design review certainly helps to identify those issues and get on the same page.

Secondly, we found there are differences in regulatory mandates. Different nation's regulators have different mandates. Some were surprised to see that we look at hazardous substances. We are much broader in our regulatory mandate than some other countries that solely focus on nuclear radiological safety. So you have to consider nuclear safety, but not all conventional safety -- I just said that one -- and that the differences in the mandate can have a fundamental effect on how regulatory requirements are expressed.

So the vendors need to do some homework to understand the requirements of the regulator, of the CNSC, and shape their submissions.

The vendor design review also helps us to understand the story behind the vendor's approach. For example, in some countries safety classification is quite prescriptive where in others, like Canada, it's more of a performance-based approach where you have to look at the safety function for that component and then sort out what its classification is.

The CNSC will expect the licensees to understand the hows and whys behind the vendor's methodologies because it is key to configuration management over the life of the facility.

So there was much that we learned about dealing with the vendors and much that the vendors learned about Canada.

Okay. What we also learned and discovered and were very encouraged by, that the CNSC requirements are indeed flexible and technology neutral. Both the ATMEA1 and AP1000 reviews show the Canadian requirements were technology neutral and applicable to non-CANDU designs. Requirements were applied to new passive features, new designs of coolant pumps and different approaches for instrumentation and control.

The feedback from these sessions during these reviews was used in the updates to reg docs, for example, on design, reg doc 2.5.2. So it was a very good way to test the interpretation of requirements and guidance language.

Okay. Pre-licensing reviews are gaining importance worldwide in light of new technologies. Designers are seeking ways to make designs acceptable in many countries and standardizing. Utilities and governments are seeking to reduce project risk by seeking early opinion of the regulator on how well a design would need a national requirement and the pre-licensing reviews permit international regulatory forms such as MDEP to compare notes and even work to harmonize regulatory approaches.

So in conclusion to part 3, the optional pre-licensing vendor design process has been shown to be a useful risk reduction tool, it reinforces Canadian regulatory requirements and CNSC expectations with vendors so they know who they are dealing with and what our approaches and attitudes are.

It is a predictable and fair process to look at how a design will meet Canadian requirements, so we ensured there was a level playing field with doing the vendor design reviews. The same criteria was applied for all.

And it also confirms the vendor is actively seeking the resolution of design issues identified and it can inform the licensing process. That's it for part 3.

THE PRESIDENT: Okay. Now, we are open for all parts by the way. You can ask any question you like, and now I am going to go through the list just to put some discipline into it, so please hold on.

I will be starting with Dr. McDill.

MEMBER McDILL: Thank you. I thought it was very good, very informative and I actually -- it may have been long, but it was good to listen to.

One comment with respect to your comment on materials, I think erosion and -- well, the people who fly airplanes always say the material is people who have got to get on it, so I guess it's much the same.

Where did the ACR-1000 end up, it was only Phase 1 that it went to?

MR. de VOS: This is Marcel de Vos, for the record. No, we completed three phases of the vendor design review and THE history ends there.

MEMBER McDILL: So you didn't present it simply because you picked some more recent examples. Okay.

Does CANDU wish to comment?

MR. SOULARD: No. I mean it was a very effective process and both the ACR-1000 and EC-6 went through the design review, it's just that the Ontario government changed their mind and went for a smaller type reactor at one point and we provided our submissions most recently with the EC-6.

MEMBER McDILL: Thank you, Mr. Chair. One could ask many questions, but I think it's a very big discussion.

THE PRESIDENT: You will get another chance. Ms Velshi...?

MEMBER VELSHI: I didn't see the ATMEA1 reactor in your part 1 of the presentation. I may have missed it. Is it one of the -- was it in one of the slides, I don't know, a Gen 3 or a reactor. Slide 18 where you had listed them. I just wondered where it fell under.

MR. MILLER: The intent was to give an illustration of some of the newer reactors being built, but in fact the ATMEA has been selected for -- it's Turkey I believe that it was selected for.

MEMBER VELSHI: And when the CNSC does its vendor design reviews, do you share your findings with other regulators?

MR. MILLER: We would share the findings with other regulators with permission from the -- or agreement from the vendor country. Usually it is the other regulator that will have to approach the vendor for sharing of information.

MEMBER VELSHI: Okay. But is that done? Because I know you said what was very helpful for you was to get information from reviews of other regulators. I just wondered if that gets reciprocated.

MR. MILLER: Yes, it does. It's that we would very much support a regulatory review of another country where the information from a vendor design review would be shared with appropriate arrangements with that other regulator.

THE PRESIDENT: But let's be clear, it's the regulator who can say to a proponent or vendor, if you're not going to share with us the submission you gave to another regulator, go away, we are not going to reinvent the wheel.

