DARLINGTON NEW NUCLEAR POWER PLANT PROJECT

JOINT REVIEW PANEL

PROJET DE NOUVELLE CENTRALE NUCLÉAIRE DE DARLINGTON

LA COMMISSION D'EXAMEN CONJOINT

HEARING HELD AT

Hope Fellowship Church
Assembly Hall
1685 Bloor Street
Courtice, ON, L1E 2N1

Tuesday, March 22, 2011

Volume 2
REVISED

JOINT REVIEW PANEL

Mr. Alan Graham
Ms. Jocelyne Beaudet
Mr. Ken Pereira
Ms. Debra Myles

Transcription Services By:

International Reporting Inc.
41-5450 Canotek Road
Gloucester, Ontario
K1J 9G2
www.irri.net
1-800-899-0006

ERRATA

Transcript :

Page 132, line 10

This is a common occurrence in sites that are on hard, very stiff materials, but studies that have been done at other locations in the U.S. have shown that these small accedence's are not important and they -- if they've done – they can do reanalyses using different spectra to show that they are not a critical importance to the evaluation of the -- of the suitability of the reactor technology to the site.

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Page 167, line 1 and 2

So following the loss of power there would be immediate shutdown of the reactor units and they were concerned about removing the decay heat for the core.

Should have read:

So following the loss of power there would be immediate shutdown of the reactor units and then we are concerned about removing the decay heat from the core.

Page 167 line 14

But if it's a seismic event, and I think that's what you're concerned about, the redundant multiple backup power supplies that are designed highly reliable to restore power to the plant.

Should have read:

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Page 255, line 2

MR. SWEETNUM: We don't have access to the system, so --
MEMBER BEAUDET: Oh, okay. Well, it's Figure 3.4.2, I think, that you would have.
MR. SWEETNUM: Can the staff have it?

Should have read:

MR. SWEETNAM: We don't have access to the system, so --
MEMBER BEAUDET: Oh, okay. Well, it's Figure 3.4.2, I think, that you would have.
MR. SWEETNAM: Can the staff have it?

Page 260, line 16

DR. AAMIR: Dr. Aamir, for the records. I am the second manager for the design.

Should have read:

DR. AAMIR: Dr. Aamir, for the records. I am the Section Manager for the design.

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Courtice, Ontario

--- Upon commencing on Tuesday, March 22, 2011 at 9:01 a.m.

--- STATEMENT BY CHAIRPERSON GRAHAM:

CHAIRPERSON GRAHAM: Thank you very much.

I believe you've had your time. We'll start the proceedings and I would ask that you move a little bit to one side or the other so that we can -- this proceeding may start.

I think we've given ample time for photo ops. If you're not prepared to move, we'll adjourn the hearings until such time as we can proceed in an orderly manner and a fair manner.

With that, we'll take a short adjournment until we can proceed in an orderly manner.

Thank you.

--- Upon recessing at 09:01 a.m.

--- Upon resuming at 12:44 p.m.

--- STATEMENT BY MR. DENIS SAUMURE:

MR. SAUMURE: Good afternoon, my name is Denis Saumure, Legal Counsel for the Joint Review Panel.

I will now read a statement as directed by the panel chair.

Ontario Power Generation has applied to the Canadian Nuclear Safety Commission to seek approval to prepare a site for the construction and operation of nuclear power reactors on the existing Darlington nuclear site within the municipality of Clarington, Ontario.

An agreement to establish a Joint Review Panel for the new nuclear power plant project by OPG has been signed between the Minister of the Environment and the Nuclear Safety Commission on January 2009 which constitutes a panel of the Commission under Section 22 of the *Nuclear Safety and Control Act*.

The Joint Review Panel has a panel of the commission under Section 22 of the NSCA, has the powers of a court of record described in Section 20 of the *Nuclear Safety and Control Act.*

Public hearings to review the proposed project have been scheduled to take place from March 21st to April 8th, 2011. The Canadian Nuclear Safety Commission has leased the premises at Hope Fellowship Church located at 1685 Bloor Street, Municipality of Clarington, Ontario, to

hold the said public hearings.

Subsection 20-6 of the NSCA empowers the Joint Review Panel to take such measures as it considers necessary to maintain order during the proceedings before it and in particular when they limit the participation in the proceedings of/or eject from the proceedings any person who disrupts the proceedings and where the person is ejected, continue the proceedings in the person's absence.

Subsection 20-7 of the *Nuclear Safety and Control Act* states that a peace officer shall provide such assistance as a member of the Commission may request for the purpose of maintaining order during the proceedings before the Commission.

The Joint Review Panel hereby requests that the Durham Regional Police take the proper actions to maintain order during the proceedings and eject from the proceedings any person that refuse to cooperate and are disrupting the proceedings.

Those refusing to leave the premises as requested will be removed as per the *Trespass to Property Act* and related criminal code

statutes. And the document is signed by Mr. Alan Graham.

We now ask everyone to leave the room.

On vous demanderait à tous de bien vouloir quitter la sale.

--- Upon recessing at 12:47 p.m.

--- Upon resuming at 2:02 p.m.

--- OPENING REMARKS:

CHAIRPERSON GRAHAM: Well, good afternoon ladies and gentlemen.

Thank you -- I thank everyone first of all for their patience in helping us getting through this situation. It was regrettable that such actions were necessary to provide an orderly process to proceed.

As a panel, we respect the points of view of every person and the process is set out to have everyone’s views heard and the points of view seen.

Yesterday, we ruled that the hearings would proceed. And rules are rules. This hearing will proceed in an orderly, fair and courteous manner. We have set aside three weeks for interventions and for participants.

Many have taken the time out of their very busy schedules to be here and we all must respect that fact. Whether we proceed here or in another venue, we are going to proceed.

We have also indicated that the record will not be closed until such time as the panel is satisfied that it has sufficient information to make a recommendation.

And with that, I will turn my co-chair here to -- co-manager -- just got promoted, co-manager to read introductory of the process which we're going to follow this afternoon which is going to be altered slightly to accommodate one of the interveners -- or one of the presenters who has other arrangements.

MS. MYLES: Thank you, Mr. Graham.

Good afternoon everyone, I'm Debra Myles, I'm one of the co-managers for the panel.

I'd just like to address a few administrative issues before we get going, the first thing the agenda. So we've had a bit of a late start today so we hope to get through the entire agenda as it was -- revised agenda as it was laid-out.

We're going to switch one of the

presenters, as Mr. Graham mentioned, and that would be the presentation from the Canadian Environmental Assessment Agency, we're going to have that first.

And that will be followed by the three presentations that were requested by the panel as a result of the situation in Japan. And then the rest of the agenda today will roll out as it was laid-out in the agenda.

We will proceed this afternoon for approximately three and a half or so hours and break for dinner and then reconvene at seven o'clock tonight.

I hope that's agreeable and we appreciate everyone's flexibility.

A few other administrative matters, we have simultaneous translation of this proceeding and all proceedings. The headsets are available just at the back of the room, French on channel 2 and English on channel 1.

To make the transcripts as meaningful as possible, please identify yourself before speaking.

The written transcript that's being created for these proceedings will reflect the official language of the speaker. The audio

files and the transcripts will be posted on the Canadian Environmental Assessment Registry internet site for the project.

If you're scheduled to make a presentation at this session, I'm sure that you're already here and have been here for a while. Just please check in with Julie at the back of the room to -- so that she knows that you're here and prepared to make your presentation.

We'll have to -- the Chair will decide as the proceedings go along today where the opportunities for questions will be. Normally they're at the end of each presentation.

If you do have a question that you would like to put the Chair for a presenter, please speak with Julie again and she will take your name down and let us know about that.

Okay. That's about all I have to say on administrative matters right now.

So Mr. Graham?

CHAIRPERSON GRAHAM: Thank you very much, Debra.

We'll now proceed. And I believe the first presenter this afternoon is going to be CEAA.

And, Mr. Leboeuf, the floor is yours.

--- PRESENTATION BY MR. LEBOEUF

MR. LEBOEUF: Thank you, Mr. Chair, Members of the Joint Review Panel, including for accommodating my agenda today.

I'm very pleased to be here today on behalf of the Canadian Environmental Assessment Agency. My presentation should be fairly short; including to making sure to provide as much flexibility for you to manage the agenda for the rest of the day, I'll try to focus on the essential of the points I wanted to cover.

Now, I want to essentially cover three different points in my presentation.

First, an overview of some basic environmental assessment principles; secondly, during this hearing phase of the Joint Review Panel process; and, third, a description of our agency's role in the context of environmental assessment by review panels.

My presentation will also be relatively short because -- and as you will see -- the reasons you gave yesterday in dismissing the motion to delay the hearings are very consistent

with some of the observations I intend to offer to you this afternoon.

I also took note of your remarks yesterday and your desire that presenters do not systematically read their written submissions, so I don't intend to do that today.

Environmental assessment is a planning tool that is used across the world to identify, assess and mitigate the environmental effects of a project before decisions are made in the context of the *Canadian Environmental Assessment Act*, and I'll refer to it under the acronym of CEAA for now.

EA is used as a tool to inform federal decision-makers, known as "responsible authorities" under the Act, about the anticipated environmental effects of a project. These federal decision-makers can then make their respective decisions knowing the environmental implications and understanding what is necessary to prevent significant adverse environmental effects to occur.

In the context of the Darlington New Nuclear Power Plant Project, the responsible authorities having regulatory decisions to make in relation to the project are the Canadian Nuclear

Safety Commission, the Department of Fisheries and Oceans, Transport Canada and the Canadian Transportation Agency.

CEAA provides for three types of environmental assessments; screenings, comprehensive studies and assessment by review panels. And only a very small number of projects are referred by the Minister of the Environment for an assessment by a review panel.

This decision under the Act is based on the potential of the project to cause significant adverse environmental effects or on the level of public concerns associated with such environmental effects.

The Darlington New Nuclear Power Plant Project was referred by the Minister of the Environment for an assessment by a review panel in March 2008. A year later, more or less, the Minister of the Environment and the President of the CNSC signed an agreement to establish a Joint Review Panel. And in October 2009, your panel was formally established.

The mandate you received from the Minister of the Environment is contained in the Joint Review Panel Agreement. An EA by a review

panel and that ties to some of points, Mr. Chair, you were making yesterday.

An EA by a review panel such as this one is a two-phase process. There is the information-gathering phase and that is followed by a second phase known as the reporting phase.

The first phase, the information-gathering phase, includes the preparation and review of the environmental impact statement, the written submission that you received earlier this year and, equally important, these public hearings that have started yesterday.

As you noted in your decision yesterday evening, prior to ending the first phase and move to the reporting phase, you as the panel will have to be satisfied you have obtained the information required for the environmental assessment having regard to the requirements of the CEAA and having regard as well to your terms of reference that are included in the Joint Review Panel Agreement.

More precisely, you will have to be satisfied that you have adequate information to, first, conclude as to whether the project is likely to cause significant adverse environmental effects

and, second, recommend what mitigation measures are required to prevent any such adverse effects to occur.

It's important to keep in mind that as a planning tool, environmental assessment and CEAA do not require identifying every technical detail of the proposed mitigation measures. But sufficient information about these proposed measures is required to ensure that they are technically and economically feasible and to be satisfied that the residual environmental effects are not likely to be significant.

Public hearings are a very important step in the environmental assessment process, one in which you will receive additional scientific and technical expert information.

And, equally important, one in which you will hear the views of the public and various organizations, including Aboriginal organizations, regarding the project and its anticipated environmental effects.

The determination that you will have to make regarding the adequacy of the information you received prior to put an end to the information-gathering phase and move to the

reporting one is a very important one and, I would add, a very difficult one in the current context, having in mind the situation in Japan.

Over the next three weeks, you will hear diverging views on this issue. Some who will appear before you being firmly of the opinion that you have enough information to move to the next phase. Others, and you already heard yesterday from some of them, will have an equally firm view that you do not have enough information.

If, ultimately, you are satisfied that you have all the information you need, you will then be in a position to move to the reporting phase.

If, on the other hand, you are of the view that you don’t have sufficient information, it will be your responsibility, as you pointed out clearly, Mr. Chair, yesterday, to ensure you obtain the missing information before moving to the reporting phase.

And, as you indicated yesterday, it will be, if you are in that situation, for the panel to then determine whether there should be additional opportunity to file written submissions and whether there should be additional opportunity

for public hearings. That will be your determination that you will have to make at that point.

With respect to our agency, the agency is a federal body established under the CEAA. The agency provides advice and assistance to the Minister of the Environment in performing the duties and functions conferred on the Minister by the Act.

The role of the agency in the context of an assessment by a review panel is not -- and it is an important point -- it is not to act as an expert for the real authority to provide scientific or technical advice to the review panel during the hearings.

This federal scientific and technical expertise resides in those various federal authorities that will appear before you over the next days, in particular, the staff of the CNSC, officials from Environment Canada, from Fisheries and Oceans Canada, Natural Resources Canada, Transport Canada, the Canadian Transportation Agency and Health Canada.

The role of our agency in the context of an assessment by a review panel includes

the three following functions that are described in our written submission, so I will just mention what they are rather than repeating what's in my written submission.

These three functions are: providing administrative support to the review panel; administering a participant-funding program to support public and Aboriginal participation in the panel process; and publishing from time to time a guidance and material to facilitate the conduct of the environmental assessments.

So, again, I will not repeat the details that are in my written submission with respect to these three particular functions.

But, in conclusion, the agency supports the environmental assessment that you are conducting in each of these three areas. Federal authorities and others that will appear before you throughout the hearings will provide you with their project-specific expertise and information with respect to the project.

Our agency and the Minister of the Environment are really looking forward for reviewing the important conclusions and recommendations that you will make upon completion

of the environmental assessment.

With that, Mr. Chair, I wish you all the best. And I'm obviously available to address any questions you may have for me.

CHAIRPERSON GRAHAM: Thank you very much Mr. Leboeuf.

I will open the floor now to my panel of colleagues and I believe, Madame Beaudet, you will be first.

--- QUESTIONS BY THE PANEL:

MEMBER BEAUDET: Thank you, Mr. Chairman.

Alors, merci d'avoir fait la presentation en anglais. On m'avait dit que se serais en français, donc je cherchais les traductions ce matin pour les différents mots. Je pense que pour tout le monde, il serait préférable de poursuivre la conversation en anglais, je sais qu'on a des bons traducteurs, mais pour pas perdre les nuances sur les définitions.

Alors -- my first point is about the signicant residual effects. I know that CEAA has raised a few times the program and the methodology that was used in the environmental impact assessment, and so I looked through the

different documents that we had to see why it was such, and I will explain myself.

For CEAA it appears that you defined the significance of an adverse effect with four points: The magnitude, the geographic extent, the duration, and the degree to which the adverse environmental effects are reverseable or irreverseable.

The confusion was that OPG had added to this probability of occurrence. And when we looked in the guidelines, this point was added there. When we looked into CEAA's review documents from -- from their personal -- it's called Staff Review Guide, and the number is SRG2.01-EIS-11NNNN-018.2 for the record, and it talks about environmental impact statement modeling.

It has also there, on the last page, there's no page numbers, that the reviewer should describe the residual adverse environmental effects in terms of likelihood and significance. And the last point is probability of occurrence.

For CEAA, and this is my question, I think the significance of an effect doesn't include the probability or likelihood that the effect will occur; am I correct?

MR. LEBOEUF: There -- there could be different way to ultimately make a determination as to whether an adverse environmental effects is significant and likely. The one that is proposed in the agency's guidance material is to look at it by asking essentially three questions. The first -- and this guidance material is referenced in my written submission.

The first is to determine whether the environmental effects is adverse. The second one is to determine whether -- assuming the effect is adverse, whether the adverse effect is significant. And the third is to determine if this adverse -- significant adverse effects is likely to occur. So this is really a three-step process, and it may be that the different methodology may allow to achieve the same result, but the one that the agency has been promoting over the years for guideance material is to look at it asking yourself these three following questions -- these three questions.

MEMBER BEAUDET: But in the last point, when you determine the significance, do you include as well the likelihood, because if you look at an event, for instance, that is beyond design

basis, it's one in a million times. If you look at the impact of -- of an accident, then, you know, it may be significant. But if it happens one in a million time, then it loses its significancy.

MR. LEBOEUF: Yeah. And in the case high impact or very significant environmental effects, when it's time to determine what are these impacts are likely to occur. And our guidance material, and you will see that, recommends in the absence of absolute certainty, that those effects are likely to occur, to take a prudent approach, and in case of doubt about the likelihood of these effects to occur, be more prudent than the opposite, and identify mitigation measures in such cases.

MEMBER BEAUDET: Yeah, that's my second point. Depending on the significance of the effect, the mitigation measures or the follow-up program is different. And so for you what would be the benchmark to establish -- to what extent you have to insist the mitigation measures or what should include the -- the follow-up program if the likelihood of an adverse significant effect is very rare?

MR. LEBOEUF: Well, I think you

would have to make the determination of what the most appropriate way to manage these type of environmental effects, having regard to the important of the environmental consequences. So the higher the consequences are the more careful you should be identifying appropriate measures, if need to mitigation measures, or follow-up measures.

MEMBER BEAUDET: Also in the *Canadian Environmental Assessment Act*, article 37(1)(a)(i):

> "The project is not likely to cause significant adverse environmental effects, or the project is likely to cause significant adverse environmental effects that can be justified in the circumstances. And responsible authorities, like in this case, DFO, CNSC, may exercise any power or perform any duty or function that would permit the project to be carried out in whole or in part. Or where taking into

account implementation of any mitigation measures, that the responsible authority considers appropriate, the project is likely to cause significant adverse environmental effects that cannot be justified in the circumstances."

And that's what you were meaning just now, in the way you prepare your mitigation measures.

Unendate is to decide or not if this project is causing environmental effects or we can say it does, but with certain circumstances the project can go ahead, or it can not go ahead.

MR. LEBOEUF: Your -- your mandate as a panel wearing your CEAA hat, is to make a conclusion as to whether the project is likely to cause significant adverse environmental effects, taking into account mitigation measures that you would propose. If your conclusion is that the project is not likely to cause significant adverse environmental effects, and that the responsible authorities accept your recommendation, then the

project will be allowed to proceed.

If your conlusion is that the project is likely to cause significant adverse environmental effects, that cannot be mitigated, then what Section 37 provides for is a mechanism for the responsible authorities to determine first if they agree with your recommendation and conclusions, and second, if they do determine if any such significant adverse environmental effects that cannot be mitigated are justified in the circumstances. This determination would be made by the responsible authorities with the agreement of the governing counsel, which is something that is provided for in subsection 37(1.1) of the Act.

MEMBER BEAUDET: What I have seen so far in -- in CEAA reports, the determination of a significant adverse environmental effect is always a qualitative judgment. There are different tables, as -- as you are aware, you know, high, low, moderate and you have a full table with different aspect. The magnitude, the geographical extent, et cetera, that finally helps you to determine if it’s significant -- I mean, if it’s an adverse effect or not.

For you, do you have any comments

on that? I mean, this must be every time there's a mandate that the panel can have some struggle as to determine -- because there's no quantitative data in that judgment, so are you doing any research of that? Do you have any comments, what -- are we progressing on this?

MR. LEBOEUF: I don't -- I don't remember the exact words that I used at the time, but a judge in the Federal Court of Appeal about 12, 15 years ago referring to that notion of significance as it is used in CEAA, saying that by definition, reasonable people will always disagree on whether an impact is significant or not. This is, at the end of the day, a relatively subjective determination.

Our guidance material provides that when -- when it is possible to do so, this assessment should be done using a quantitative approach. But when data to proceed in that way are not available, then it is appropriate to proceed by way of a qualitative approach as you noted in many reports.

MS. BEAUDET: If I may, Mr. Chairman, I'd like to ask CNSC more details about how they function especially with this document

which is a Staff Review Guide. Is there any document or guidance that are given to the proponent when they prepared the EIS?

CHAIRPERSON GRAHAM: Ms. Thompson, do you want to -- or Patsy Thompson, do you want to answer that?

MS. THOMPSON: Yes. Patsy Thompson for the record. Essentially the CNSC has done over 40 environmental assessments since the *Canadian Environmental Assessment Act* was revised in 2003. We have developed essentially the Staff Review Guide that Madam Beaudet just referred to. It was drafted based on the experience of CNSC staff had developed over the course of doing environmental assessments and using the agency guidance.

Many of the environmental assessments that have been done, have been done for modifications to existing sites or for projects where the project was defined in terms of the -- the technology and -- and the activities. What we found is that with the improvements in -- in the science of ecological risk assessments and the determination of environmental effects, that we've been able to use the quantitative risk assessment

methods to be able to define in numerical values or using information on, for example, populations of fish, to be able to define criteria that would be used for, for example, magnitude geographical extent, duration of impacts and the reversibility because the assessments are done for while the plant is operating and then when decommissioning and later so that we have a sense of whether the environmental impacts would change over time.

And so the Staff Review Guide is based on essentially the expertise that CNSC has developed over time. Many of the environmental assessments or some of the environmental assessments that we've done have been comprehensive study reports that have been submitted to the Minister of Environment and have been found to be acceptable by the Minister for decision-making.

In terms of the -- the likelihood of -- of a significant environmental effect, many of the assessments that are being done for accidents and malfunctions for nuclear facilities, are based on essentially detailed safety analysis and -- and the safety methods are quite well-developed and -- so that we are able to identify categories of accidents with probabilities of

occurrence. And we have integrated this information into guidance for significance.

We do make that -- that guidance available to proponents, but not -- probably not always in -- in written guidance; we try to incorporate in the -- in the guidelines that are being drafted and then are used by the proponents.

CHAIRPERSON GRAHAM: Thank you, Ms. Thompson.

MEMBER BEAUDET: I have one more question. When we had our technical meeting in June with OPG, they referred to an environmental impact assessment they did for the refurbishment of Pickering, and I went back to the CNSC document and further contacts of -- for the determination of significance, the permeability is included in the criteria that you're supposed to use to determine the significance. As you say, and correct me if I'm wrong, most of the EIS that were done were for furbishing or -- very few for new nuclear. I think we are the first one. And so I would like to hear what you're going to do now with -- if they're new projects. I mean, the significance has to be determined first before the likelihood of having them. You have to see what would be the

consequences -- what would be the appropriate mitigation measures or follow-up before you determine the likelihood or not of the event?

MS. THOMPSON: Patsy Thompson.

You're right. We have done or are in the process of doing assessments for new projects, for example, new uranium mine projects. I think one of the -- the challenges that OPG's proposal for the new reactors at Darlington pose was the lack of information on the final reactor -- the reactor technology that would be chosen. And essentially, to be able to determine the significance in this kind of project, we requested that OPG develop potential emissions to the environment using industry practices with proven mitigation measures. So the -- the information that is provided in the EIS and the technical support documents are not just, for example, releases to the environment or bounding releases to the environment. There is technical background information that was available to make a determination of whether the mitigation measures were real or fictional essentially so that we could have a judgment on -- are the projected releases something that we can rely on for EA purposes.

So there -- there are descriptions of mitigation measures and safety systems at a high level granted, but they're based on engineering and scientific analyses that have been done on existing designs and what is normal for new -- new reactor designs.

MEMBER BEAUDET: Thank you. I'm not saying OPG is wrong here. I think they followed the guidelines; they followed everything, what I'm saying is there's a doubt as to how the significance of the effects were determined. Thank you.

MS. THOMPSON: Thank you, Monsieur Leboeuf.

CHAIRPERSON GRAHAM: Thank you, Madam Beaudet. Mr. Pereira?

MEMBER PEREIRA: Thank you, Mr. Chairman. I just have one question. In your panel member document you describe two funding envelopes, the regular funding envelope and the Aboriginal funding envelope and you provide some figures as to how much was awarded in each of those envelopes. Could you indicate whether the envelopes are fully used or whether there was additional demand; whether there's been more appeals for funding and

how were those -- were those demands satisfied to the satisfaction of participants?

MR. LEBOEUF: I do not have with me the numbers in terms of the initial funding request that were submitted to the agency. That's information, however, I could easily find and submit to -- to the panel if you're interested in having this information.

It is important to keep in mind that the purpose of our participant funding program is not to provide full financial support to cover all aspects of the financial implications of participants in the process. We hope to provide them some support to participate in the process. So it is not intended to cover everything, but to assist in their participation in the process.

But I will identify what the initial funding request was and I will get back to the panel with that information.

MEMBER PEREIRA: Just a general comment then, with these programs do you -- and in CEAA's experiences, are these -- do these generally meet the needs of -- of applicants or is there satisfaction with what CEAA does in these programs?

MR. LEBOEUF: That's our

understanding, yes. We conducted an evaluation of our program last year and overall the level of satisfaction was very high. Not surprisingly we heard from many that the amounts allocated were not enough in their perspective.

CHAIRPERSON GRAHAM: Thank you, Mr. Pereira. I think we'll introduce this as undertaking number four for the record to have this information provided to the panel.

CHAIRPERSON GRAHAM: And -- before we wind this one up, I'll ask OPG do you have any questions to CEAA on this matter.

MR. SWEETNAM: Albert Sweetnam for the record. We have no questions.

CHAIRPERSON GRAHAM: Thank you. In the essence of getting -- trying to -- maybe not get back on schedule, but at least trying to get as much heard today as possible, do any of the interveners want to have one question? If you do, there's a microphone at the back of the room and I would entertain several questions -- several different interveners if you keep it very succinct.

--- QUESTIONS BY THE INTERVENERS:

MR. MATTSON: Yes, very succinct. Thank you, Mr. Chairman, and good morning.

Just one question; the funding provided through CEAA is -- the applications for funding and the actual awards and what the money is to be paid for is online; is it not, sir?

MR. LEBOEUF: Yes, it is.

MR. MATTSON: Thank you.

CHAIRPERSON GRAHAM: Thank you very much. With that information probably undertaking number 4 is not necessary if it is online.

MR. MATTSON: But not the amount though; the initial amount.

MR. LEBOEUF: If it is sufficient I'm giving you the procedures to just access this online.

CHAIRPERSON GRAHAM: Is it the amount each one has been awarded?

MR. MATTSON: Yes.

CHAIRPERSON GRAHAM: Plus the request ---

MR. MATTSON: Yes.

CHAIRPERSON GRAHAM: --- that they put in, say -- and what percentage?

MR. MATTSON: Yes.

CHAIRPERSON GRAHAM: That seems

fine. Is that satisfactory Mr. Pereira?

MR. PEREIRA: I will review and confirm that everything's there. If it's not all there, I will submit additional information.

CHAIRPERSON GRAHAM: Okay, well, we'll just note understanding (sic) number 4 and leave it on the record and then if the Secretariat want to remove it then afterwards we can.

That concludes your participation for today. I want to thank you very much for presenting before us this morning -- this afternoon, I guess. And like Mr. Mattson, I've still got morning on the mind.

Anyway, I want to thank you very much and safe travels to your next meeting. Thank you very much.

MR. LEBOEUF: Thanks a lot.

CHAIRPERSON GRAHAM: Before we go into the next agenda item, in my notes for this morning, we had -- undertaking number 3 was the report that OPG had given -- the understanding they would produce regarding questions from Madame Beaudet yesterday. And we have been giving that information. So we will take that off the record as one of the undertakings that is now complete.

Is that satisfactory Madame Beaudet?

MEMBER BEAUDET: I'll have questions. But I think the agenda this afternoon is ---

CHAIRPERSON GRAHAM: Yes.

MEMBER BEAUDET: --- full enough. We'll take another day.

CHAIRPERSON GRAHAM: Just to forewarn to have some answers.

Thank you.

Now, we will go into the next group of presenters or next presenters. And this is the one where we're having the seismic information provided.

And do you want to read this or what? Okay.

Okay, yes, I guess the way we're going to handle this is that I'm going to call on Barclay Howden and in light of the events of the last 12 days in Japan, the Joint Review Panel determined that it would be beneficial to have a brief decision -- discussion, pardon me, and presentation regarding seismic issues as they relate to Canada and the Darlington site in

particular.

Today's agenda has been adjusted to allow time for these discussions. And we're going to begin with NR Canada, but I think Barclay Howden from CNSC, the floor is yours to introduce the people involved to do the presentation.

Thank you very much.

MR. HOWDEN: Thank you. Good afternoon, Mr. Chair and members of the panel.

For the record, my name is Barclay Howden. I'm with the Canadian Nuclear Safety Commission. Behind me today is Dr. Patsy Thompson also with the CNSC. And at the front table is Dr. David Scott, Director of the Geological Survey of Canada, Northern Division.

With us to present to you today are Dr. Maurice Lamontagne also at the front table, a seismic specialist, from the Geological Survey of Canada within NRCan. Next to me on my left, Mr. Gerry Frappier, Director General of Assessment and Analysis at the CNSC and to my far left, Dr. David Newland, Director of New Major Facilities Licensing Division at the CNSC.

Today Dr. Lamontagne is going to provide a presentation on seismicity in Canada.

Mr. Frappier is going to present information on the events in Japan. And Dr. Newland will be providing you with our view on how these events relate to the environmental assessment and the licence to prepare a site for the new Darlington project.

At the end these gentlemen will be prepared to respond directly to questions from the panel supported by our staff.

First of all, I'd like to turn the floor over to Dr. David Scott to introduce the Geological Survey of Canada and Dr. Lamontagne.

MR. SCOTT: David Scott, for the record. Good afternoon Mr. President and members of the panel and members of the public.

Natural Resources Canada is pleased to participate in this Joint Review Panel process today.

The Geological Survey of Canada which is a part of Natural Resources Canada has a mandate and a long history of creating geoscience knowledge of Canada's landmass and providing this information to the public to support decision-making processes.

As per the panel's request, my colleague, Maurice Lamontagne, will share with you

his knowledge in a presentation on earthquakes in Canada with an emphasis on seismicity in eastern Canada.

Dr. Lamontagne is well qualified to provide this information to you as he's Senior Research Scientist at Natural Resources Canada. His academic credentials include a Bachelor of Engineering degree from the University of Laval and graduate degrees in geophysics including a Masters degree from the University of Western Ontario and a Doctoral degree from Carleton University. His graduate research studies focused on the seismicity of eastern Canada.

Dr. Lamontagne has 25 years of service with the Geological Survey of Canada and is recognized across Canada and internationally as an expert in the seismicity of eastern Canada. I present to you Dr. Maurice Lamontagne.

--- PRESENTATION BY DR. LAMONTAGNE:

DR. LAMONTAGNE: Good afternoon. My name is Maurice Lamontagne and I will present -- my presentation is on earthquakes in Canada.

Okay, I'll start with what is an earthquake? Well, we start with like two blocks of rocks. And in general these two blocks of rocks

can be fractured by what is called “faults” that can be quite old and they are in general pre-existent in the earth’s crust.

And then with time and because in the earth’s crust you have stresses that accumulate; these stresses if they are sufficiently strong, they will slowly deform the rocks, but not so much in something we can easily measure, but they will deform the rocks.

And then when they exceed the resistance of the fault, it leads to an earthquake which is really a slip on a fault surface. And when this occurs, this releases a series of seismic waves.

In this case, we’re seeing the P waves which travel very fast in the earth’s crust and across the whole globe, in fact. And they’re followed by the S waves or secondary waves. Secondary waves have lateral motion and they are those that cause damage.

And when the slip is sufficiently strong then these waves can actually cause damage. If the slip is sufficiently large, the slip, as you can notice, we used to have a continuous layer here that has been displaced out of the fault surface.

If it’s sufficiently strong, then the rupture can reach the surface and that can induce additional damage or if it’s under the ocean, it can actually trigger a tsunami. So that’s the basic.

We very often hear about earthquake magnitude or the magnitude on the Richter scale. It’s certainly a number, but it’s an important number because it refers to the actual rupture that occurs.

So when we are talking about a magnitude 5 earthquake versus a magnitude 9 earthquake, it’s very different physically. And how is it different?

Well, in this figure, you can see that what is shown in yellow here represents the actual rupture surface. That’s the surface on the fault plane that actually ruptured. The bigger or the larger the rupture surface, the larger the earthquake. So if I use a 3D model like this one so we’re talking about rupture, that’s the entire plane that slips. And when I was saying that it’s the actual surface, in a real earthquake, it will be only a portion that will rupture.

In the case of a magnitude 5, it’s about a diameter of 1 kilometre that will rupture.

In the case of a magnitude 9 -- I have to reverse it to something like that -- we're talking about rupture plane that has many hundreds of kilometres of surface.

We're talking, in the case of Japan, for example, they're still working on the model, but we're talking about 600 to 700 kilometres by about 100-kilometre. So magnitude 5, 1 kilometre and magnitude 9 is just huge. Okay, so that's very important.

What does that mean? That means that when you have a magnitude 9 it will start rupturing, but it will not be all like that over 900 or, let's say, 600, 700 kilometres.

It will start rupturing and then it will slowly progress, and what does that imply? That implies that once it starts rupturing, it will send its seismic waves, it will continue rupturing, rupturing, and then at any place it ruptures, it sends new seismic waves.

The seismic waves can pile up, making the ground vibrations stronger. Not only stronger, they will last longer and, in the case of Japan, the entire rupture lasted between two and three minutes. And, naturally, the ground

vibrations were intense, but they were actually very long.

In the case of a magnitude 5, so it's only 1 kilometre, and it's only a few seconds at the most over which there will be rupture. Naturally, the intensity of the vibrations will be much less and the duration will be also much less.

And this is what I show in here, and you can see that what we call the hypocentre is actually where the rupture actually starts. And then after a while then, the rupture will have ruptured the surface in yellow.

What we call the epicentre is actually the point on a map where the rupture started and you can see it's a fault line on the surface. In this case, the rupture did not reach the surface, therefore, there's nothing on the surface that will be seen.

In the case of a magnitude 5 because it's only 1 kilometre, if the hypocentre is sufficiently deep, then there won't be anything seen at the surface. We will know that it occurred because the ground vibrations would have been recorded at the surface.

In case of the magnitude 9 in

Japan, the rupture was many hundreds of kilometres. And what we call the rupture, the displacement on the fault -- that is to say, the amount of displacement of one block in respect to the other -- was in the -- probably between 10 and 15 metres.

And when this rupture of 10 to 15 metres reached the bottom of the ocean, it pushed all the whole -- thousands of metres of water on top and that triggered the tsunami that caused the damage we saw.

But for a magnitude 5, at maybe -- let’s say at 10, 15 kilometres of depth, that’s not something that’s possible because the rupture is very small and then the rupture doesn’t reach the surface.

The next one. So for the earthquake magnitude, we saw that depends on the size of the reactivated fault surface. For what you call large subduction-related earthquakes, the magnitude can reach -- and can exceed, in fact -- magnitude 8. And, in fact, almost all of these magnitude 8-plus earthquakes occur at what we call plate boundaries. We will see that in a minute.

Earthquakes below magnitude 2.5 are too small to be felt but they can be detected

by seismograph stations. When you get into magnitude 4s and greater, the ground vibrations will be recorded by seismographs but, in addition, it can be felt over fairly large areas.

Last week we had an event near Hawkesbury in Ontario, a 4.3, and it was felt to a distance of about 100 kilometres.

If you are near the epicentre, magnitude 5 is about the minimum magnitude to make light objects fall, if you're very close to the epicentre. And when you get slightly above magnitude 5 at around 5.5, it can start causing some damage to chimneys, for example, that are very brittle in general and they can be damaged in an earthquake.

In the history of Canada, historically, the largest event is estimated to be magnitude 7. I don't quite like that .0 here, because it's an historical earthquake. It was in 1663, it was in the Charlevoix region near Quebec City and the magnitude is only estimated from the written descriptions of that earthquake, so that's why it's an estimate.

Almost all earthquakes are weaker than magnitude 5s in eastern Canada. That is to

say on a yearly basis the average is maybe 2 or 3 magnitude 4s then you go by steps of 10. Every time you down one, they need to -- so we can expect about 30 magnitude 3 -- between 3 and 4, and then many more between 2 and 3.

And then almost all earthquakes are weaker than magnitude 5, which is below the threshold that might cause damage to engineering facilities.

If we look at the global picture of earthquakes, and you recognize the global picture with the topography, and if we plot all the -- for a 20-year period -- of all the earthquakes of magnitude greater or equal to 0, this is more or less what you would see.

We would see that they don’t occur at random over the entire globe; they concentrate in certain areas. And, in fact, it’s even more striking if you go to magnitude greater or equal to 7.7 represented by these yellow circles here.

You can see that they occur mainly around the Pacific, and it’s related mainly to what we call the plate boundaries. That’s where the tectonic plates collide or have relative motions to each other.

Okay, you can notice also that when -- for this 20-year period, we only had 1 earthquake; I think it was in 1989. So that was in the Ungava Peninsula of Quebec, but for any 20-year period this will be pretty much the image you would be getting.

And I was saying that it's related to plate tectonics, and what you see here are the major plates on the globe. So the globe, more or less the outer shell of the earth, is broken into these large plates that have the dimensions of continents really. And what I have shown with arrows are the relative motions of these plates in respect to each other.

So we can notice that in Japan, for example, the two plates are converging towards each other whereas in some places like the San Andreas fault that is very well-known, you can see that the two plates slide past each other.

And then under the ocean in some places you will actually push the two plates away from each other, and that will lead to volcanic activity.

But you can see that around the Pacific where we had most of these earthquakes in

yellow, the magnitude 7.7 and greater, that's where most of the subduction earthquakes are actually; that's where most of the bigger ones are actually.

In offshore British Columbia, we are in the situation where we have all three possibilities in a sense. We have what you call spreading centres, we have subduction zones, and we also have strike-slip environment, as we're going to see in a minute.

But in eastern Canada, we're right in the middle of the North American Plate. That's why we would call our earthquakes intra-plate, that is to say, within a plate.

On a global scale, many set-ups of all the energy released by earthquakes is on plate boundaries. That leaves only about 3 percent of the energy released for these intra-plate earthquakes. And the reason is that the energy is really released in these big earthquakes. Smaller ones of magnitude 5 or 6, they release very little energy compared with these magnitude 8 and greater.

These plate boundaries hinted that they were of three types. So we have here the type of margin which could be divergent, and you can see that the two plates are moving away from each

other. That's what we see under the Atlantic Ocean, for example, very small earthquakes, in general magnitude 5 maybe up to 6, but not any greater.

If I go all the way to the right, the transform environment where two plates slide past each other, that would be the San Andreas fault.

And then we have the convergent zones, where you have one plate sliding under the other, giving rise to earthquakes. And in this environment, the earthquakes can go from the surface, that is to say 0 kilometres of depth, down to 670 kilometres of depth.

When the rupture we're talking about is fairly shallow, say in the top 50 kilometres, then it can lead to a tsunami. And that's where most of the big tsunamis are happening.

So if I go with another 3-D model, I would have the Pacific Plate on this hand, that would be Japan, and then the plate of the Pacific would slide. It will take time to build up the strength, but then eventually it will go down all of a sudden. And when this happens, the crossing

top rebounds just like a diving board and that's what pushes the water on top giving rise to a tsunami.

And that's the situation we have in offshore British Columbia which is similar -- which is analogous to the situation in Japan except that in Japan we didn't have a ridge like that.

So offshore British Columbia, you have spreading, convergence and then one plate -- in this case the Juan de Fuca plate which slide under the other.

It's locked for hundreds of years. And then all of sudden one day, this energy gets released, this plate goes up, this one goes down and that gives rise to the tsunami that can come offshore -- it can come onshore, excuse me, and it can also go in the other direction.

You also notice that offshore the Queen Charlotte we have a fault that is similar to what we find in California.