MR. FRAPPIER: Correct. Gerry Frappier for the record. So this is not done casually, there is actual technical agreements between both regulators and then when we enter into a service agreement with somebody, as the

President was just saying, that they want us to review then, for instance in the case of Westinghouse, it was, well, we have a lot of questions and it will take many years or you can give the U.S.NRC the permission to give us the results of their -- and of course the vendor is motivated to do that.

But it is proprietary information, we will protect the proprietary information and that includes we will not release any of the proprietary information without prior approval.

MEMBER VELSHI: I know in one of your slides you talk about different goals that the different parties have for the design or standardization is a goal and, of course, the regulator has their own unique requirements or specific requirements, some maybe just because the climate is different, but there may be some.

Is there any negotiation then that says, well, you know, I will have to change the design just for you and I would rather not do that? Like, do you get into those kinds of conversations?

MR. MILLER: That's a very good question. Through the MDEP Program there is collaboration between regulators to look at the various technical requirements and harmonize regulatory positions so that there is moving towards greater standardization amongst regulators and we take that information into account when we are looking at updating our regulatory documents. Maybe Mr. Frappier would like to add.

MR. FRAPPIER: Yes, Gerry Frappier, for the record. So I would describe it a little bit differently. We have requirements, and perhaps a good example is instrumentation and control where we feel maybe we are a little bit ahead of some of the other countries. So the vendor designs need to be upgraded to meet the Canadian requirements.

The vendor can decide to do that or not, but either way we are going to make our decision based on our requirements. In that case I don't think it's so much that they were negotiating with us one-off, they saw the world is going that way and so they are going to have to design to the modern requirements.

Another good example is all the things coming out of Fukushima, so you might have a design certification pre-Fukushima, if you are going to sell into Canada you are going to have to meet the requirements that we are putting in place for post-Fukushima.

So there is certainly a discussion, that's part of what is very valuable I think to the vendors in these vendor design reviews. They may think they have something that is perfectly okay and find out that, oops, in fact there are different requirements.

Internationally, as Doug mentioned, with the MDEP Program, we are trying to harmonize between regulators as well because obviously the laws of physics are the same no matter where you go. But there is a lot of constraints to doing that, there is a lot of difficulty to doing that, primarily, you know, anchored in the legislation and how legislation is put together and, in particular, how prescriptive people want to be versus how performance-orientated they want to be.

So if you are prescriptive it is very difficult to be flexible to new innovative ideas and that.

THE PRESIDENT: But the other side of the coin is that there is going to be the regulatory creep, right, everybody will go mitigate to the highest regulatory requirements and point out to one country asking for more and more.

So, for example, in Canada we have a requirement for two shut-off system, right, does that automatically apply to every other design and would we insist on that? You know, that's the kind of issue that I see every time you look at a design, you look at it from scratch as to what is the basic safety requirement.

MR. FRAPPIER: Gerry Frappier, for the record. That is actually a very good example you used because while we have that as a requirement for some designs, our regulatory requirements have evolved such that it actually becomes now dependent on the characteristic of your plant design and then with your fundamental inherent safety of the design.

So there is a potential for creep and certainly you will hear that a lot from vendors and may be CANDU Energy wants to comment on that as you go around the world, but I think as regulators we are trying to be responsive to that and I think we need to be.

Again, vendors can certainly point out where they think that we are exaggerating too much on things. So it is a difficult issue.

THE PRESIDENT: But I think we should not fall into this regulatory sovereignty theology, follow up maybe a little bit more the airline business rather than the car business where, you know, the difficulty we had about -- you should know, you came from Transport Canada I believe, about some of the silliness about requirements between across the border about whether it's an American-based car or Canadian car.

MR. FRAPPIER: Gerry Frappier. I certainly agree that we have to be conscious about that. At the same time, a nuclear reactor is not a car. If the vendors could guarantee they were doing exactly the same thing every time it would be a lot easier, but I don't think there's very many plants that have been built exactly the same.

We really see that when you go through something like a probabilistic safety assessment where you're really look at fundamental, you know, components and how they interact and you will find that for sister plants that were supposed to be exactly the same, the PSA comes out quite different as to what's important and what's not because, in fact, the vendors cannot keep it to exactly the same, their reactors end up being different.

I mean fundamentally if you look at just one chart they look the same, but when you get into the details that we need to to ensure safety and they can -- there are differences.

THE PRESIDENT: Monsieur Tolgyesi..

MEMBRE TOLGYESI : Merci, Monsieur le Président. I will go back a little bit to reactor's review. We are facing the kind of legacy of nuclear reactors because we are saying they are old, therefore, unsafe and large footprints and we are saying that everything that's new is going well, it's efficient, even the regulations and laws should be upgraded because that's the new way.

So if -- I'm sorry.

--- Off microphone / Sans microphone

MEMBER TOLGYESI: I don't say that, the public is saying that.