How do we know about earthquakes in Canada? We have a network of seismograph stations and it's fairly high density; we have over 100 probably 150 seismograph stations by now. And then in eastern Canada, we have a network that is

fairly dense.

That can vary with the years; sometimes we'll identify parts of it for special studies. And that's what you see in, for example, near Yellowknife. And that's what we had in southern Ontario for a little while.

The seismograph network is such that it can detect earthquakes that are even smaller than those that can be felt by people. And all this information goes into what we call the "Canadian National Earthquake Catalogue" that is online and available to anyone.

And it's an authoritative inventory of earthquake locations, magnitude, depths, felt reports and so on. It's based on written historical accounts, that's for the older earthquakes so when we didn't have instruments to record them. And then after about 1900, we started having instruments to actually detect them.

NRCan seismograph network can detect all earthquakes rated a magnitude 3 anywhere in the Canadian territory and again, 1, 2, 3, wouldn't cause damage but it could be felt if you were very close to the epicentre.

There's some populated areas that

denser station network allows us to detect earthquakes as small as magnitude 1 on the Richter scale, so very tiny ones. And even in some areas it can be as small as 0 on the Richter scale which is very small.

If the earthquake can be felt, we can record and measure it, there's no doubt about that.

This map shows -- it’s our record of the magnitude 6 and greater earthquakes in Canada and smaller events that were notable. That was an exercise we did a few years ago for the Atlas of Canada that has a special map on earthquakes in Canada.

So as you can see, there's a lot of activity on the west coast and again this is related to plate tectonics when we were saying. And then in the east, you will notice some dots. Most of them -- if they are greater than 6, you see they would be 1921 -- 1929, excuse me, that was the Grand Banks earthquake, magnitude 7.2 that caused a slump -- that generated a tsunami that went onshore and killed people in the Burin Peninsula in Newfoundland.

So it’s not so much a rupture,

there was no rupture; it's the slump that induced the tsunami.

In Charlevoix, like I was saying previously, we had a magnitude 7 in 1663 and a magnitude 6 in 1925. Magnitude 6 was in 1935 here in Témiscamingue as we will see later.

But these earthquakes were not necessarily major; they were listed there because they had some impact on houses for example.

Historically we've never had a collapse of a building in Canada but we've had history of damage to chimneys, masonry buildings and so on. And that's why as soon as I was saying some damage to chimneys; they would enter in this database of earthquakes with impact.

And as you can see, most of them are concentrated along the Saint Lawrence and also we have some ones that are somewhat isolated.

This one was on the U.S. side, it was in 1929, an earthquake slightly more than a magnitude 5 on the Richter scale, it was near Attica, New York.

I wanted to show you about -- in 1700, we had a large earthquake and we know about this one because it triggered a tsunami that could

be dated. And we know this is a mega thrust earthquake offshore B.C. similar to what they had in Japan last week.

And we also expect eventually an earthquake of that size offshore B.C. Naturally the return period is about 500 years, so it takes a long time to accumulate this energy.

And then in 1949, we had a magnitude 8.2 in the Queen Charlottes along a fault plane that is subvertical like that, a bit like the San Andreas Fault.

If we look at earthquakes in eastern Canada, earthquakes that can be felt in eastern Canada are fairly rare, only a few every year.

They occur mainly in well-defined zones, characterized by many tons of small -- smaller than 1, 2, 3 earthquakes annually. So most of them occur in fairly well-defined zones, they don’t occur at random.

Most earthquakes that have caused any damage have occurred in these known seismic active zones and we will see them in a minute.

Most earthquakes occur at depths between five and 25 kilometres of depth. So this

is well within the earth crust but that would be from the mid to the upper crust.

And they represent reactivation of old faults that exist in the pre Cambrian basement or if you prefer that what we call the “Canadian shield” that also is present even if it’s not always seen at the surface. We know it exists at depth and most earthquakes occur within the Canadian shield.

All of these -- from the history of earthquakes we only know of one earthquake that is known to have ever caused a false surface rupture. That is to say, the rupture reached the surface and it was actually visible along the fault that motion had occurred. And it was in 1989 in the Ungava Peninsula of Quebec.

And to get a surface rupture in general, it has to be fairly close to magnitude 6 or it has to be greater than that. A magnitude 5 is generally too deep and too small to cause any rupture.

Faults at the surface are not necessarily seismically active, very often of California we think any fault is active. But in the Canadian Shield; it’s not true at all. There

are faults everywhere in the Canadian shield because it's quite an old geological environment. It has faults that were created over millions and even billions of years.

But it's not because of a fault that you will necessarily get an earthquake.

The Canadian National Earthquake Catalogue in our knowledge are the basis for the -- what we call the "seismic hazard maps" and that's what we will see in a few minutes.

This is a map that shows you the distribution of earthquakes, this map is fairly representative of what we get on a regular basis. And as you can see they are concentrated in certain areas.

The circle -- or the ellipse represents one of these concentrations which we call the "western Quebec seismic zone." It's a zone that has about -- between 60 and 70 small earthquakes recorded every year.

And then, historically, you had some damaging earthquakes. The damaging earthquakes are not necessarily greater than 6.5, I don't want people to think they're bigger than 6.5, it's just that they had an impact.

And for example, there was 1935 in Témiscamingue, 1944 near Cornwall, 1732 very close to Montréal that damaged many buildings there.

Another zone that’s quite active is the Charlevoix seismic zone, this zone has known five earthquakes of magnitude 6 -- between 6 and 7 in fact historically.

And then finally there's another zone that we call the “lower Saint Lawrence zone.” A zone of concentration of activity again.

In Charlevoix, because we have a very dense network, we record between 200 and 250 earthquakes every year.

And then in southern Ontario, you can see also that there’s some activity but it’s usually of much lower level.

This knowledge is integrated into what we call the “seismic hazard maps” and the seismic hazard maps are –- estimate a shaking that the new buildings are required to withstand under the National Building Code of Canada.

So this is the latest versions of the seismic hazard maps. It shows the hazard at the given period of .2 second, and you can see zones in red represent an increasing hazard. The

bull’s eye here represents a shot of our seismic zone because historically it’s been very active, in New Orleans, also very active. But you can see also or recognize the Western Quebec seismic zone and then the lower St. Lawrence seismic zone.

And in between, you can see zones of red, it’s because we know that there are faults that could give rise to activity there. That’s why the hazard is rated higher than, for example, elsewhere in the Canadian Shield. And you can see here a zone of low to moderate activity, and that’s related to this Attica Earthquake of 1929 and also the low level –- low level of activity in that area.

If we look at the map of all magnitude 5 and greater for the period June 1900 until to date, this is the picture we would be getting. We see that most of the magnitude 5s, including the 1935 magnitude 6.2 earthquake, are concentrated in the Western Quebec seismic zone. Then we have the Attica, New York Earthquake, and then a few others in Ohio. So most of them are very concentrated in these recognized zones.

In conclusion, the large earthquakes, the magnitude greater than eight, are

expected near plate boundaries such as subduction zones. Eastern Canada is considered an intraplate environment because it is well away from the plate boundaries. In such an environment, we have low level of earthquakes, but we have also some well-defined zones that are recognized as being more active, and one of them is certainly Charlevoix, which is the most active one.

Historically, most Eastern Canadian earthquakes occur in these well-defined zones, but they've triggered some damage that is considered relatively minor. No collapse of buildings or anything like that.

The region around Lake Ontario is one of low to moderate seismicity. Earthquakes elsewhere in the Canadian Shield are even more rare than what you find around Lake Ontario, but Lake Ontario, low to moderate seismicity.

Historical observations and more recent continuous records of earthquake activity are used to develop the seismic hazard matter maps that they find the seismic provisions of the National Building Code of Canada, and that's integrated in the construction of new buildings. Thank you.

CHAIRPERSON GRAHAM: Thank you very much, Mr. Lamontagne. Questions? Yes, direct questions to Pereira.

--- QUESTIONS BY THE PANEL:

MEMBER PEREIRA: Thank you, Mr. Chairman. You –- you say that in the area around Lake Ontario we have low to moderate seismicity, so when you say that, what sort of earthquakes could one expect to encounter there over a period of, say, 100 years? Can you –- is that –- does that translate to a range of magnitudes and excitation frequencies?

DR. LAMONTAGNE: I have to check my notes in terms of earthquakes in the area because I have some statistics. Okay, yeah. I have that since 1900 there were about 143 earthquakes that have been recorded within 100 kilometres of the Darlington facility. All were small. The largest one within the 100 kilometres was magnitude 4.1 in St. Catherines in 1954. The strongest shaking experienced at Darlington in the last 110 years was from several moderate but more distant earthquakes that produced motions in the one to two percent G range corresponding to mild shaking that would be felt by some observers if you

were at the site.

The probability of a magnitude 6 event is less than 1 in 500 years in Southern Ontario in the addressing Great Lakes Region, so it's a bigger region. So that's what I have.

MEMBER PEREIRA: So I hear you say one- to two-percent G is the range there, so in terms of the Building Code –-

DR. LAMONTAGNE: Excuse me, the one- to two-percent G range was what was experienced –-

MEMBER PEREIRA: Experienced.

DR. LAMONTAGNE: –- in the last 100 years.

MEMBER PEREIRA: So in terms of what the Building Code would –- would consider for that area, what would they go with based on this record? Would it be higher than two percent G?

DR. LAMONTAGNE: I would have to double check. I'm sorry. I don't have this number with me.

MR. PEREIRA: That's okay. Just for clarification. Now, the seismic hazard map, this is developed based on measurements taken over a period of time. How often is that hazard map

updated, and on what basis would it be updated?

DR. LAMONTAGNE: Okay. I can tell you that the previous versions, there was one in 1970 that was purely deterministic. It was updated in 1985 using a more statistical basis, and then it was finally updated or graded in 2005.

MR. PEREIRA: So when you say a statistical basis, is that a probabilistic approach?

DR. LAMONTAGNE: That's what I -- I meant. I'm sorry. I was looking for my word there. Exactly.

MEMBER PEREIRA: And how different would the -- would that be in terms of how seismic tolerances is analysed? Like, right from a deterministic approach to a probabilistic approach, is this sort of a superior approach, or in what way is the probabilistic approach different from a deterministic approach in terms of what comfort the public can get?

DR. LAMONTAGNE: Okay. It's certainly considered better, and that's why most seismic hazard maps now are probabilistic because they -- they are better defined, and they don't rely only on the historical knowledge. So you go

into something that's related to more or less the seismicity budget, and in the case of the latest version, what was interesting is that some geological knowledge was integrated for the first time, whereas before, it was purely seismological more or less like the seismicity budget. But in the 2005 version, there were –- there was this knowledge that normal faults that you find along the St. Lawrence Valley could lead to earthquakes that are not present in the historical –- historical catalogue of earthquakes, and that's why this 2005 version is better. And in addition, we moved to lower probabilities.

MEMBER PEREIRA: Thank you. And the probabilistic approach, is this an approach that is used now elsewhere in the world, or is it adopted by the international community? Would it have been used by the Japanese, for instance?

DR. LAMONTAGNE: For Japan, I don't have this information, I'm sorry, but I can tell you that in North America, this is certainly the preferred approach nowadays as a –- in the US as well as in Canada.

MEMBER PEREIRA: In terms of the area around Lake Ontario, you talk about a –- a

monitoring network. Could you describe what –- what stations we have, where do we have monitoring stations around Lake Ontario and in Eastern –- Eastern Ontario?

DR. LAMONTAGNE: We have the permanent network, which was augmented by a series of stations around the –- we call that the Golden Horseshoe more or less. That was to monitor these small earthquakes and to learn more about that, and they were in operation since about year 2000.

And the advantage of this is that the earthquakes could be better located certainly, and also you could detect much smaller ones from which you could learn more scientifically. So it was really –- it showed that it’s really the western part of Lake Ontario that was –- that was active for these tiny ones. And there are reports in the literature about that, and it was done by scientists at the University of Western Ontario.

MEMBER PEREIRA: Now, in the historical record and in what is predicted from your probabilistic hazard approach, what sort of damage would one expect to –- to incur in large civil structures in the area around Darlington based on what you’ve forecast for the next 100

years? Is there –- can you give some sort of idea? I guess it depends on the type of building, but –- and so it's a very difficult question to answer, but given what you know, can you see significant damage from the historical and the predicted record of -- of earthquakes.

DR. LAMONTAGNE: I will say that because we consider the -- the likelihood of certainly a magnitude six we were saying that's considered fairly low, find it a bit arduous to get into this.

If we're talking about normal buildings, there's no doubt that the older ones, the older buildings built of masonry that were built prior to the introduction of -- of seismic resistance in building codes, these are most at risk. And that could be for earthquakes, I would say, in the five and a half range. Then you would start seeing damage, for these old buildings. Nowadays, though, the newer buildings are supposed to be more earthquake resistant.

MEMBER PEREIRA: Thank you, I'll follow up on that issue with the CNSC when they come to discuss the design for (inaudible). Thank you very much.

CHAIRPERSON GRAHAM: Thank you, Mr. Pereira, Madam Beaudet. I don't want to ask no questions. I have one question, and I think it's been a concern indicated in some -- many levels. The earthquake in Japan did not cause as much damage as the tsunami afterwards, and of course the earthquake caused the tsunami, but is it -- is there any possibility that a tsunami could be -- could occur in Lake Ontario and affecting along the shores of Lake Ontario?

DR. LAMONTAGNE: I'm sorry, can -- can you repeat your question, please?

CHAIRPERSON GRAHAM: Is there any possibility, in all your models and so on, and the types of earth crusts that you explained and so on, could a tsunami occur followed -- an earthquake followed by a tsunami, could there be a tsunami in Lake Ontario?

DR. LAMONTAGNE: Yeah, I cannot be -- I'm certainly not an expert in tsunami. I can talk about the -- say the seismic input. Because the earthquakes are quite small around Lake Ontario, it would be very unlikely that you would get the surface rupture at the bottom of the lake that could give you the impulse. Naturally experts

in tsunamis could work from this inputting if we have such an input here as what it would cause, but this is outside my field of expertise, and I'm sorry about that.

CHAIRPERSON GRAHAM: I guess your explanation you gave with regard to faults and the different type of faults around --

DR. LAMONTAGNE: M'hmm.

CHAIRPERSON GRAHAM: -- three -- three different examples. The faults in -- and of course, on the Pacific are around all the Pacific and especially the ring of fire and so on. Has that -- are the faults in -- in this part of the world, in this part of Canada, especially Lake Ontario area, is -- are the faults similar or is it a different type of fault?

DR. LAMONTAGNE: Well, certainly around the Pacific and the Indian Ocean, we have these subduction zones. And as we saw, they can lead to very, very large earthquakes where tsunamis are something that happens when -- in these magnitude eight plus earthquakes.

Around Lake Ontario we don't expect such big earthquakes because as we saw previously, they're mostly in these subduction

zones. And Lake Ontario is certainly not a subduction zone, it's well inside the plates. So we don't expect the large earthquake that could cause a tsunami.

CHAIRPERSON GRAHAM: Okay. Thank you. Questions? Do you have another question? Okay.

Before I go to interveners, I guess Mr. Mattson, you are going to have a -- you're walking to the microphone to have a question. I'll allow one question and then we go to the other part of the presentation, which is CNSC, but I will allow one question.

--- QUESTIONS BY THE INTERVENERS:

MR. MATTSON: Thank you, Mr. Chairman, that's kind of you. And I just -- before I get to my question, there was a clarification from Member Pereira's question about the percent acceleration due to gravity as a result of a six Richter scale earthquake, and I didn't quite get the answer to that. Was there an undertaking, Mr. -- Dr. Lamontagne? That was -- what was the percent acceleration due to gravity as a result of a Richter scale six earthquake?

DR. LAMONTAGNE: Oh, okay.

MR. MATTSON: (inaudible) talking about 1 to 2 percent.

DR. LAMONTANGE: Okay. It's -- what I was saying was that historically, for 110 years of monitoring, it's estimated that the maximum ground acceleration for 110 years of recording would be between 1 and 2 percent g, and I think it's only an estimate, because to my knowledge I don't think there were -- there was a trigger of an instrument. So that's only an estimate I think.

MR. MATTSON: Yeah, I was thinking of the one in 500-year six Richter scale. I thought that was what Member was asking you about.

DR. LAMONTAGNE: Okay, but this I cannot answer at this time. I'm not --

MR. MATTSON: Could we get an undertaking to that though? The one in 500 year earthquake Richter scale, what the percent ground acceleration would be. And I know the 110 year one --

DR. LAMONTAGNE: Yeah.

MR. MATTSON: -- I think we need to know the 500-year one.

DR. LAMONTAGNE: Okay. That

naturally depends on the distance you are from the epicenter, and also on the focal depth, so it's not only magnitude six equals ground acceleration.

MR. MATTSON: Okay. Could you do it the same as you did if they were 1 to 2 percent?

CHAIRPERSON GRAHAM: Just through the Chair, Mr. Mattson.

MR. MATTSON: Oh, sorry, Mr. Chair.

CHAIRPERSON GRAHAM: And I think what I will do on this, so we don't get into a debate, the panel member, Mr. Pereira, will ask the question. If he was not satisfied with the answer he got, then we'll do an undertaking.

And I guess, Mr. Pereira, were you satisfied or not?

MEMBER PEREIRA: I am satisfied with the level of this presentation. I expect the CNSC staff to cover the issue when they talk about the hazard spectrum use for the design of the Darlington reactor, and I will be questioning him on the basis for what is -- having considered for the -- for the design of the Darlington reactor, justification of that. So that issue will be covered then.

MR. MATTSON: And, Mr. Chairman, (inaudible) but a follow-up question.

CHAIRPERSON GRAHAM: Okay. Mr. Mattson, I think we'll cover that under CNSC when they do the presentation, and then I'll give you an opportunity to ask another question then. And one other gentleman would ask a question, but I think we'll hold those until Mr. --

MR. MATTSON: Mr. Chairman, I think it'll be helpful on my question. That was just a clarification. I didn't understand if there was an undertaking or not. It helps in terms of trying to --

CHAIRPERSON GRAHAM: Oh, okay.

MR. MATTSON: -- help the board and be of assistance to this -- to this discussion and this environmental assessment. I only have one question.

CHAIRPERSON GRAHAM: Okay. But the patience for CNSC for the undertaking.

MR. MATTSON: I'll get to them too, I hope, if I could.

CHAIRPERSON GRAHAM: Okay.

MR. MATTSON: But Dr. Lamontagne, back in 1992 I was counsel at the demand supply

plan hearing, and there was discussions about ground acceleration on Lake Ontario, and that the American plants in Port Perry and Nine Mile Point on the American side were built to 15 g, and the Canadians were built to 3 g, and the concern was that there was a potential -- I'm not sure if those are factful, but there was a concern was that there were two new lineaments discovered, the Niagara lineament, and the Georgian Bay lineament mining under Lake Ontario, and they, in fact, crossed under the Darlington Nuclear Plant. And I'm wondering if you have any familiarity with those two lineaments, and whether or not you could inform the panel if they exist or if they've been ruled out. Thank you.

CHAIRPERSON GRAHAM: Mr. Lamontagne, do you care -- are you able to answer that?

DR. LAMONTAGNE: To my knowledge OPG commissioned professors at different universities to look into these problems. And I think there were internal reports that were sent to OPG on these topics.

CHAIRPERSON GRAHAM: Okay. Mr. Pereira, you had one follow-up question and then we

will go to CNSC and perhaps some of this -- some of these matters may be clarified.

MEMBER PEREIRA: Just a clarification on magnitudes and the Richter scale. The numbers are quoted, perhaps you could clarify as to the relative strength of earthquakes when you go from five to six to seven, and so on, so sort of the -- we can all understand what this means in terms of severity.

DR. LAMONTAGNE: We all know that for the general public it's the Richter scale, but among scientists we know that we don't use a Richter scale as traditionally defined. Traditionally defined by Charles Richter in 1935 is that if you have an earthquake and you're measuring its vibrations at -- say at 100 kilometres, a step from five to six or any step of one unit in the magnitude scale means that the ground vibrations will be multiplied by ten. So from five to six it would be ten times greater. From six to seven it would be ten times greater, but from five to seven it would be 100, and so on.

In terms of energy, and here is the confusion, is that from five to six is 30 times -- about 32 times the energy. So from five

to seven, would be 32 times 32, close to a thousand times more energy released and that's why these magnitude nine earthquakes are just incredible in terms of the energy released. They're beyond imagination compared with these magnitude fives.

MEMBER PEREIRA: And -- and that's an important point to consider because we're in this presentation now because of what happened in Japan where they had a 8.7 and -- so putting that in the context of this thought of -- of Ontario, we're talking about hazards which are significantly lower if -- if we believe what the network is telling us; is that correct?

DR. LAMONTAGNE: Excuse me, you said considerably smaller than --

MEMBER PEREIRA: What was experienced in Japan?

DR. LAMONTAGNE: Oh, absolutely. It's much -- the -- the level of hazard in -- in Ontario is not comparable to these large subduction zones that we -- we find around the Pacific. There's absolutely -- if we just look at the energy, like we were saying, it's -- it's many thousands of times smaller when you have a magnitude five.

MEMBER PEREIRA: And this is the evidence that you get from your monitoring network and your prognostic approach to hazard assessment for Canada?

DR. LAMONTAGNE: I'm sorry. You mean that it's considerably smaller in --

MEMBER PEREIRA: Based on your measurements and your hazard spectrum?

DR. LAMONTAGNE: Oh, absolutely these earthquakes we're measuring are very, very small. In fact I -- if you are talking about the magnitude two, you can get that only be setting off an explosion in a quarry for example. So they are very small. And magnitude five, in terms of energy, that's still very small compared to a magnitude nine. Magnitude nine, in fact, is quite surprising, but you have to consider that it's raising or lowering hundreds of kilometres of rocks at the same time so the energy is such that the earth is sent in a vibrating mode for days afterwards. It's incredible. They're in two different leagues really, the magnitude fives and the magnitude nines.

CHAIRPERSON GRAHAM: Okay, thank you very much. I think perhaps to expedite this as

well as possible, I'll call on Mr. Barcley Howden to introduce and -- introduce the topic from CNSC's perspective.

MR. HOWDEN: Thank you, Barcley Howden speaking. As I said before, I have Mr. Gerry Frappier and Dr. David Newlen (phonetic) who are going to present. It's a single presentation, but broken into two pieces where Mr. Frappier is going to talk about the events in Japan and then Mr. Newlen will be providing your view -- our view of the impact these may have on our view of the new Darlington project. And I think we may be able to answer some of the questions that have been posed by the panel. So I turn it over to Mr. Frappier.

--- PRESENTATION BY MR. FRAPPIER:

MR. FRAPPIER: Thank you, Barcley. Good afternoon. My name is Gerry Frappier and I'm the director general, assessment and analysis at the Canadian Nuclear Safety Commission. First of all I'd like to start off that on behalf of the Canadian Nuclear Safety Commission to offer condolences to all the Japanese who lost their loved ones; lost their lives due to the earthquake and the subsequent -- subsequently through the tsunami that -- that occurred there. I think we're

-- obviously as was just mentioned, an event of historic proportion as far as geology goes.

Today we're going to spread our presentation into two pieces. First of all we'll talk a little bit about the Fukushima event itself and then we'll talk about what we believe are the implications for the Darlington new build that -- that we're talking about. We've already talked a bit about seismicity and we'll talk about some of the -- the lessons that we've learned already from Japan.

Certainly immediately after the -- the event that happened in Japan, the Canadian Nuclear Safety Commission activated its emergency operation centre to monitor, support and learn from the events happening in Japan. We have a very strong linkage with other regulators, both the Japanese, the Americans, the British, the French and several others, as well as the linkage with the International Atomic Energy Agency.

So the information I'm going to present here is information based mainly on information released by the Japanese authorities who have the responsibility for managing the situation including the release of information

details. However, it is a -- still a changing event and we're not going to comment necessarily on hour to hour developments at the Japanese reactor.

This is a picture of the Fukushima site which shows the six nuclear power plants that are located at that site, four which are in the foreground, units one to four, and five and six are -- are viewed a little bit further down the -- down the coastline.

A little bit closer view of it, the first four reactors in -- in the foreground. The unit four is the closest reactor followed by then three, two, one and then further in the back is five and six. The high box or building that -- that you see a little bit to the left of those pictures is the actual reactor building and then the long lower buildings are the turbine halls that would have turbines and generators in them.

This is a quick cut-away view of a typical boiling water reactor similar to the one that the Japanese had at -- have a Fukushima Daiichi. The reactor pressure vessel is the brown cylinder in the centre. There's a steel primary containment which consists of the -- what's called the drywell or that light bulb-shaped steel vessel

surrounding the reactor and extending below. And then the wetwell or the torus, but basically that donut-shaped, if you like, that -- there is around the bottom -- ring around the bottom of the -- of the reactor.

The secondary containment is the square concrete building housing the primary containment. And particular to this design is the spent fuel storage pools which are located below the overheard crane near the top of the -- the primary containment vessel. You can see the -- the arrow showing the spent fuel pool. The fuel is stored there in vertical racks. I know most of the people in this room have experience with CANDU reactors and as you can see this is a design that is very, very different than -- than the CANDU design.

A bit of a schematic view of the -- the primary containment itself. Steam may be vented into the drywell. That’s the -- the donut-shaped torus at the bottom either from a loss of coolant accident or as in Japan, by automatic or manual pressure relief valve operations. That is if the -- if the pressure gets too high in -- in the main drywell, they can open a valve and release

it down into that torus. The vented steam bubbles through the water in the suppression pool, condensing the steam and removing little solid fission products. Gaseous fission products and any hydrogen that may be present if the fuel has been overheating, will collect above the suppression pool and both the drywell and the wetwell can be vented to the secondary containment to maintain -- contain the pressures below limits. So clearly in a severe accident situation like we have there, it's important to ensure that pressure doesn't get too high and so controlled venting is something that needed to be done.

The fuel assembly again, very different than CANDU facilities. Fuel is composed of ceramic pellets that are enclosed in a zirconium cladding which forms fuel rods that are 3.7 metres long. These fuel rods are then combined into an eight by eight fuel assembly matrix that's shown here. As I mentioned also within the containment is a -- is the spent fuel pool, a picture of which is shown here. These pools continue to be of concern in unit one and four and I'll talk about that in a minute, but clearly the -- the pools have to maintain cooling to maintain the -- the

integrity of the fuel.

I'm not going to talk too much about the cause of the earthquakes because we just had a much better presentation from Dr. Lamontagne than I -- than I could do, but I do want to just highlight a couple of things. First of all the importance of differentiating between earthquakes generated at the borders between seismic plates, the plate tectonic ones which is the case in Japan and as was mentioned in the West Coast of Canada, versus intraplate earthquakes experienced here in Eastern Canada which are generally much, much smaller in magnitude as Dr. Lamontagne said, really in a different league.

So to bring the earthquake magnitude that we've been talking about into the realm of engineering, we have to go through a -- a chart that goes a little bit like this: So magnitude is a measure of the energy released from the earthquake and there are very many magnitude scales, as was just mentioned the Richter Scale being perhaps the best known, but not as useful as some of the others. The potential effects on facilities depends not only on the magnitude, but also on the distance and the foundation of the soil

that the building lies upon. So hazards to a facility is dependant on the intensity of the motion that the building will see, usually expressed in terms of peak ground acceleration at the site.

And a facility is designed to withstand a ground motion with a certain intensity in annual probability which is the design-based earthquake.

So we start off with energy measurements which is important at the hypocentre or the epicentre but from a building perspective what we really want to do is talk about how much motion, what's the intensity of motion that the buildings in this case 1 and 2, are going to feel and we do that through discussions about peak ground acceleration.

And in this case, all things considered, equal building number 1 being closer to the hypocentre, you would expect to have a larger peak ground acceleration.

So it’s important to understand that there’s distance as well as size of earthquake that’s important.

We were just showing some charts

that -- indicating that the area around Darlington is a very -- a low to medium earthquake zone. This is a chart that shows all the earthquakes from 1985. And as you can see on the scale, there are quite small earthquakes in and around Lake Ontario.

Let's go back to Japan and talk a little bit about the Fukushima event. So just prior to the event, the six units which you can see here, their size in megawatt electric plus the year they came into service. Years 1, 2, 3, were normal operation; 4, 5, 6 were in outage at the time. Unit 4 in particular was in the process of being defueled.

The initiating event, as was just mentioned, was an earthquake magnitude 9 on March 11th centered offshore of the Sendai region which contains the capital Tokyo. The plant designed for a magnitude 8.2 earthquakes so a magnitude 9 is roughly about 8 times stronger in energy.

But most important is it was followed by a very significant tsunami and significant aftershocks measured in hundreds and hundreds of aftershocks, some of which were over 6 and even over 7 so really quite earthquakes in their own rights.

So what happened at the site? So our understanding of this might change a little bit as details get finalized but I think we have enough to construct a bit of a story. The description is general and is not intended as an accurate chronology of events as they occurred but basically to get the outline.

So an earthquake strikes and the operating reactors, Unit 1 and 3, immediately shutdown as they were designed to do. Although the fusion is zero in the reactor once it’s shutdown, there's still decay heat which must be removed so you must continue to have cooling systems.

At the same time, the external electric power from the grid was lost to the station and diesel generators started which provided backup electric power for the plant safety system, again as designed.

After about 20 to 30 minutes, the site is struck by a very large tsunami and about an hour or so diesel generators stop functioning due to the tsunami-induced damage.

At that point, cooling pumps no longer operate and the reactor core cooling is compromised. In the absence of pumped flow, the

coolant of the reactors start to boil and that builds up pressure.

Up to -- in eight hours or so they had electric power and that allowed certain equipment to be maintained and in particular instrumentation and control. But subsequent to that, the station goes into a complete electrical blackout and they have no power on site.

So several hours pass as the primary loop water boils away eventually resulting in the top of the core becoming uncovered.

As we mentioned, there's no chain reaction going on at the time but the core is still hot and needs to be cooled.

Without any water on it, degradation will start and fuel elements will lose their structural integrity. The fuel cladding begins to fail resulting in release of fusion products into containment and the fuel elements we believe have started to partially melt or at least break apart.

The fuel cladding and steam reaction produces hydrogen, zirconium itself will develop into hydrogen when exposed to air and heat. And as boiling continues, steam continues to raise

the pressure in the primary loop of the boiling water reactor.

Steam and hydrogen at that point need to be vented to protect the containment and is vented into the reactor building.

Hydrogen accumulates within the reactor building and eventually explodes which was the dramatic pictures that I'm sure most people have seen.

So at this point the -- while the timing of the core degradation at different units in unclear, it is believed that Units 1, 2, and 3 have all suffered core damage.

As a result of the explosions in Unit 1 and 3, reactor building collapses around the containment, now this is the outside of the building, the containment itself is still there. At this time, the primary containment and reactor pressure vessels are intact.

After the initial few hours and through the event, severe accidents management procedures were initiated beginning with getting seawater injected into the primary loop to add water to cool down the core.

Offsite electric power was brought

in but had difficulty being connected. Fire hoses were used for dousing and as the pressure builds in the primary containment, operators vented to relieve the pressure and release hydrogen. And that results in an onsite and offsite radiological release.

Eventually an explosion occurred in Unit 2 as well. And this occurred we believe down in the torus area and that damaged primary containment; although that is yet to be confirmed.

So at various times, offsite emergency response is taken to evacuate people from the vicinity, initially it was a three-kilometre zone, subsequently it was increased to 20 kilometres.

Authorities recommended sheltering between 20 kilometres and 30 kilometres; that is you don’t have to evacuate but you should stay indoors.

Fires occurred at various locations, both in the units and in the spent fuel storage. The spent fuel storage as we mentioned, has fuel that has already been in the reactor but still has heat, in particular Unit 4 whose core had just been taken out of there, so it was still

fairly hot. And again, without power, the cooling for those pools starts to be suspect.

Radiation hazards that -- in the area, impeded recovery efforts. And today -- I really do mean today, so I've got to check my slight update here that I have as of this morning -- so this is a bit of the situation.

So you can see for Units 1 to 4 which are the ones of primary concern although I'll talk about 5 and 6 in a minute, we have the -- I think everybody will understand the colouring codes, but green is where we're pretty good, yellow is very concerned and red is severe condition.

The only change I would say to -- of significance to this chart today is a good news story on Unit 2 where we talked about the offsite AC power whereas we're just getting it to the substation before, we now have it actually to the unit and so they're starting to start up different systems within Unit 2.

But clearly there's been some damage to buildings, the water level within the reactor pressure vessel is below the core. And the pressure while stabilized is still not as secure as we would want it.

Units 5 and 6 are in good shape. And in fact even the yellow levels on the bottom having to do with their spent fuel pool temperature today is moving over to green as they have power now and so their cooling systems can resume.

So in summary, the current situation today is we are seeing some steady improvements but the overall situation at the Fukushima Daiichi nuclear power plant remains very serious. Contamination has been measured in the locality of the plant both onsite and off.

The restoration of electric power to Unit 2 is good news; the AC power is available and electrical load checks to pumps, et cetera, is currently going on. This should provide us with getting the systems back in order to provide adequate cooling.

Work on the restoration of offsite power to Units 3 and 4 is also underway.

Seawater is still being injected in the reactor pressure vessels, Units 1, 2 and 3 to maintain cooling.

The pressure in the reactor vessels and the containment vessel dry well at Unit 3 which had been rising over the past few days has

now began to fall again so there's some control being in place there.

Water is being sprayed periodically into the spent fuel pools at Units 2, 3 and 4. We still lack solid data on what the water level is in those pools or what the temperature is in the spent fuel pools of the first four reactors.

As I mentioned, following the restoration of cooling unit 5 and 6 temperatures in the spent fuel pools continue to decline and that's good news as that'll get us back to normal.

So what have we learned from this event that's important to this panel? The CNSC's been monitoring 24-7 the Fukushima events and evaluating it very closely. Here are some of the key lessons learned to date.

We must not underestimate the importance of the capability of the plant to mitigate natural events such as earthquakes, floods, tsunamis, tornadoes, fire events -- let's say in Canada we also put extreme weather such as ice storms and whatnot.

The capability of a plant to mitigate combined natural events such as flooding

resulting from an earthquake or combination of earthquake with an ice storm; those kinds of things have to be taken into account.

The capability of a plant to survive and to maintain integrity even with a complete station blackout.

The capability of a plant to mitigate severe accidents including loss of major safety systems; for example, robust power supply over a long term is important.

An effective severe management -- accident management program is needed and effective emergency management -- sorry, emergency planning both within the site and also with offsite -- in our case, provincial authorities is absolutely key.

So what I'd like to do now is ask Dr. Dave Newland to provide some of the insight into how the implications here, what does that mean with respect to what's been done so far on the Darlington new build program.

--- PRESENTATION BY DR. NEWLAND:

DR. NEWLAND: Thank you Mr. Frappier.

I'm Director of the New Major Facilities Licensing Division. And what I'm going

to talk about are the implications of the event.

I will explain start, fuels regarding the implications of these events in Japan to the EIS, the Environmental Impact Statement report and to the application for licence to prepare a site.

First I'd note is that staff needed to re-evaluate our work that had been done on the suitability of the site.

Second, we recognize there will be many lessons learned. And I would like to give the panel a sense of how the CNSC intends to move forward with these.

The CNSC has established its modern requirements for the design of new nuclear power plants. And we will review these to ensure that lessons learned, as they are learned, will be incorporated. In particular, there may be lessons learned on the characterization of external events and on severe accident progression and phenomena.

Finally, CNSC's staff will ensure that the CNSC's safety goals for severe accidents are met during the licensing process so that the environmental impact statement is respected.

I would like to start with the

overall conclusions so that you can keep these in mind as we go through the rest of the presentation.

CNSC's staff understands the Japan event in sufficient detail to be able to draw conclusions on the implications for the environmental impact statement and the licence to prepare a site.

Taking into account the lessons learned to date; staff's conclusions and recommendations with respect to both the environmental impact statement and licence to prepare a site remain unchanged.

There will be more detailed lessons learned that could have implications for design and severe accident management, to take two examples, that will be taken into account at the time of an application for a licence to construct.

So let us first discuss the suitability of the site with respect to seismicity. As we've heard before, earthquake of magnitude 9.0 is not credible for Canadian inland sites.

Nuclear power plants are seismically designed following regulatory expectations in RD-337 for which there are clear acceptance criteria. We have technical

requirements set out in standards of the Canadian Standards Association that will be updated taking into account international state-of-the-art information.

Design basis earthquake is defined as the grand motion with an annual probability of exceedance of less than 1 in 10,000 years. For the Darlington site, given that frequency, that is a peak ground acceleration of approximately 0.2.

All proposed designs within the environmental impact statement will be anchored as proposed at 0.3g. So in conclusion, staff believe that the site is seismically suitable.

Turning now to the question of tsunamis; designs must consider tsunamis and such. Tsunamis are long-period gravity waves generated by a sudden displacement underneath the surface of the water. Darlington site is located in the Great Lake region of Canada.

It’s in a geologically stable, mid-continental region where, as we have heard, the rate of occurrence of earthquakes is low. At inland sites, tsunamis such as those in Japan are not credible and nor is a combined earthquake with a tsunami event. So in conclusion from staff’s

perspective, we believe that the site is suitable.

We now come to the current design requirements for new nuclear power plants. And although it is not directly relevant to the environmental impact statement or the licence to prepare a site, I would like to give some assurance that these types of events that occurred in Japan have already been thought about by staff in setting up their requirements in RD-337.

So CNSC has established its modern requirements in that document. It contains requirements for many of the phenomena that occurred at Fukushima. So for example, it contains provisions for station blackouts, mitigation against severe accidents, for hydrogen mitigation, for external events and for fire protection.

CNSC staff will take lessons learned from the Fukushima event into consideration and will, as appropriate, update its requirements. Furthermore, CNSC staff will, at the time of the licence to construct, ensure that the selected technology has adequate division -- design provisions to address both CNSC requirements and the lessons learned.

So the next two slides give

examples that illustrate in a little bit more detail.

So with respect to designing full station blackout; in Canada, current and proposed plants are well provided with redundant power supplies. There are emergency generators, standby generators. It is recognized that those have failed in the event at Fukushima.

Some modern designs go further and have passive features that do not require power.

Once again, I would stress that staff will review our requirements and, again, at the time of a licence to construct ensure that the selected technology will have adequate design provisions to such types of events i.e. station blackout.

As another example, let’s consider severe accidents. As I indicated last night, nuclear power plants around the world and in Canada are required to have specific design provisions to address severe accidents.

CNSC has identified those explicit requirements in our documentation in RD-337, so I give a specific example. Design identifies the equipment to be used in the management of severe

accidents. Confidence that this equipment will perform as intended in the case of a severe accident is demonstrated by environmental fire and seismic assessments.

So that is an example of what we already have in our requirements. Existing and modern designs do have provisions to mitigate against severe accidents. Once again, we will take lessons learned from what we've seen in Japan.

We will review our requirements once again at the time of the licence to construct; we'll ensure that all that is appropriate will be in place.

So, in summary, the scale of the earthquake and resulting tsunami at Fukushima is, in the view of staff, incredible for the Darlington site.

CNSC requires that reactor designs consider all natural events such as earthquakes, tsunami, flooding, tornadoes, as design-basis events as appropriate to the Darlington site.

Designs are required to consider combined events where appropriate, for example, flooding that could occur as a result of an earthquake, again as design-basis events.

Station blackout, one of the worst consequences of these common-cause events, must be considered in the design of any new nuclear power plant for Canada.