--- Off microphone / Sans microphone

MEMBER TOLGYESI: Now, when you are looking at this new fourth generation or third-generation reactors, they are much larger than the previous ones. Does that mean also that by technological progress these reactors will have higher performances, smaller footprints so they will leave less behind them than the old ones?

MR. de VOS: I think that depends on which technology. Marcel de Vos for the record, by the way. Certain reactor designs, when you can look at the EPR, are actually tending towards larger scale.

They are seeking to improve things like use of the fuels so that they get better -- they can squeeze more energy out of the fuel, but they are reaching kind of a maximum capability in the technology right now and that is where you are moving into the Gen 4 technologies which indeed tend to creep towards smaller more compact cores, better use of the fuel to increase the efficiency, less nuclear waste in the long-term or even in some countries closing the fuel cycle entirely and recycling the used nuclear fuel to the maximum extent to squeeze the most life they can get out of it.

So it really depends on which technology you're looking at.

MEMBER TOLGYESI: My last is that I'm looking at smaller SMRs, small modular reactors. When I say smaller, you were talking about 100, I'm looking at below 100, because when you look at the mine sites, it depends where they are, but they use 20, 50, 75 MW. So communities, it's the same thing. So is military technology, you are talking about nuclear reactors which is a nuclear submarine is a small one, could we say that that technology -- I'm sorry, I pushed it far away, I park it somewhere in the northern community and I hook up a grid and it will operate.

MR. de VOS: Marcel de Vos for the record. Four of the vendors that I spoke to in the slides are actually pursuing that and their designs are based loosely on very old designs which were originally military, whether they be high temperature gas or lead cooled, they are actually targeting that and the designs can go as low as 3 MW for one of the designs, because a northern community would never use more than 1 or 2 MW at most, but they are allowing for growth, so they are offering more power to those communities.

THE PRESIDENT: Go ahead.

MR. MILLER: That's a very good point. The technologies we have discussed such as NuScale -- we didn't mention that one, but DoE is funding that -- and Empower are really a land-based variant of what was used in submarines and marine -- military marine vehicles. So they are building on that experience and looking at the advantages there in terms of this market.

THE PRESIDENT: Well, isn't the Russian actually putting one of those small things on a barge and shipping them around to various ports?

MR. de VOS: Marcel de Vos for the record. Yes, I presented that earlier. I think the first one is due to be commissioned and placed in service in -- I think the timeline has slipped to 2016, but they are planning another six vessels after that for around the Russian coastline.

THE PRESIDENT: Mr. Tolgyesi...?

MEMBER TOLGYESI: Just to complete it, because when you look at mining, the mine life is, say, five, 10, 15 years, so these small reactors should be portable and mobile and what to do with the used fuel eventually when it's over, okay.

So I think that's a core sense of industry or so.

MR. MILLER: Doug Miller, for the record. Yes, those are indeed some of the policy issues that we are looking at. It's quite -- it may be feasible, a transportable reactor, and then what do you do with the spent fuel?

It may be technologically feasible, but you have to go through the policy discussions and discussion with the public and stakeholders to come out with final solutions. That may take time.

THE PRESIDENT: Thank you. Dr. Barriault...?

MEMBER BARRIAULT: Thanks, Mr. Chairman. First of all, I would like to thank you for that presentation, it was very enjoyable.

One question, three parts. The first part really, what is the total cost of a Phase 1, 2, 3 evaluation, on the average?

MR. MILLER: Well, let me see. It's a million for Phase 1, two million for Phase 2 and Phase 3 is to be determined depending on how good or bad Phase 2 goes, but it's on the order of, like we indicated, 15,000 person hours at whatever the organization's labour rate is.

MEMBER BARRIAULT: Okay. Who is it costed to as a cost-plus?

MR. MILLER: Doug Miller for the record. It's the vendor that would pay those fees.

MEMBER BARRIAULT: Okay. And just pay the fees or is it the fees plus an administration or whatever?

MR. MILLER: No, our overhead is built into the fees.

MEMBER BARRIAULT: Okay, thank you. That's all, Mr. Chairman. Thank you.

THE PRESIDENT: Thank you. Dr. McEwan...?

MEMBER McEWAN: My question has just been asked. Actually, I will comment that as I was listening to it, and it was a great presentation, thank you. This is very broadly analogous to the drug approval process where the pre-meeting has become an absolutely critical part of developing strategies, so it's interesting how it moves across regulatory frameworks.

THE PRESIDENT: Funny you should mention this, it is one of my pet peeves that Health Canada must test drugs regardless of where they are approved already. So even though somebody says physics is the same everywhere, human beings seem to be not the same everywhere.

So if France, Germany and the U.K. approve a drug, it still has to go through our own because of regulatory sovereignty, if I understand correctly the legal requirement.