CNSC requires that reactor designs consider severe accidents a very low probability by including what we refer to as “complementary design features”, i.e. those features necessary and specific to mitigate the consequences of severe accidents. Furthermore, CNSC requires that severe accident management guidelines be in place.

And, once again, I would stress that detailed learned -- lessons learned from the Fukushima event will be considered for the design of any new nuclear plant project and in particular for Darlington new build.

So here I simply reiterate the three conclusions that you’ve seen before; I won’t read them again.

That completes the end of the presentation. Thank you.

And I look forward to answering questions that the panel and intervenors may have.

CHAIRPERSON GRAHAM: Thank you very much.

I believe now would be an opportune time, we've been going about 2 hours, to take a 15-minute break.

When we come back, we will start with questions from panel members.

So we'll be back at 4:15. Thank you.

--- Upon recessing at 4:00 p.m.

--- Upon resuming at 4:17 p.m.

CHAIRPERSON GRAHAM: Okay, ladies and gentleman, we'll start -- or continue on this morning's agenda this afternoon, and I will go to Mr. Pereira for the first questions.

--- QUESTIONS BY THE PANEL:

MEMBER PEREIRA: Thank you, Mr. Chairman. I'll start with a few questions concerning their program -- what happened in Japan.

We had some overview of the sequence of events following the earthquake and the tsunami.

Mr. Frappier spoke about controlled venting. How far into the event did the operators decided to vent, timewise?

MR. FRAPPIER: Gerry Frappier, for the record.

So there was a couple of different venting events, and if you give me a moment I'm just going to get my page here that will tell me.

So by venting I assume you mean venting to the atmosphere as opposed to inside the containment?

MEMBER PEREIRA: Inside the containment.

(SHORT PAUSE)

MR. FRAPPIER: Perhaps if you could do another question while I just -- I know I have the paper because I was expecting that. I just can't find it right now.

MEMBER PEREIRA: And while you're doing that, inside containment and then to the atmosphere as well. So I'll go into another question.

They also experienced a loss of power from the grid. Is this similar to the reference that Dr. Newland made to a station blackout?

DR. NEWLAND: For the record, Dave Newland.

No, the two are a little bit different. So the loss of grid was a direct

consequence of the earthquake that took the grid down. That meant that the plant itself no longer had power from the grid directly.

As Mr. Frappier explained, diesel generators did start up, they did function for 20 to 30 minutes prior to being struck by the tsunami and some of them did function up to an hour.

Once those failed, there was still other sources of power and in particular battery power. And so it's not until you lose all sources of power that it become a true station -- what we traditionally call a "station blackout sequence".

MEMBER PEREIRA: So in lay terms then station blackout means total loss of power to the reactor -- electrical power?

DR. NEWLAND: Yes, exactly.

MEMBER PEREIRA: Another question. These spent fuel pools, there was some reports, and Mr. Frappier referred to them, of overheating in the pools. Was that caused by a loss of coolant from the pools or loss of cooling to the pools?

MR. FRAPPIER: Gerry Frappier, for the record.

The spent fuel pools have a need for cooling to maintain the water at the

temperature that you want it to be at to ensure that all the spent fuel is kept cool. With the loss of active cooling, the water started heating up and evaporation increased.

When the hydrogen explosion occurred, in particular in Unit 4, you basically lost the top of the building over top of that pool and so evaporation occurred much quicker and, of course, as it’s heating up there's -- it’s occurring faster still.

There's been several reports that indicate that a lot of the water had gone through some mechanisms, perhaps a breach in the pool of some sort. That has not been confirmed and is hard to see giving that we’re able to refill the pool.

So the thinking right now is that most of the pool water has -- it’s been through evaporation although there might have some associated with the explosion and a bit of a question mark at this point as to whether fuel was actually exposed to air or not.

And perhaps just to go back to your first question, sorry, so the venting into containment occurred after eight hours and then from the containment into the reactor building

itself was a few hours after that until about a day.

MEMBER PEREIRA: You don't know what the few hours later was? Was it 12 hours, 16?

MR. FRAPPIER: I don't have it right here in front of me, no.

MEMBER PEREIRA: Okay, another question.

Dr. Newland, you referred to -- in considering the lessons learned, the CNSC would be looking at re-examining safety goals and looking as to how any changes might be made to ensure that the environmental assessment stays valid.

Is that what you said or did you say something slightly different?

My concern -- my interest is in a remark you made about the environmental assessment.

DR. NEWLAND: Dave Newland, for the record.

I don't think that is quite what I said so let me attempt to clarify it.

What I said was that we will ensure that the design will respect the safety goals that we already have. Those are the safety goals on which the EIS is based because we have

used, or rather OPG has used, safety goal-based releases in order to drive the requirements for offsite response.

And so when we get into looking at the design, we would ensure that those safety goals are respected both in terms of frequency and the quantities of (inaudible).

MEMBER PEREIRA: You miss a very important point because we have had a considerable number of questions about the application of the plant parameter envelope and the analysis of what that means in terms of accidents.

And so your clarification is that when the choice is made of technology from the CNSC's point of you, you would be going back to make sure that the technology choice in the reactor design fits in with what was assumed for the environmental assessment; is that correct?

DR. NEWLAND: That's -- that's exactly right, and we will take into account the lessons learned from Fukushima.

MEMBER PEREIRA: Thank you. One of the points in Mr. Frappier's report, besides the hydrogen release and the explosions resulting from hydrogen and containment -- ignition of hydrogen

and containment, you referred to other fires in the plant. Clearly fire protection is an important issue in the operation of any nuclear power plant.

Do you have any knowledge of what would have been the causes of those other fires, I know the damage is pretty severe, but at this stage, very early days, do you have any information on the cause of those fires?

MR. FRAPPIER: At this stage the -- the assumption for most of the fires is they have to do with hydrogen and hydrogen buildup. The other, more general fires that we're hearing about could be from the -- especially now, with us trying to put electric power back into systems and systems that have been damaged, but the -- the exact cause of each of them is -- is not known at this point.

MEMBER PEREIRA: And I'm jumping around a bit. We made some references to station blackout, and they got some clarification on that. In your experience with power reactors in Canada, we did, in 2003, have a loss of electrical power in Ontario, and which I presume affected all of the operating reactors, how the reactors -- the reactors fared then, and what did you learn from that experience in terms of what we do when you

build reactors.

DR. NEWLAND: Dave -- Dave Newland for the record. You're testing my memory a bit here. One of the -- one of the key lessons that we did learn was for one of the units. It -- it went through the events, but it was essentially without any form of backup power for approximately five hours. But because of natural phenomenon, that was perfectly fine. There was no other -- there was no damage, no damage to the fuel. It was cold, but we recognized that if maybe that had gone to a lot longer, or more importantly, if there had been some other event at the same time, it may not have been such a picky situation.

So we then required that each of the stations take a look at what backup power they have, and for Pickering A, they installed backup diesel generators. That was one of the key lessons learned. I think there were many others, but that was one of the key ones for me.

MEMBER PEREIRA: Thank you. And -- and in terms of new reactor designs, backup power is something that is standard in designs now?

DR. NEWLAND: Yes, it is.

CHAIRPERSON GRAHAM: Just on that

before I go to Madam Beaudet, I remember very well at licencing that the backup power, there wasn't adequate backup generation, OPG didn't have, and it took almost a year to get the adequate diesel generators in place. Is there a secondary -- was there a secondary backup at that time, like batteries, that kicked in before because there wasn't adequate diesel generators, or was there no power at all for five hours?

DR. NEWLAND: The -- just to clarify, there were other sources of power, but they weren't available in order to force the circulation around the heat transport system. So certainly there were at least two other classes of power available for things like instrumentation and for backup.

CHAIRPERSON GRAHAM: Because if I remember there was -- it's not just a little bit of power, it's -- it's, you know, diesel generators that had to be purchased and installed by OPG were -- were quite large, 25 to 50 megawatt generators, I believe, at the time. Is there now, and following Mr. Pereira's questioning, is there now -- is that now a requirement that adequate diesel generators are -- are in place at all of these

facilities?

DR. NEWLAND: Dave Newland for the record. I'm going to start by saying that it probably depends on the design because some designs do not need that backup. They -- they rely on passive systems in order to remove the -- the decay heat.

There are other systems where you do require the backup. In any event, depending on the design, we would require those passive safety systems to be clearly demonstrated that they were adequate and robust, and that if you can't do it passively, then we would expect at least one backup. And certainly in some of the designs they are looking at what they refer to as a station blackout backup source of power.

CHAIRPERSON GRAHAM: Do all four of the proposed types that there are before us, do they all have a passive backup system? Do they all have that -- that passive way of cooling?

DR. NEWLAND: I can't be sure. Some of them will rely on active systems rather than passive, and I think that that level of information, I certainly don't have at my fingertips, and I'm not sure that it would be in

the application.

CHAIRPERSON GRAHAM: Thank you. I'll save that question for OPG later. Madam Beaudet?

MEMBER BEAUDET: Thank you, Mr. Chairman. I have a question for Mr. Newland and then for Mr. Lamontagne.

We have in the presentation of CNSC here, lessons learned from the Fukushima event. On page 23 you say that:

> "We must not underestimate the importance of capability of the plant to mitigate natural events, such as earthquake, floods, tsunami, tornado and fire events."

When we look at the PMD 1.3, the analysis of CNSC on page 137 and 138:

> "We realize that for the EPR there has to be more. A similar evaluation has to be done, has to be performed for the EPR design to mitigate against the issue of high-spectro frequency excedents

of designs response spectra."

So CNSC has recommended that there should be further analysis done.

And then for the Westinghouse, on the next page:

"We had more information regarding the winds, floods and external hazards."

I know that for engineers there's solution for everything, but for me, and I did ask you this at the technical meeting of December 2009, what's -- on what the government will choose -- make their choice of the technology. And I remember at the time you said that it would probably be -- be in the procurement documents, and I went to look at them and it's exactly what is say the EIS, and there's a lifetime cost of power that the basis for choosing the technology.

The ability to meet Ontario's timetable to bring new supply in 2018 and the level of investment in Ontario -- by Ontario has nothing to do with what we're talking about today, and I know you said you will make sure when you review the documents for the licence to construct that it will be met.

But what do you base in your assessment to say that everything will be met.

And isn't there a way that the government can get some advice? Or is that our responsibility to flag -- the word flag, that there are still problems, and when they do choose the technology -- because they will choose it after you get whatever.

A company comes in front of you for the licence to construct, is chosen before. So, two things, how do you make sure that the Ontario government makes the right choice? And on what do you base your confidence that what we're discussing today will be met?

MR. FRAPPIER: Gerry Frappier, for the record.

Just so I understand where we are in the licensing process, so at this point in time we have some designs that have been talked about, but form a licensing perspective what we have is a strong set of requirements. And the requirements must be met.

As we move into the construction -- application for construction, a licence to construct the nuclear power plant, we will be going

through in detailed review that will last several years to make sure that the design as it was chosen in fact meets all the requirements that we have in place, detailed design requirements.

At this stage, we've done reviews of the PPE and that the designs are credible to fit within those -- that envelope, if you like, or that box, and that we can see that the designs are going to be able to meet those requirements.

But the detailed analysis of whether they in fact do meet those requirements will be happening in a different phase of the licensing process.

MEMBER BEAUDET: My mandate -- the agreement covers all phases on a higher level than the detailed analysis you'll do, nevertheless, I have to be confident -- because you have questions raised with the -- in your document here.

It may be more simple to me to give the information about fire hazards and things like that. But for me it is not clear that you are so far satisfied.

MR. FRAPPIER: Gerry Frappier, for the record.

So those are important for us to

hear from you, because that's -- the process that we're in right now, and over the next few days or few weeks, any area that is of concern is -- between ourselves, as making sure we believe the requirements can be met and perhaps, more importantly, the OPG demonstrating to you that they're going to be met, I agree with you, that is a big part of what we're here for.

MEMBER BEAUDET: Is it in your power, after the government has chosen the technology, that you say it can -- certain things cannot be met, they have to choose another technology? Is that possible?

MR. FRAPPIER: Absolutely. The Canadian Nuclear Safety Commission will not issue a licence to anybody to construct a nuclear power plant that we do not believe is going to meet our requirements.

The Ontario government, presumably with advice from OPG, but from our perspective it's OPG, as an applicant, is going to say they are going to construct a certain design.

We will review that design and assure it meets the requirements. If it does not, then they will not get a licence to construct. And

that is the role that the Commission -- when I say "ourselves," we provide advice to the Commission, and the Commission itself will make that determination.

MEMBER BEAUDET: We'll come back later when we will evaluate the PMD of CNSC regarding the definite recommendations you have proposed before the licence, to prepare a site or before the licence to construct.

I have a question for -- both questions for Monsieur Lamontagne.

I go back to your slide, earthquake distribution of eastern Canada. There's no page here, so -- this one.

I have here from -- I think it's -- it is from the Ministry of Natural Resources, the southern Ontario seismic network that I got from the internet, and the map here indicates also the seismicity patterns for the historical earthquakes seen from 1890 until 1969.

What I would like to know is if this map also presents the historical earthquakes, because here, what we can see, is there are some seismic events of the magnitude of 2 to 5.4, under Lake Ontario and under Lake Erie, and they are not

indicated here.

And the map here is magnitude 4.5, so here 5.4, it should be included here? Is there a reason for that? There must be an explanation in the methodology that you've explained to my colleague earlier.

DR. LAMONTAGNE: This map was made a few years ago, but the pattern hasn't changed. Probably there would be a few additional dots under Lake Ontario, but that was more to show the pattern of seismicity.

And this map includes historical events that are coming from written accounts of the impact of earthquakes. But, as we progress in time, when had instruments, we could add these smaller dots that you see.

So lower magnitude, so it's a mix of historical earthquakes, plus instrumentally recorded earthquakes. But, I agree with you, it's not totally up to date.

MEMBER BEAUDET: Okay. I accept that answer. Is it also because some of the historical events cannot be verified? You don't have enough data to make sure that they did happen? Would that be also a reason?

Because if you have events -- let's say, in 1663, okay, there's one event.

DR. LAMONTAGNE: Yes.

MEMBER BEAUDET: Probably people have talked about it ---

DR. LAMONTAGNE: Okay.

MEMBER BEAUDET: --- in letters and whatever. If you have an event in 1819, there's probably a newspaper talking about it.

How do you check the veracity of what is reported in your methodology?

MR. LAMONTAGE: Okay.

There are two aspects. One is called completeness of record and that varies across the region we're looking at.

To give you an example, we're pretty sure that any earthquake over this map area that exceeded magnitude 6 would have been known since probably 1700s.

But there could have been a magnitude 5, say, under Lake Michigan, and we wouldn't know about them -- about that one because there was nobody there. Or, if there was anybody, maybe he didn't write about it.

So that -- when we do the seismic

hazard maps, a completeness of record is considered in the description, in what is used for seismic hazard purposes.

In terms of veracity of the descriptions, this is kind of what you call historical seismology. And we -- naturally, there's a lot uncertainty about the exact magnitudes. They're always estimates.

Then we try also to look at who wrote about what, and so on. So it's quite a field of -- it is extremely interesting but there are always some unknowns left.

MEMBER BEAUDET: Because you realize it's important. You were talking in the Pacific, the return phase, for instance, in B.C., is 500 years.

MR. LAMONTAGE: Yes.

MEMBER BEAUDET: So that there could be also things that happened 500 years ago in our region, and, you know, it hasn't come back. That's a little bit what I'm getting at.

Are you aware of anything? Sixteen sixty three (1663) would be the earliest record that you have of anything happening in western Canada?

DR. LAMONTAGNE: That was a -- there were a few smaller earthquakes that were reported in the writings. But around Lake Ontario, say if we say in 1625, there wasn't anybody there to actually write about what was felt locally.

But you were talking about these large earthquakes in British Columbia. That's a good example of a large earthquake. It would leave tracks of its occurrence.

For example, in the sedimentalogical record, because it would create slumps and then you could date these slumps, and in British Columbia, that was done.

In Eastern Canada, we don't have a history of these large slumps, but in some cases we were able to date liquefaction features; that is to say, when you have a strong shaking then the sand that is saturated with water that would come to the surface bearing some vegetation that you could date. And to my knowledge, nothing like that has been found around Lake Ontario. It has been found, we're talking about Charlevoix, around Charlevoix, but to my knowledge, there was nothing found around Lake Ontario.

MEMBER BEAUDET: When you do a

historical assessment, and you say you base yourself mainly on written records, is there a field where they also try to base the analysis on traditional knowledge?

Because there were people living all around the lakes; I mean, they would know, they call Mont-Tremblant in Quebec because, you know, it's earthquake area. Would that be also assessed?

DR. LAMONTAGNE: It's been looked at indirectly. There's a report by Pierre Gouin, who looked at the historical earthquakes, mainly in Quebec, but also in New France, for example.

But the problem sometimes with the oral tradition is to put a date on what is reported, unless the people who had the writing capacity or writing possibility felt it as well.

On the west coast, for example, there was a strong oral tradition reporting a large earthquake and it's only afterwards that they could relate it to this 1700 earthquake. Before that they didn't know exactly the date, but from geological evidence, they were able to pinpoint the exact date, and then they said, yes, there's an oral tradition that supports such a large earthquake.

MEMBER BEAUDET: Thank you.

CHAIRPERSON GRAHAM: Thank you.

To wind up the seismic portion of today's session we'll call on OPG for their presentation.

Pardon me? You'll have a question -- I'll entertain questions after all three have finished their presentations and then you can either do CNCS, Environment Canada -- or NR Canada or OPG.

MS. McCLENAGHAN: Mr. Chairman, I want to put on the record that I object to the limiting us of one question to all these presentations. I actually have more than one question for each of the presenters.

We only have a few registered participants here asking questions. I think these are very important issues. The kinds of questions we have to ask are of high importance to the public. This topic is of high importance to the public and it's one of the places where you indicated we would be hearing about accident risk.

So I've heard what you said; I'd like you to reconsider, and I definitely want it to be noted that I object.

CHAIRPERSON GRAHAM: I accept your objection and, due to time, we'll probably be able to let you have more than one question. I'm not going to confine or muzzle anyone. We're going to try and get everything done and treat everyone fairly. I said that yesterday. We'll do that again today.

So we're going to proceed and go to ---

MR. MATTSON: Okay, but I would also just like to put on the record, Mr. Chairman, that we're entering an area that we objected to to come into the hearing yesterday. You allowed it in. You said to us that as this new evidence came forward we had no opportunity to get any other facts in other than what we're hearing.

And it's really important, particularly since the experts spoke of just the Candu, they didn't speak of the other reactors. My friend, the other Member, had concerns about that, and my friend said he's going to share the evidence with OPG and with you.

And I remind you that Section 34 of the *Canadian Environmental Assessment Act* makes it by law that you have to share it with the

public. And we need the opportunity to ask questions of these witnesses where there's no other opportunity.

So I just want to get that on the record.

CHAIRPERSON GRAHAM: Mr. Mattson, I don't need to be lectured on the law or on the rules. I'm quite aware of them and will tend to really be fair, and we will.

The lady asked for more, if she has more than one question, and we'll do our best to do that and accommodate her.

There's a gentleman at the back who had a question earlier and I'm going to entertain him when the time comes as the first questioner because he courteously waited until all the presentation was done.

And we're going to go that route, but I don't need to be lectured. I will be fair.

Now, OPG, you proceed.

MR. MATTSON: Mr. Chairman, I just want to make sure that you and I can remain friends about this, but we have to get our objections on the record because without that, then we can't even have this viewed in terms of whether or not ---

CHAIRPERSON GRAHAM: You will get your objections on the record and I will be fair with everyone. I said that at the outset.

We lost all morning and we're going to try -- and we're not doing a marathon to catch up by tonight or any other time. We have three weeks and we're going to be fair and we're going to follow up on these various questions that interveners may have.

I know this is an important subject and we will -- and I promise you that we will spend the time that's necessary for my panel colleagues to be able to get the right questions in for our interveners today to pose questions.

So OPG, will you proceed please.

--- PRESENTATION BY MS. SWAMI AND DR. YOUNGS:

MS. SWAMI: Good afternoon, Chairman Graham, and Panel Members Beaudet and Pereira.

For the record, my name is Laurie Swami, and I am the Director of Licensing and Environment for the Darlington New Nuclear Project. I am responsible for the licensing and environmental assessment process.

With me today is Dr. Robert

Youngs. Dr. Youngs is the principle engineer of AMEC GEOMETRIX and has established a credible resume in terms of seismic hazard assessment.

He has a University of California Berkley Masters of Science degree in geotechnical engineering, as well as a PhD from the same institute.

He will be providing an overview of the work completed in support of the New Nuclear Project, which OPG filed with its licence to prepare the site application in September of 2009.

OPG has completed comprehensive studies in support of these processes and we are pleased to describe those for you this afternoon.

Dr. Youngs.

DR. YOUNGS: Thank you.

I'm Dr. Robert Youngs for the record, from AMEC GEOMETRIX.

What I would like to do this afternoon is give a brief overview of the seismic hazard assessment that was conducted as a part of the application and submitted to the Joint Panel for the review.

The talks are to present an objective of the probabilistic study and a brief

summary of the input data that was used and a brief summary of the results.

The primary objective, it was to quantify the seismic hazard at the new build site in terms of the probability of occurrence of strong ground motions of various levels. This is necessary to provide the information needed to assess the suitability of the site in terms of seismic hazard for construction of a new plant and to meet the regulations in place from the CNSC.

And the other important objective was to perform this analysis following the guidance provided in international standards for incorporating uncertainties and alternative models and hypothesis into the seismic hazard model, so to address not only best estimate models, but to include the effects of uncertainty in these models in the results.

We've had a talk already this afternoon on the general setting of the site, in terms of seismicity, and the discussion of the three basic areas where there are some concentrations of earthquakes.

To the southwest, about 50 kilometres, there is an area near Niagra Falls

where there are some low-level activity. To the east and north about 200 kilometres of the nearest approach is the western Quebec seismic zone. And then the 1663 Charlevoix earthquake is about 300 kilometres from the site.

There is yet another seismicity map to look at. This is the seismicity map for the catalogue that was put together for the project analysis that I will describe in a moment.

An important background for this assessment was a study that was commissioned in the period of 1995 through 1997 by the Atomic Energy Control Board of Canada, which is, as I understand it, the parent organization of CNSC. The purpose of this study was to evaluate the seismic hazards in southern Ontario. The study was started by holding a large workshop where a number of experts came and discussed various sources -- potential sources of earthquakes in the region and how they might be used to assess seismic hazard.

As a follow along to that workshop, a probablistic seismic hazard model was put together incorporating the various hypotheses and alternative sources that were discussed in that workshop in order to perform a seismic hazard

assessment for southern Ontario.

That model was submitted for review and questions and comments to all the participants of that workshop, the original workshop and those comments were incorporated into the study published in 1997 under the sponsorship of AECB.

The PSHA that was the seismic hazard, the Probabilistic Seismic Hazard Analysis or PSHA as we call it that was conducted for the new build site, used the model that was developed in the 1997 ASE study with some adjustments to include additional information that had become available post the 1997 study.

There are three basic inputs to a Probabilistic Seismic Hazard Analysis; they are the seismic sources, which define where earthquakes can occur; the earthquake recurrence models which determine how often and how big they can be and then the final important step, the ground motion models that translate the occurrence of an earthquake in a particular location into effect at your site. So those are the basic elements that are needed to perform a Probabilistic Seismic Hazard Analysis. And I will briefly go over those.

The first important element is what we call seismic sources which basically defines the spatial location of potential earthquakes. And the model that was used for the NND PSHA is basically the same model that was developed for the -- it's a part of the AECB study and it used two types of sources; regional sources and postulated local sources.

These seismic sources were refined using more recent information. Some of the boundaries of the regional sources were adjusted based on new tectonic information. And one of the potential local sources, the Rouge River fault, was dropped from the model because subsequent studies have shown that the offsets that were observed in the ground were likely caused by glacial processes rather than by tectonic processes. Other than that, the model was basically the same as the 1997 model.

This is a map that is showing an example of the regional source zones. Basically, they encompass the entire study region and they allow for the occurrence of earthquakes at all locations within the study region. They are used to define regions of the crust that have different

geological characteristics that may affect how you would calculate hazard from them.

In particular, the blue areas indicate areas where the crust has been extended during its long history of accreting on the eastern margin of the North American plate. And those extended areas, we would expect to see potentially larger earthquakes than in the central craton, the grey areas to the west.

So the differentiation between these two zones has some impact on the assessment of a largest size that can occur.

The other important sources that were included in the model are potential local sources. These were identified and characterized as a part of the AECB study. And they represent potential locations where earthquakes may be concentrated based on various scientific hypotheses about how the features that are observed relate to earthquake activity.

One of them does include the Niagara Pickering lineament that was mentioned earlier today.

These sources were included in the model as potential local sources of activity and

earthquakes were assigned to them based on the observed seismicity in their vicinity. The probability that these sources actually are active sources was assessed using the methodology that would have been developed in the -- a big study conducted by Electric Power Research Institute in the United States in the mid-1980s which was a multi-expert study that develops the criteria for assessing the potential activity of local features.

And that was applied to each one of these to assess whether they should or should not be included in the model. So they were included in the model with some probability as being an active source.

The next important step is defining the earthquake recurrence rates which determine -- define the rate of activity of earthquakes of various sizes, basically the frequency part and also the limit upper size.

That frequency is based on assessment of the historic catalogue and the instrumental catalogue that has been gathered for the region, and as you can see on this -- this is an example for the region that's around the site or one possible regional source zone that encompasses

this site.

The black dots on here represent the historical data that would be in the catalogue as part of sizes and frequencies of earthquakes. And the red curves represent the model that it uses in hazard, and we extrapolate from the observed seismicity up to the largest events we think may be possible in the region.

So they are typically extrapolated well beyond the largest observed event to include the possibility of larger events in the seismic hazard assessment.

The catalogue that we used for this is the compilation of the catalogue developed by the GSC, the Geological Society of Canada, and the U.S. Geological Survey. Both institutions have developed catalogues for seismic hazard mapping. And we merged those together to do the assessment for this site.

And then the final piece of this is the assessment of the largest sizes of earthquakes that could possibly occur in the region, and that assessment was based on a global database of the largest earthquakes we've seen in similar tectonic regions, basically the largest

events we've seen in stable continental regions.

The final piece that is needed to do the hazard is an assessment of ground shaking which is basically a translation of an earthquake occurrence at a particular distance for your site into motions the site actually feels or experiences.

And these are -- the ground motion models we use are typically represented in engineering terms by what we call response spectral acceleration which is basically the level of shaking that a simple structure would experience given that an earthquake has occurred of a certain peak-ground acceleration.

They basically give the information the engineer needs to evaluate how much force a particular type of earthquake would induce in its structure. And so they -- they produce -- sorry -- this is an example of models that were used in the analysis representing the ground motions that a magnitude five and a half earthquake might produce at a distance of 20 kilometres from the site. This is just one example of the many possible scenarios included in our model.

The ground motion models we used

for this analysis are results of recent research in the nature of ground motions in Eastern North America published by well recognized experts in this field. And it includes multiple models because there is uncertainty in estimation of ground motion. And as part of the overall process of including alternatives in our assessment, we do include multiple ground motion models.

The final result of this calculation is what we term seismic hazard which has already been discussed but basically expresses the annual frequency at which various levels of strong ground shaking may be exceeded at your site.

It's basically as the -- as you look at a larger ground motion level, typically we would expect that the frequency at which it's exceeded, it decreases which is basically because the size of earthquake decreases; the bigger the earthquake, the less frequent they are; the bigger the ground motions, the less frequent they occur. The same relationship.

As it's been described earlier, the current Canadian and international standards suggest that the ground motion exceeding frequency that we should be using for evaluation of nuclear

power plants is 1 in 10,000 or 10 to the minus 4 (10^{-4}) annual frequency of exceedance.

So that we then take the results of hazard calculations at the various structural frequencies and calculate the 10 to the minus 4 (10^{-4}) ground motion level, connect those together in a smooth curve, and we produce what we call a uniform hazard response spectrum. Basically a response spectrum that represents at all different structural frequencies the same level of probability of being exceeded.

And the one that we constructed for the new build at Darlington site is shown by the dashed black line on this figure.

And also shown by all the various coloured lines are the design response spectra for the various technologies that are under consideration. And we can see from this figure that the uniform hazard spectrum for the site is well enveloped by the design spectra for these technologies.

We point out that the -- in particular the CANDU 6 design which is shown by the brown curve, it’s the design spectra for Eastern hard rock, far exceeds the uniform hazard spectrum

in all the frequencies of importance to the reactor.

There are a few designs that -- for which the uniform hazard response spectrum does exceed the certified design at frequencies of about 25 hertz.

This is a common occurrence in sites that are on hard, very stiff materials, but studies that have been done at other locations in the U.S. have shown that these small exceedances are not important and they -- if they've done -- they can do reanalyses using different spectra to show that they are not a critical importance to the evaluation of the -- of the suitability of the reactor technology to the site.

So in conclusion, the site is in the area of low seismicity. The ground shaking hazard is quantified by the 10 to the minus 4 uniform hazard response spectrum is well enveloped by the certified design response spectra for a number of modern technologies.

And from the standpoint of seismic hazards, the site should be suitable for construction and operation of a new reactor.

Thank you.

CHAIRPERSON GRAHAM: Thank you very much.

Madam Beaudet?

MEMBER BEAUDET: I have no questions.

CHAIRPERSON GRAHAM: Thank you.

Mr. Pereira?

MEMBER PEREIRA: I have no questions.

--- QUESTIONS BY THE PANEL:

CHAIRPERSON GRAHAM: Okay. We -- I have one question or perhaps two questions to CNSC on their presentation and then we'll go to the public intervenors.

My first question was -- pardon me, my first question is to OPG and that is when CNSC referred to a passive design for -- to cover in cooling, do all four designs that are being considered, do they all have a passive design -- are they all meeting the passive design?

MS. SWAMI: Laurie Swami, for the record.

I will ask Jack Vecchiarelli to provide a more detailed response if necessary.

However, all of the designs under

consideration have passive design features. They are different from each other but they do include passive design features.

MR. VECCHIARELLI: Jack Vecchiarelli, for the record.

Each of the designs that were considered for the Darlington New Nuclear Project do have passive features built into them of varying degrees.

And I believe the question was posed more so in the context of if there were a loss of power, offsite power.

And so in the case of the AP1000, for example, there is a natural circulation loop from the heat transport system. There's a body of water which will enable a natural circulation to cool the core.

The EC6 and ACR rely on, if there was a loss of power, they would have a similar natural circulation between the flow of the primary coolant through the steam generators, which would cool it down and then recycle it through the core and you have natural buoyancy-driven flow if you'd like.

And a similar effect occurs with

the EPR where, coupled by the momentum of the heat transport pumps that would continue to slow -- continue to -- to provide some motion for the fluid, that would assist in a transition towards a natural circulation through the steam generators for some time.

CHAIRPERSON GRAHAM: Well that was the other part of my question was for some time, would this be a continuous flow or was it -- would the whole system heat up and it would only last for X number of hours?

In each one, is this -- would this be a continuous flow of coolant or a passive flow that could be counted on say for unlimited time or are there time limits on that?

MR. VECCHIARELLI: Jack Vecchiarelli, for the record.

The natural circulation that is induced with a loss of power, would last for a sufficient period of time to enable backup power restoration.

In the case of the AP1000 it tends to be quite long, as well with the EC6 and the ACR, plenty of time -- hours and/or even days.

CHAIRPERSON GRAHAM: Thank you.

The other question I have; it's to CNSC and there was significant discussion with regard to RD-337.

And you did mention that it would be modified after the lessons learned were all incorporated and so on, and that would come back and apply to the licensing application if and when the go -- the go-ahead with the construction.

But has any part of the RD-337 essential to be modified before the EA process is complete?

DR. NEWLAND: Dave Newland, for the record.

I believe no.

CHAIRPERSON GRAHAM: Okay. Those were my questions.

And I will now open the floor to interveners and I will ask Mr. Kavelor to take the mic at the back so your interventions or your questions are recorded and you're, I believe, represent One World.

Someone give Mr. Kavelor help -- okay, very good then.

--- QUESTIONS BY THE INTERVENERS:

MR. KAVELOR: I am short, but my

intervention may not be short.

As I've listened to at least five or six people, I presume if you allowed me one question per presentation, I've got five or six questions.

CHAIRPERSON GRAHAM: Mr. Kavelor, you go ahead with your first question and then we'll look at the second one and so on.

MR. KAVELOR: Okay.

CHAIRPERSON GRAHAM: Depending on time.

MR. KAVELOR: Firstly, I want to congratulate Mrs. Beaudet for saying very succinctly what I couldn't think of before and that she said that engineers have all the solutions.

Let me tell you as an engineer I'm not one of them. Yes, engineers at the design table are wonderfully full of confidence and can design around anything. However, just here we saw that we got all kinds of reviews and solutions but we haven't got a clue of their cost implications.

One thing is very obvious, what Fukushima has done is it has increased the cost of nuclear power. If nothing else, that's clear. What we don't know, if it is 10 percent, 20

percent, 50 percent or 100 percent.

And to say that we have a solution and I haven’t seen one, I would like to question the solutions when they are done, not on a promise. I can’t question them on their promise of solution.

So those are some of the problems. Today as perhaps you know, there is a budget coming in Ottawa and it’s an austerity budget. So the cost implications are really important.

And we should also be careful to note that the cost of sewer and water, power, wind power are going down while the cost of nuclear power is going up.

CHAIRPERSON GRAHAM: Mr. Kavelor, could you ask your question, please.

MR. KAVELOR: Yes. No, I'm just stating the facts as I see them.

CHAIRPERSON GRAHAM: I realize that, but I mean I have three other intervenors that have questions too, in fairness.

MR. KAVELOR: Sure. Well, okay. We have also been advised that in view of the seismicity that we have seen that there is a very low probability of having a seismic event that can cause damage to the reviewed designs.

Well, let me ask you, sir, one question now if you like. Is -- does that probably mean certainty; certainly not. If it means certainty to them, it doesn't mean to me or anybody with commonsense.

And this kind of event as just admitted, is a low probability and high consequence event. And low probability doesn't mean no event, so you have got a high consequence event coming.

The data -- seismic data that we have is very limited. Like again, Mrs. Beaudet said, we have no data about -- 200 hundred old, 300 year, 500 years ago, and is it recorded and what size is beyond. So again ---

CHAIRPERSON GRAHAM: Can we stop there and ask -- have that -- have that first question answered?

MR. KAVELOR: Okay. Sure.

CHAIRPERSON GRAHAM: CNSC, would you like to respond to that?

MR. HOWDEN: Barcley Howden. I'll do my best to respond to this.

I think there's a couple of points –- important points that were made. I think one is from the Japanese event. There's no indication

that the seismicity in Ontario has changed. I think that's very important.

Two, I think we just want to re-emphasise that –- a couple of things that we consider are natural phenomena, and I think we've been talking a lot about seismicity, and I don't think there's any new information regarding the Darlington site.

I think what is coming out is would it be a plant response to a significant event and, again, Dr. Newland keeps going back to the safety goals of RD-337. They're technology neutral. They're site neutral. And so we can always go back to those and they deal with normal operation, anticipated operational occurrences, design basis accidents, and severe accidents. So those are starting to deal with the low probability/high consequence.

I think the last point I want to make is about the engineering solutions. When people propose engineering solutions, there are assumptions made and you need to be able to validate the assumptions. I think in some cases, the mitigation measures are well-known and I think they're quite easy to do.

I think where the challenge is, is where the mitigations are new or novel, and one of the things that we drive at the CNSC is the need for proponents with their vendors to be able to actually have real R&D programs that actually demonstrate that the assumptions are correct, especially when you're talking about passive features.

So they're not all just engineering solutions that are done on paper. There's a large investment that has to go behind the scenes to support the assumptions, and they need to be validated to the benefit of everyone.

The last point is as we go into potentially future phases of this project, there is a public process that the Commission goes through for licensing that continues to encourage public participation.

Thank you.

CHAIRPERSON GRAHAM: Thank you, Mr. Howden.

Mr. Kavelor, you can have one other question for now.

MR. KAVELOR: Okay, thank you.

Today also happens to be the World

Water Day, and I haven't heard anything so far -- of course, there is review going on further. What are the implications to water because Canadians -- as Canadians, we have the highest water footprint, and this will only increase the water footprint of Canadians.

And if it has not come out yet, I'd really recommend in future presentations that they address the water footprint of Canadians.

CHAIRPERSON GRAHAM: Thank you. Those will be covered.

In fact, I believe tomorrow, if we -- if we get back on the agenda, aquatic biota and habitat whee Environment Canada are here and Ontario Ministry of Environment, and I believe a lot of those with regard to water and water issues will be covered.

I think the proper people to answer some of your concerns, some of your questions, aren't here today but will be here tomorrow, and if you have the patience, we'd appreciate it if you would hold that question.

MR. KAVELOR: Patience is one thing and coming here without public transit is another thing.

CHAIRPERSON GRAHAM: Thank you, and I realize that.

The next intervenor that I will recognize is Ms. McClenaghan of CELA.

MS. McCLENAGHAN: Thank you, Mr. Chairman, and I have four questions, and I'll be brief in respect of each.

The first is on the CNSC slide 11, you don't need to go to it, but it says that the facility is designed to withstand a ground motion with a certain intensity and annual probability, and it's called the design basis earthquake.

And my question is, what is the design basis earthquake and can that be expressed in magnitude terms?

CHAIRPERSON GRAHAM: Thank you.

Mr. Howden, would you like to respond to that or Mr. Frappier?

MR. FRAPPIER: Thank you. Gerry Frappier, for the record.

Yes, there is a design based to earthquake and this is the earthquake at which the plant is designed to be able to be fully operational afterwards, and it's not obvious to put it into seismic terms of magnitude, if you like.

The engineering term that's important here is the peak ground acceleration that it must see. And so, as we said, the peak ground acceleration that is the requirement for these units to meet is the .3 Gs, which is an order of magnitude greater than what Dr. Lamontagne was saying was sort of appropriate measurement in that area.

As to how that translates into –- into the Richter Scale if you like, if that's what you're looking for, then that becomes one of what distance away from the plant that Richter –- that earthquake event occurs, and perhaps I would ask our Director of Engineering Design Assessment, Andrei Blahoianu, if he wants to do that.

MS. McCLENAGHAN: I assume it's close for the purpose of the hypothetical?

CHAIRPERSON GRAHAM: Do you want further explanation, Ms. McClenaghan?

MS. McCLENAGHAN: Yes. I'm understanding, from trying to piece the information together, that if there was an event -- and I understand people are saying there's not likely to be an event, but if there was an event let's say of magnitude 6 even, far lower than the 9 that

occurred in Japan, very close to Darlington, my understanding is that would exceed the 3 G ground acceleration, and I'd just like to understand if that's an appropriate conclusion to reach.

CHAIRPERSON GRAHAM: CNSC, do you want to have your expert speak to that, please?

MR. BLAHOIANU: For the record, my name is Andrei Blahoianu. I'm Director of Engineering Design Assessment Division.

So I would just like to quote what US NRC just released. So it's coming from the "NRC Frequently Asked Questions" relating to March 11, 2011, Japanese earthquake and tsunami.

Question number 9: What magnitude earthquake are currently operating US nuclear plants designed to? Ground motion is a function of both, the magnitude of an earthquake and the distance from the fault to the site. Nuclear plants and, in fact, all engineering structures are actually designed based on ground motion levels, not earthquake magnitudes.

The existing nuclear plants were designed based on the determination or scenario earthquake basis that accounted for the largest earthquake expected in the area around the plant.