MEMBER McEWAN: This is off-topic, but --

--- Laughter / Rires

THE PRESIDENT: It's very much on topic I think.

MEMBER McEWAN: The fundamental reason goes back to thalidomide.

THE PRESIDENT: Yes, I know. It's because of the liability and the legalese, I didn't say there wasn't a rationale. But I assume if you pick up three countries you can trust the regulatory system, then you should not spend the same fundamental research they've done. This is off-topic.

Anybody else want to go in? First

of all, thank you for this presentation, it's great and, you know me, this is going to be posted.

Okay. So if you want to post it and you want to tweak it because of some of the comments you just heard. What I was surprised about you didn't mention natural uranium is driving the CANDU which is a unique design. So somewhere along the line when you do the story preview it was always fascinating to me why more countries did not adopt that because it didn't require enriched uranium.

So anyhow, you may want to build that in somewhere. I also wanted to ask AECL --

MR. SOULARD: Former AECL.

--- Laugher / Rires

THE PRESIDENT: CANDU, but during the AECL days, I mean you guys develop this slowpoke, just talking about SMR, it would be really -- I don't understand why AECL and CANDU Canada now does not still in the design for the promised nuclear battery that some of those people are actually using.

MR. SOULARD: Mike Soulard, CANDU Energy. If you look back at the history, you know, NPD and Douglas Point were SMRs, right. NPD 40 MW I think and Douglas Point was 225, but of course when you were doing all this demonstration of power reactors economics were really driving the design up toward the 600-plus megawatt range and that's where it's been.

Now, pre-CANDU, AECL was sort of looking at developing some small reactors, CANDU-80, CANDU-300 batteries, but now within CANDU Energy I don't think there's any appetite in the foreseeable future to move down the SMR path and we will continue with exploiting our CANDU technology with respect to the fuel cycle adaptations, as I was mentioning before.

THE PRESIDENT: So your EC-6 is there, you are kind of content there for competition in this space?

MR. SOULARD: Yes. And the ACR-1000 I guess was sort of ahead of its time and had some folk issues, first-of-a-kind issues that utilities and governments weren't willing to take on, so now with EC-6 has being proven, we have adapted it to modern licensing requirements and modern plant expectations of the so-called Gen 3 expectations and that will be our baseline vehicle to exploit the natural uranium market and also relieve the advanced fuel cycle market as we see with China and right now with the U.K., so to speak.

THE PRESIDENT: My last question. On the international community I noticed that I actually believe those who invest in a particular technology presumably look to unfold the computing technology. So is lead cooled technology the leading contender?

MR. de VOS: I would say it's an equal toss-up. Marcel de Vos for the record again. It's an equal toss-up between lead cooled technology and high temperature gas, they both seem to be developing at roughly the same pace with sodium cooled technology right behind them. All of them have --

THE PRESIDENT: When you say that, it means that people are building them?

MR. de VOS: Yes, that is correct.

THE PRESIDENT: So I guess in a few years we should have a pretty -- something will emerge, right, as the leading technology, just like water-based eventually won.

MR. de VOS: That is correct.

It's likely something is going to emerge, but it all depends again on the customers.

THE PRESIDENT: When? When do you think?

MR. de VOS: Well, in countries like Russia it is already happening, in China it is already happening. They have an active program to close their fuel cycle, so they are developing reactor technologies to do that and they are eyeing export of those designs as well.

Other countries, there is less of an appetite for the more exotic designs because the utilities want tried-and-true, they want designs that are familiar with what is currently on the market that they know how to operate economically and they are a bit more risk averse to using a new design.

So I think it more depends on whether or not there is a brave customer out there.

THE PRESIDENT: Okay. Thank you. Any last question? Thank you.

Go ahead.

MEMBER TOLGYESI: I just want to say that I am a little bit disappointed that we have -- Canada has so much potential to develop up north and these technologies or these sources of energy could be one of supporting, and I see CANDU is saying that they don't do that anymore so we will rely much more on the China and, I don't know on who, and Russia and it's not China who has that potential, it's us. So we will import that technology.

THE PRESIDENT: That's the market working here, whoever wants to pay. I can tell you there is an interest in Canada, but my understanding there are some great interest in rural Canada, but they will not go first unless it's practical, efficient and affordable machine. It's a tall order in the nuclear.

Okay, anything else anybody wants to say?

So thank you. We will break now.

MR. LEBLANC: We are done.

THE PRESIDENT: We are done for today and we will reconvene tomorrow. Marc, remind me when?

MR. LEBLANC: Nine o'clock.

THE PRESIDENT: We will be here tomorrow at nine o'clock.

Thank you. Thank you all.

--- Whereupon the hearing adjourned at 6:16 p.m., to resume on Thursday, February 6, 2014 at 9:00 a.m. / L'audience est ajournée à 18 h 16 pour reprendre le jeudi 6 février 2014 à 9 h 00