Margin is further added to the predicted ground motions to provide added robustness.

So this is the answer that US NRC, our colleague regulators, have provided and it's the right answer.

We could do many, many speculations but, as I said, intensity, which is how it's felt the earthquake at this particular site, depends on the distance for the epicentre and also for the hypocentre, and also of the nature of the soil it encounters and potentially many other things.

So it would be -- all this extrapolation or speculations would be –- would be incorrect.

We could say that for definitely 11 –- 11 and level 7 Richter earthquake, if it happens in the vicinity of the site, it's something that we would expect to be, okay, this was 0.3, and with a slight –- with a slight amendment that could be even higher than this.

But, again, this is very, very broad affirmation and under all these circumstances could be considered, but it's reasonable to believe that a 7 magnitude Richter in the vicinity of the

site would be accommodated.

And one more thing if I'm allowed to say, we talk about design basis earthquake. So we should understand that it's not about the plant capacity, which is a total of other things.

When we –- when we say it is designed for this means the plant will work, operate normally like any other design basis event. That means all the safety features will be fully preserved and the plant will operate as normal.

This is very important; it's design basis. If you talk from this perspective, there are lots of safety margins in engineering which will ensure that the plant itself could be operated, could be safely shut down, perform the safety functions for earthquake even higher than this because it's designed with a lot of conservatives.

So when we say 0.3 pg was chosen for this, it's a lot of plenty –- it's a lot of safety margins beyond this level.

CHAIRPERSON GRAHAM: Thank you.

Ms. McClenaghan.

MS. McCLENAGHAN: Mr. Chairman, I'll go on to my next question, although I don't

believe my question was actually answered about how the design basis translates to a close earthquake at Darlington in terms of magnitude.

Now, the question is, in terms of the lessons learned and preliminary lessons learned is probably a better term, but CNSC has started to draw from the incidents in Fukushima-Daiichi.

I noted on page 15, there's a statement about the magnitude 9 earthquake exceeding the 9 magnitude –- the 9 magnitude which was experienced exceeded the 8.2 to which it had been designed. And I'm suggesting, and I'm wondering if CNSC would agree, that an extremely important lesson to draw is that unexpected events can exceed the design -- design basis. And I'm wondering in particular, and the – the witness just speaking spoke a little bit to this, if CNSC can talk about how much conservatism and room for error in terms of assumptions behind the design basis is included in the licensing process?

CHAIRPERSON GRAHAM: Mr. Frappier?

MR. FRAPPIER: Gerry Frappier for the record. So –- so just to be clear, I think Andre was clear that a magnitude 7 right at the

site would be acceptable. I think that we should also put that in perspective to what Dr. Lamontagne was mentioning earlier with respect to a magnitude 7 not being what we would predict for anywhere near Darlington. I think the other thing is, again, to try to get through the idea of design basis versus what you're referring to, which would be beyond design basis.

So when a designed-based accident or a design-based earthquake, the plant will continue and be able to operate, that is, the next day, or perhaps it would take –- there'd be –- there'd be checks and things like that that were done, but that plant would get back up. It would run; it would produce electricity; it would –- it would be able to fully function as it was before the earthquake.

If, as you're pointing out in the case of –- in Japan, that we have something that is beyond what was the designed-based earthquake, then we get into, what we call, either severe accidents or beyond design base. At that point in time, the –- there is still safety margin, as Mr. Blahoianu was suggesting, that allows for earthquakes that would be greater than that, and you would still be

able to do your -- your safety function of shutting down the reactor, cooling the reactor, and controlling any releases. But the reactor itself may not be able to ever operate again with respect to producing electricity.

MS. McCLENAGHAN: Okay. So I have one final question, which is, on slide 32, CNSC talks about requiring that reactor design considers severe accidents a very low probability by including complimentary design features necessary to mitigate the consequences and that severe accident management guidelines be in place. And I'm wondering specifically about evacuation plans.

We heard in the OPG review last evening about planning in the EIS for evacuation circumferences of 10 kilomoetres, but I'm wondering whether either CNSC requires that greater distances be planned for and spelled out and whether OPG has done that for this –- for this EIS, such as we've seen in Japan with that –- with that particular scenario where they were calling for 20 kilometres, and the United States was calling even for – for greater distances there.

CHAIRPERSON GRAHAM: Mr. Howden or Mr. Frappier?

MR. HOWDEN: I'll start, and Mr. Frappier can add more information.

I think the important thing is when you look at RD-337, it does account for beyond design basis accidents, and within that, there could be requirements for protective actions offsite, and that is outlined in that.

With regard to protective actions offsite, which could be sheltering evacuation on an interim basis, that needs to be factored in, and it's a requirement of the operator to work with the offsite authorities, in this case Emergency Management Ontario and the Region of Durham, to make sure that those particular plans would be in place.

And I think we're going to have a session on that on Friday where EMO is going to be here where, I think, you can explore it in quite a bit of detail.

MS. McCLENAGHAN: All right. Thank you, Mr. Chairman.

CHAIRPERSON GRAHAM: Mr. Mattson, you're next on deck.

MR. MATTISON: Thank you, Mr. Chairman.

Short people –- Mr. Chairman, the first question, I really would like to have it written as an undertaking because it's been asked three times, and it hasn't been answered.
And it's quite a simple question, and it's this: Dr. Lamontagne talked about a 1-in-500-year 6 Richter scale earthquake. We need to know –- we've heard about the ground acceleration. We want to know, just simply, what would the ground –- maximum ground acceleration be at the Darlington nuclear plant proposed site with a 6 Richter scale earthquake?

We know that they've built in conservancy, acceptability. We've heard all the variations. We just want to know the simple fact what would be the maximum ground acceleration as a result of a Richter 6 earthquake at the proposed site, that's all.

CHAIRPERSON GRAHAM: Can that question be answered now, or do I put it as an undertaking?

MR. FRAPPIER: If we can listen to another question and I think by the time we get the second question, we will be able to come back to this one with the answer.

MR. MATTSON: We'll take it as undertaking, and then --

CHAIRPERSON GRAHAM: Well --

MR. FRAPPIER: Well, I'll take it as an undertaking, and if they don't have it --

CHAIRPERSON GRAHAM: Before -- before we break for supper --

MR. FRAPPIER: If we don't have it, I don't want ---

CHAIRPERSON GRAHAM: No, I won't forget about it.

MR. MATTSON: Okay.

CHAIRPERSON GRAHAM: I've got a good memory.

MR. MATTSON: Okay.

CHAIRPERSON GRAHAM: Go ahead, Mr. Mattison.

MR. MATTSON: Thank you.

MR. FRAPPIER: As a matter of fact -- sorry to interrupt, but -- Gerry Frappier. As a matter of fact, I can give the answer right now. There -- it's just I had to look at some parts.

CHAIRPERSON GRAHAM: Proceed. Okay.

MR. FRAPPIER: So I would ask

Andre Blahoianu.

MR. BLAHOINU: Okay. So if understand right, it's about a Richter -- assuming that you have an earthquake magnitude 6, it's like when I -– for qualification when I said site, I had in mind something like 20, 25 kilometres. So for a 6, actually what you'll have will have, like, around zero -– zero, three, G. Zero -– Zero, 27, I guess. I guess zero, 27, yeah. 0.27 G.

MR. MATTSON: Thank you. My second question is –-

MR. BLAHOIANU: For clarification, the numbers I got from all colleagues from NRCan.

MR. MATTSON: Thank you.

MR. BLAHOIANU: So they give us all this information, which, of course, as I said under the reservation that it's not appropriate to talk about converting Richter in Mercalli Intensity Scale with all the other assumption that an earthquake is near vicinity, happens there. These are the answers.

MR. MATTSON: My second question, Doctor, and maybe you can answer this, from the Provincial Environmental Assessment to Ontario's plan in the early '90s, it's on the record that the

peri-nuclear power plant and the 9-mile point –- the 9-mile point which shares Lake Ontario and our drinking water with all of us, the regulator there requires the reactors be built to withstand a 1.5 G, almost five times what you're proposing. Can you speak to that?

CHAIRPERSON GRAHAM: CNSC, or do you want to assign someone to speak to that, please?

MR. FRAPPIER: I'm not sure. You're saying they wanted a 1.5 G or a .15 G?

MR. MATTSON: .15, several times more conservative than the current proposal for the new Darlington nuclear power plant.

MR. FRAPPIER: So could you clarify that again? You're saying that they require -- I'm just –-

MR. MATTSON: Well, maybe -- well, maybe, Mr. Frapper, you can just give us some -- you can check with the NRC, you have those connections, and let us know what the reactors on the other side of Lake Ontario are built to withstand --

MR. FRAPPIER: Okay.

MR. MATTSON: -- for earthquake.

MR. FRAPPIER: Perhaps we could take that as a --

MR. MATTSON: Thank you.

CHAIRPERSON: I'm going to assign that as Undertaking Number 5.

MR. MATTSON: Thank you, Mr. Chairman.

CHAIRPERSON GRAHAM: And bring it back when you -- when you get the information.

Mr. Mattson?

MR. MATTSON: And my final question going directly to the Fukushima tragedy in Japan, and I think it was Mr. Newland spoke about the lessons learned in Japan, and he seemed fairly confident that he had most of the answers, and I -- I just want to ask him, the fuel leak -- if there is a fuel leak at the number 4 fuel pond -- and you speculated that it could have been caused by an explosion. I'd like to ask, could it also have been caused by a leak that might have been caused by the earthquake?

CHAIRPERSON GRAHAM: I think that was answered this afternoon and said it hasn't been determined yet because they can't get near.

MR. MATTSON: That would be a good

answer.

CHAIRPERSON GRAHAM: My understanding, that's what Mr. Frappier said, that it hadn't been -- in following the line that the jury is still out on that.

MR. MATTSON: So there's still -- so there's still things to learn that -- what the earthquake did to that reactor and -- is that correct?

DR. NEWLAND: Dave Newland for the record. I am not confident that we know everything that we know about this event. There will be a lot to learn both in terms of design, external events, the impact of external events on the design, severe accident management, severe accident phenomena. There will be a lot to learn, I agree.

MR. MATTSON: And Mr. Newland just because you mentioned -- you never mentioned the earthquake could have caused the leak in the fuel pond. You mentioned explosion. You agree that it could have been caused by the earthquake?

CHAIRPERSON GRAHAM: I beg to differ. My recollection was -- because I had that same question -- that it could have been caused by that, but ---

MR. MATTSON: Thank you.

CHAIRPERSON GRAHAM: --- the lessons are still to be learned and ---

MR. MATTSON: Thank you.

CHAIRPERSON GRAHAM: --- when the plant cools down.

Ms. Lloyd, you're the last one; last, but not least so go ahead.

MS. LLOYD: Brennain Lloyd from Northwatch. And I have a question for CNSC and I believe two for Ontario Power Generation.

I'm also interested in CNSC's ability to come to conclusions at this stage given Tepco as of this afternoon was still not able to say whether the situation has become stable.

Either EA as of this afternoon still didn't have information on temperature or water levels in three of the four cooling ponds' fuel bays which are of highest concern.

My question for CNSC; I've gained an impression from CNSC/OPG presentations of today and OPG's presentation of yesterday evening that the events we're so concerned about at Fukushima Daiichi are not as a result solely of the earthquake and the tsunami but as a combination --

the result of a combination of that natural event initiating a series of other events which relate to the engineered safety mechanisms at that facility.

And I'm wondering if CNSC can comment or give me some sense of how they would apportion cause to that effect? And particularly to what degree is this a series of events -- a crisis created by a natural event versus a full failure of the defence in depth which OPG described yesterday evening? And I'd particularly like them to comment on the failures of the back-up power and maybe of the back-up to the back-up power; the failure to maintain cooling, the failure to maintain water cover and the failure to maintain containment?

So my interest is in how much of this crisis is created by an initiating natural event versus created by a series of failures of the so-called defence in depth?

MR. FRAPPIER: Gerry Frappier, for the record.

So let's be very clear here and I hope we didn't leave the impression that we think we have gotten all the lessons learned out of the Japanese event.

There is lots and lots that's going to be learned over the next few years with respect to that event. And those will be incorporated into requirements and facilities; both new facilities and facilities that are currently in place will be upgraded based on what we learn. So we're certainly not saying we've learnt everything.

What we are saying is based on the event in Japan, we believe that we -- that has not changed our understanding of the seismicity of the site that we're talking about at Darlington and therefore with respect to a licence to prepare a site, there was not really very much new there.

And the second part is whether the environmental assessment has to be modified and again, what we're saying is that we believe our requirements, if they're met -- and they're going to be met -- then that part will not have to change either.

With respect to detailed engineering in detailed requirements, it'll be -- you know, we'll be required to build such a facility; that we do expect there will be lessons learned and there'll be input at that time.

With respect to initiating event,

I think it's pretty clear the initiating event was the earthquake itself and the -- followed by the tsunami so a natural external hazard.

And certainly I cannot speak to how well the facility was designed against those or what caused the failure of multiple barriers that the -- I'm sorry, I've forgotten your name, but the person -- the intervenor has stated about.

Those will be things that will become out in due time with appropriate investigations. The Canadian Nuclear Safety Commission's already volunteered to the IEA to send some experts to participate in that. And I expect that we will have some members on the international team that will come to some of those conclusions.

CHAIRPERSON GRAHAM: Ms. Lloyd?

MS. LLOYD: I didn't hear an answer, but in the interest of time I'll move on to my question to OPG. From OPG, today, we heard a -- all their presentation was about seismicity.

And I'm wondering if it's OPG's position that seismic activity is the only sort of natural based disturbance which could initiate a series of malfunctions such as continue to cause the crisis at Fukushima Daiichi?

I'm particularly interested in -- well, in particular, the kind of extreme natural disturbances which we are subject to here in Ontario and in Southern Ontario and here in Durham Region and for which there is a history.

CHAIRPERSON GRAHAM: OPG, would you like to respond?

MS. SWAMI: Laurie Swami, for the record.

As part of the environmental assessment and particularly with the licence to prepare the site, we were required to assess a number of external factors; seismic was one of those.

We presented that information today so that there would be an understanding of the material that had been submitted for that particular study.

However, we did look at seven different nuclear safety considerations which we submitted that includes extreme weather events, if you would, including freezing rain as an example.

So there are a number of things that we have considered in our licence to prepare a site. They were filed with the panel at the time

of the original filing. And they were, of course, subject to the public review process. And they did meet the specifications provided to us through RD-346.

MS. LLOYD: Well, I don't know what RD-346 is without the name, but I did review technical support documents for accidents and malevolent acts and I found one reference to one of the designs having a mention -- it was not a review, but a mention with respect to tornadoes.

I find nothing for hurricanes; some reference to a general statement by the Nuclear Regulatory Commission in the U.S. considering hurricanes to be an extreme weather event and I think we could agree they're an extreme weather event.

So how in particular have you looked at hurricane and tornado potential for the Darlington new nuclear; for all of the four designs which the panel has been asked to consider in a multiple-technology approach?

MS. SWAMI: Laurie Swami, for the record.

I appreciate that the intervenor would have looked to the technical support

documents on accidents and malfunctions. However, there are other reports that were filed under the licence to prepare the site.

I'm not sure if the intervenor would have had an opportunity -- although they were available on the website -- to also review those documents.

Dr. Vecchiarelli can provide us a more detailed assessment of how we, in fact, did those assessments if that's helpful this evening.

CHAIRPERSON GRAHAM: To expedite time, I wonder if the reference documents could be given to Ms. Lloyd and if she has other questions, I'll let those come as time goes on.

But I mean there are reams of documents and I realize and appreciate you haven't read them all, but I know that hurricanes and tornadoes and ice storms and so on were all involved. So if you could provide when we recess for dinner, if we do, we will -- if you could provide those to Ms. Lloyd. I think that that might be a way to expedite that. So if that's all right with you, Ms. Lloyd?

MS. LLOYD: Yes and even the references and I can look at them electronically.

CHAIRPERSON GRAHAM: Yes, the references and you can follow up.

Do you have one other question?

MS. LLOYD: One last small question and it's for Mr. Vecchiarelli.

He stated, I believe, Mr. Chair, in response to one of your questions that power -- we would not move into crisis mode, I don't remember his exact words, but we would not move into crisis mode with a failure of power for hours or maybe even a day.

Well, we're at day 11 at Fukushima Daiichi and I think there is power restored to one off the four reactors which are of highest concern.

So I wonder if you could comment on the ability to stay out of crisis state for, say, even a week?

CHAIRPERSON GRAHAM: OPG?

MS. SWAMI: Laurie Swami, for the record.

I will ask Dr. Vecchiarelli to respond to your questions.

I think that we're speculating now on the events that are taking place in Japan. And it's very difficult to start to speculate on the

issues and concerns that they were trying to address in terms of restoring power to the site.

When we looked to the new designs that are being considered for the Darlington site, all of those will come as described earlier, with emergency power generators that will be seismically qualified and able to respond should there be a seismic event.

I appreciate that you may think to the flooding that occurred as a result of the tsunami that also caused damage to those events. In our assessment, we have considered flooding as one of the assessments that we're going to provide you later this evening.

And in that case we looked to protecting the equipment that's necessary to operate so that we would have backup power.

Dr. Vecchiarelli can provide you more information on the exact nature of the length of time for the reactor progression through an event.

DR. VECCHIARELLI: Jack Vecchiarelli, for the record.

So following the loss of power there would be immediate shutdown of the reactor

units and then we are concerned about removing the decay heat from the core.

There are large inventories of water available to the core that would, through natural circulation, provide considerable length of time until the emergency power supply -- if we're talking seismic event, emergency power supply would be restored within 30 minutes.

The standby diesel generators kick in within a few minutes in a loss of power situation. But if it's a seismic event, and I think that's what you're concerned about, the redundant multiple backup power supplies that are designed are highly reliable to restore power to the plant.

But failing that, we do consider even beyond that what other means are available to provide cooling to the core. And that would include other bodies of water available.

In some cases, for example with the Calandria, with the Candu design, the entire core is surrounded by a large volume of water which provides a passive backup heat sink or heat removable capability in case power cannot be restored to the emergency core cooling system.

And beyond that, as I described yesterday, there are other provisions -- for example in the enhanced Candu 6 design, to provide from a seismically qualified elevated reserve water tank, water can be provided to the heat transport system to this Calandria vessel which provides a backup heat sink to the steam generators to continue to provide cooling to the secondary side.

And so these are additional examples, this sort of heat removal capability can go on for many days.

And there's also complementary severe accident management guidelines that would be implemented. And this is something that the entire industry has looked at as being implemented.

This makes use of any available means within reason to intervene and provide alternative sources of water such as we witnessed in Japan.

So I'm confident that there would be ample time for cooling of the cores before power can be restored.

MS. LLOYD: Mr. Chair, I’m not anticipating a tsunami to be the next natural extreme weather event in Clarington.

My question, my concern, my interest is how long -- and I'm -- maybe I didn't make it clear, my interest, my question is how long could the fuel pools, the fresh fuel pools go without power before we had a crisis event due to loss of power?

CHAIRPERSON GRAHAM: My understanding, just to put in layman's term because that's what I am, is that depending on the type of reactor that is chosen, some could go as a matter of many days.

Isn't that what you just said a few moments ago?

The other thing is is that there are other secondary power available within the complex and that's diesel generator backup ---

MS. LLOYD: M'hm.

CHAIRPERSON GRAHAM: --- batteries, but even in natural cooling that there are other -- that this can last a considerable length of time depending on the design. Is that correct?

MS. LLOYD: Yeah. And I guess again, Mr. Chair, my question is how much time? And if Dr. Vecchiarelli can't provide that answer,

so be it.

But I want to be clear on -- I'm not asking him to comment on the tsunami in Clarington.

CHAIRPERSON GRAHAM: I want the answer also so we will get it for you.

MS. LLOYD: Okay, thank you.

CHAIRPERSON GRAHAM: There's a lady sitting very patiently alongside of you. Madam, do you have a question?

You didn't register and we'd like you to register but I'm still not that hungry so ---

MS. LACANISKY (phon.): Elga Lacanisky (phon.) from Curtis, Clarington.

We have seen two mapping on seismicity here and they are very different. And we don't have enough information for Lake Ontario.

And I wish I would have it along with me so I could quote but it says on Environment Canada website that glacier -- Lake Iroquois shoreline that is running parallel to Oak Ridge Moraine and Lake Ontario shoreline, so it's just about I would say 5 or maybe less kilometres from Darlington.

The uplift of this Lake Iroquois shoreline continues from Kingston in comparison to Toronto, about 30 centimetres -- it’s about like this -- a century.

And there's not enough information -- it just says one sentence. I would like to know if one of those presenters -- one of them was OPG and the other one -- I don’t remember the name of the gentleman, if they could find out and give us some information on this movement?

Because as far as I remember in 1992 in my house, we had several cracks in the basement foundation and it’s not going to be -- it’s not there this OPG, but still it’s lying on the bedrock and our chimney cracked right through.

So I was just wondering if it is just some kind of earth movement or could it be earthquake? Because OPG mentioned for the Rouge and Niagara Falls, so this maybe it because this Lake Iroquois shoreline is coming from Niagara Falls all the way to Kingston and a little bit behind.

CHAIRPERSON GRAHAM: Thank you.

Who would like to answer the question? It should be OPG. One of your slides

was quite detailed I think on that but OPG ---

MS. LACANISKY (phon.): It’s very close from Darlington.

CHAIRPERSON GRAHAM: Thank you.

OPG would you like to respond with regard the intervenor’s question? And I thought one of your slides had covered that but maybe I'm wrong?

MS. SWAMI: Laurie Swami, for the record.

It may be helpful to put up Slide 8 of our presentation, if that’s possible. Dr. Youngs will try to answer your question but hopefully this was the graph that you were looking at when you were thinking about your question?

MS. LACANISKY (phon.): In of those two coloured, purple and red, because that wouldn’t be it. It’s parallel with Lake Ontario shoreline and it’s just in between as I said, Oak Ridges Moraine and Lake Iroquois shoreline.

DR. YOUNGS: Robert Youngs for the ---

MS. LACANISKY (phon.): Map of Durham region so this is the Lake Iroquois shoreline, this is Oak Ridges Moraine and this is

Lake Ontario shoreline. So I would say we are just about here from Darlington. It's a very short distance.

CHAIRPERSON GRAHAM: I'm going to ask OPG to explain Slide A to you, and with that then we'll adjourn for supper or for lunch or for dinner, whatever it's going to be called.

MR. YOUNGS: This is Robert Youngs for the record.

The phenomenon that you're describing, as I understand it, is a slow uplift of a large area along the lakeshore, and that may, in fact, be a result of the removal of the latest ice sheet that was over the area, and there is noticeable uplift that is occurring along much of Canada in response to that.

CHAIRPERSON GRAHAM: Thank you.

With that, this will -- we will try and get -- start after supper or after dinner. Being Maritime I guess it's called supper here -- it's called dinner.

But regardless, we will convene to do the rest of the morning session with the Canadian Nuclear Safety Commission on deck with their presentation. And that will be at seven

o’clock. Thank you very much.

--- Upon recessing at 5:58 p.m./

L’audience est suspendue à 16h58

--- Upon resuming at 7:00 p.m./

L’audience est reprise à 19h00

CHAIRPERSON GRAHAM: We’re not going to sit beyond nine o’clock. I think 12-hour days are probably long enough. And in fairness of all of that, when people get tired maybe we get repetitious and we don’t adhere to all of the things that are going on.

So I would ask your co-operation. If we don’t get all the questions asked to the presenters tonight, there’ll be a day tomorrow.

So with that -- Kelly, do you have something to add to this?

Okay, we’ll start off with the presentation from CNSC.

MR. FRAPPIER: Mr. Chair, it’s Gerry Frappier.

If you’d allow me, I didn’t answer Mr. Pereira’s question earlier and I can take two seconds to just answer it now and get it on the record.

CHAIRPERSON GRAHAM: Please.

MR. FRAPPIER: Mr. Pereira is asking about venting at the units during the accident that happened in Japan, so I found my notes and can now give you what I have.

This is still a bit sketchy because of the overall accident situation but Unit 1, as we mentioned, roughly about eight hours into the event it vented into the reactor building, and 22 hours into the event, so about 14 hours later is when they had the hydrogen explosion which then vented it to the atmosphere.

Unit 2, it was about 47 hours after the event that they had to vent and about 27 hours later that they again -- a hydrogen explosion had to go.

And then Unit -- sorry, that was Unit 3. And then Unit 2 it was 93 hours later where they had the thing.

Thank you.

CHAIRPERSON GRAHAM: Thank you, Mr. Frappier.

Dr. Thompson.

--- PRESENTATION BY DR. THOMPSON:

DR. THOMPSON: Good evening, monsieur le président, madame et messieurs les

commissaires and other interested parties.

My name is Dr. Patsy Thompson. Je suis la directrice générale de la Direction de l'évaluation et de la protection de l'environnement et de la protection radiologique of the Canadian Nuclear Safety Commission.

With me tonight and to my left Mr. Brian Torrie, who is the Director of the Environmental Assessment Division, and to my right, Mr. Andrew McAllister, who is the assessment specialist for this project. We also have members of the CNSC technical review team present and available to answer questions.

Overall CNSC staff has concluded that the proposed Darlington new nuclear power plant project is unlikely to cause significant environmental effects, taking into consideration mitigation measures and the recommendations outlined in CNSC staff's panel member document 11-P1.3, which was submitted to the Darlington Joint Review Panel on January 31st, 2011.

With regards to the determination of significance, I will add some information perhaps to try to better answer the question that was asked this afternoon. When determining

significance for this project staff assessed -- predicted effects on the various valued ecosystem components and used criteria such as severity, magnitude, duration, geographic extent and reversibility.

In the specific case of accidents and malfunctions, because the reactor technology has not been chosen, the approach using the assessment is what was called a safety goal based assessment. In this type of assessment the effects which are calculated as radiation dose or radiation exposures to members of the public were estimated for two types of release, a small release frequency and a large release frequency. So the actual consequences of those releases were assessed for significance.

Therefore, in the cases of accidents and malfunctions the determinations of significance was not based on the probability of occurrence, the assessment was in the event that such release occurs what are the consequences to members of the public and can they be mitigated.

The purpose of today’s presentation is to provide an overview of the results of CNSC staff’s review and assessment of

Ontario Power Generation's environmental impact statement and supporting documentation for their proposed new nuclear power plant project on the Darlington site.

CNSC staff's presentation will provide background information on the project, background information on the CNSC, the licensing process, as well as the role that staff played in the Joint Review Panel process.

We will then summarize staff's overall conclusions on the significance of environmental effects of this project.

The remainder of our presentation will focus on our key areas of interest, findings, recommendations and our role as Crown consultation coordinator for this project.

In September 2006 the CNSC received a preliminary licence application from Ontario Power Generation for up to four new nuclear reactors. And there is a lot of details provided on their project last night so I will not go to more details on this, but to say that the location of the project is on the existing Darlington site and on the shore of Lake Ontario.

Again, this is a picture that has

been shown a couple times already. In the yellow area is the existing Darlington site, and in the foreground is where the proposed site is proposed to be located.

In Canada nuclear activities and facilities are federally regulated. The Canadian Nuclear Safety Commission is the federal authority responsible to licence nuclear facilities such as nuclear power plants. The CNSC is a quasi-judicial tribunal. The CNSC has a broad mandate. It's mission is to protect the health, safety and security of persons and the environment and to respect Canada's international commitments on the peaceful use of nuclear energy.

The CNSC established in May 2000 under the *Nuclear Safety and Control Act* replace the Atomic Energy Control Board that existed under the 1946 *Atomic Energy Control Act*. This gives us 65 years of experience as Canada's independent nuclear regulator.

In its additions to its responsibilities under the *Nuclear Safety and Control Act* the CNSC has environmental assessment responsibilities under the Canadian *Environmental Assessment Act* which will be outlined on the next

slide.

In the case of the CNSC an environmental assessment is required in relation to this project under the Canadian *Environmental Assessment Act* because the CNSC may issue a licence under subsection 24-2 of the *Nuclear Safety and Control Act*.

For the Darlington new nuclear power plant project the licence that would be first required is a licence to prepare a site. An explanation of what a licence to prepare site will be provided by our colleagues who might be presenting later tonight and their submission is Commission Member Document 11-P1.2.

On this slide, which is a generic slide of the licensing process, I would like to draw your attention to the orange box which is in the middle, and it’s entitled Environmental Assessment.

An Environmental Assessment under the *Canadian Environmental Assessment Act* is intended to look at lifecycle of the project.

As such, one environmental assessment is required. It is being conducted by the Joint Review Panel, but separate licences will

be required for site preparation, construction, operation, decommissioning and abandonment as identified in the yellow box on the flowchart, which I think looks greenish to me but.

The other key point to make from this slide is the continued involvement of the public, Aboriginal groups, and interested parties throughout the future licensing process as depicted in the blue arrows on the left side of the slide.

Part of this continued involvement could also include the recent CNSC's participant funding program which was recently established. This program is to enhance Aboriginal, public and stakeholder participation in the CNSC's licensing process and to help stakeholders bring valuable information to the Commission.

An important point to reiterate is the CNSC's mission to protect health, safety, security of persons and the environment.

And those responsibilities do not stop at the environmental assessment stage of the regulatory process, it is applied throughout the lifecycle of all CNSC regulated activities, including the consideration of subsequent licences for the new nuclear power plant.

Mr. Brian Torrie will continue with the staff's presentation.

--- PRESENTATION BY MR. TORRIE:

MR. TORRIE: Thank you. Good evening.

CNSC staff perform many activities during the environmental assessment undertaken by the Joint Review Panel.

Staff reviewed environmental impact statement and supporting documentation; proposed information requests to the Joint Review Panel; assess the sufficiency of OPG's responses to information request made by the Joint Review Panel; provided other support functions to the Joint Review Panel, such as technical briefings that are available in the Canadian Environmental Assessment Registry; acted as the Crown consultation coordinator on behalf of the federal government in engaging and in consulting Aboriginal groups; and finally, coordinated the federal government review team that has participated in this Joint Review Panel process.

CNSC's staff Panel Member Document addresses CNSC staff's review of the environmental impact statement and related

information on the Canadian Environmental Assessment Registry for this project.

And it also provides CNSC staff conclusions and recommendations for consideration by the Joint Review Panel in support of the environmental assessment being conducted.

CNSC staff's Panel Member Document was structured to follow the general order in which the topics are presented in the Environmental Impact Statement Guidelines.

As mentioned at the beginning of our presentation, in CNSC's staff's opinion, the proposed project is unlikely to cause significant environmental effects taking into account mitigation measures and the recommendations outlined in CNSC's staff's Panel Member Document.

CNSC staff is also of the opinion that a well developed rigourous environmental assessment fall program will be needed.

CNSC staff's Panel Member Document in Section 2.27 lays out a proposed approach to the development of this program, including recommending the involvement of multi-stakeholder working groups in order to scope out the follow-up program.

Other post-environmental

assessment considerations are outlined in the following slide. In using the bounding approach, OPG has often indicated that specific mitigation measures, such as those at the detailed level of design will not be forthcoming until a reactor design has been chosen. Instead OPG makes commitments to the development of specific mitigation plans.

In staff's opinion the suite of potential effects are genuinely well understood and have known effective mitigation measures that can be employed.

CNSC staff's professional opinion is formed on the basis of the information provided, as well as extensive knowledge and experience on the environmental impacts associated with operating nuclear power plants in both Canada and abroad.

CNSC's subsequent licensing phases allow for the consideration and approval of detailed mitigation plans to ensure the protection of the environment and human health and safety.

For example, a proposed condition of the licence to prepare site is that OPG shall have these requisite plans, such as the detailed mitigation plans and an environmental assessment

follow-up program accepted by the CNSC prior to commencing applicable licence activities.

Further, CNSC staff commits to continue to engage relevant federal departments in the technical reviews that will support the subsequent licensing stages should the project proceed to licensing, for example, in reviewing a detailed mitigation plan or design of a monitoring program.

CNSC staff would like to clarify some of the terminology used in our Panel Member Document, more specifically, the term “satisfactory” and “below expectations”.

Satisfactory refers to a topic for which there are no proposed recommendations for the Joint Review Panel’s consideration based on CNSC staff’s review and assessment of OPG’s environmental impact statement and related information.

Below expectations refers to deficiencies having been identified in staff’s review. These deficiencies generally were not of a nature to alter conclusions on significance, however, they warranted a recommendation for the consideration of the Joint Review Panel. These

recommendations are intended to enhance the mitigation and follow-up measures proposed by OPG.

With an explanation of those terms, let us first examine those topics that CNSC staff deemed satisfactory. We will then examine those topics for which CNSC staff had recommendations.

CNSC staff found OPG's assessment of the following topics, including proposed mitigation and follow-up satisfactory for environmental assessment purposes: Public and Aboriginal participation, radiological conditions, atmosphere, economy, land use, Aboriginal traditional land use, human health, physical and cultural heritage, and malfunctions, accidents and malevolent acts.

We will speak to human health and malfunctions, accidents and malevolent acts in further detail on the following slides.

We have chosen to provide further information on these specific items to address potential concerns in these areas which are of interest to the public.

From a radiological respective, human health effects were examined under normal

operations and malfunction acts and scenarios for both nuclear energy workers and members of the public.

The key conclusions from OPG's assessment are that under normal operations doses will be well below regulatory limits and will be maintained as low as reasonably achievable or ALARA through the application of specific measures in both the design and operation phases of the project.

With respect to human health effects in relation to malfunction in accident scenarios put forth by OPG, the anticipated doses to workers and members of the public would be below regulatory limits, notwithstanding OPG's commitment to maintain doses below regulatory limits and ALARA, will continue to be an area of focus throughout the execution of any proposed licenced facility.

With respect to malfunctions, accidents and malevolent acts, staff concluded overall that the objectives for the review are met for environmental assessment purposes.

Staff did identify additional information requirements that will expected at the

time of an application for a licence to construct with respect to malfunctions and accidents from the nuclear reactor and from a criticality -- criticality perspectives.

The methodology for analysis of the radiological releases from the plant, i.e. involving the reactor and the bounding approach used the identification of the limiting credible accident, in this case a safety goal based release, is acceptable for environmental assessment purposes.

This safety goal based release represents a credible severe accident or beyond design basis accident that has offsite radiological consequences.

A release of this magnitude would cause either a temporary evacuation or a permanent relocation. We have a technical backgrounder that we think would be useful to the panel and they can provide this by Friday morning, March 25th, if the panel so requests.

The assumptions and factors considered in the modeling of the safety goal-based release, are adequate, and a 72-hour release duration is an acceptable assumption for the

purposes of estimating release impact for the environmental assessment and applicable -- and applicable to the designs considered in the environmental assessment.

Continuing with some of the key findings from CNSC's staff's assessment, OPG's detailed evacuation time estimate study demonstrated that an effective evacuation could take place if a nuclear emergency were to occur with an offsite consequence from a radioactive release to the environment. CNSC staff reviewed this study and found it acceptable.

Finally, CNSC staff will conduct a detailed review of the analyses and demonstration of compliance with all safety goals identified in CNSC RD-337, Design of New Nuclear Power Plants as part of the licencing process, at the stage of application for a licence to construct for the chosen design.

I will now pass the presentation over to Mr. Andrew McAllister who will discuss some of CNSC staff's specific findings and recommendations. Thank you.

--- PRESENTATION BY MR. McALLISTER:

MR. McALLISTER: Thank you, Mr.

Torrie.

For those topic areas for which CNSC staff have identified deficiencies, CNSC staff has proposed 27 recommendations on how a deficiency can be resolved for the Joint Review Panel's consideration with respect to matters related to mitigation and/or follow-up.

Those topic areas are alternative means; project description; geology; geotechnical and seismic hazards; surface water; groundwater; terrestrial environment; aquatic environment; severe weather and climate; transportation; and follow-up.

We'll now describe CNSC staff's key areas of interest and findings and recommendations identified in PMD 11-P1.3. These are highlighted in red in the slide.

OPG indicates it undertook an assessment of alternative condenser cooling water technologies in accordance with the environmental impact statement guidelines, and it has identified its preferred alternative as once-through cooling and is proposing existing Darlington Nuclear generation station design. They have since, in their presentation yesterday, made additional

commitments to further design measures.

In CNSC staff's opinion, the frequent use of the terms "preferred", "less preferred", "least preferred", often without supporting factual information, makes objective comparisons of the alternatives challenging.

Based on staff's assessment, OPG's preference for once-through cooling appears to be a trade-off between direct and indirect mortality of aquatic species from once-through cooling and potential socio-economic effects as well as capital costs and losses in plant efficiency for cooling towers.

CNSC staff has concluded that no significant environmental effects are likely from any of the condenser cooling water technology alternatives being considered.

Given the limitations in OPG's assessment of alternatives and the requirements under the *Nuclear Safety and Control Act*, as well as pollution prevention principles as outlined by the *Canadian Environmental Protection Act*, staff recommends that should the project proceed, once a vendor has been selected and as part of an application for a licence to construct, OPG

undertake a formal quantitative cost benefit analysis for the full range of condenser cooling water options, applying the principle of best available technology economically achievable.

Currently, for the once-through cooling option only, OPG proposes to undertake a cost benefit analysis in a detailed siting study.

The term "best available technology economically achievable" refers to proposed risk control technologies that can be, or have been successfully demonstrated, as economically achievable and implementable within the industry. It is often referred to by its acronym ATEA.

However, should the Joint Review Panel determine that a once-through cooling system is acceptable, staff recommends that the system be designed to include the optimal mix of the latest in mitigative technologies and techniques that have been demonstrated to be economically achievable at the industry level.

For clarification on these slides and subsequent slides, the relevant recommendation number in CNSC staff's panel member document is identified in this slide and the subsequent slides

for the topic areas to be discussed.

OPG developed a bounding approach known as the “plant parameter envelope”, utilizing postulated worst-case design parameters from the reactor designs identified in this environmental assessment and has presented these design parameters as a model plant.

For example, for parameters such as public dose, OPG would obtain the design parameters from the technology under consideration and chosen the value leading to the highest dose to a member of the public.

CNSC staff noted that the approach to the bounding concept by OPG was not consistent for all assessment factors and end points. The plant parameter envelope was used for certain parameters such as public dose during normal operations. In other cases, such as nuclear waste management, values more conservative in the plant parameter envelope were used for the bounding scenario.

As we advised the panel in a briefing dated March 24th 2010 that's on the Canadian Environmental Assessment Registry in their briefing to the Commission, April 8th, CNSC staff is

of the opinion that the environmental assessment can be completed without referencing any specific reactor technology, and the environmental assessment conclusions would be applicable to a range of reactor designs that fall within the bounding envelope defined by the Proponent.

The expectation is that the reactor technology selected for construction will fit within the approved bounding envelope. This evaluation will be performed once the reactor technology is selected and the applicant will be required to demonstrate that the chosen reactor technology falls within the bounding envelope as part of an application for a licence to construct.

An environmental assessment follow-up program will be put in place to provide assurances that this is indeed the case.

With respect to the topics of geology and geotechnical and seismic hazards, OPG concluded that there were no unacceptable sub-service conditions that cannot be corrected by means of a geotechnical treatment or compensated for by constructive measures. As well, OPG concluded that there were no seismicity related issues identified that would render the site

unsuitable for consideration of new nuclear facilities.

In staff's assessment, the geological baseline characterization was acceptable, however, deficiencies were identified, most notably the absence of any baseline data in the vicinity of the proposed Northeast landfill.

After staff's review and assessment, staff concurred with OPG's conclusion regarding geotechnical hazards, however, the effect predictions were often based on limited information.

As such, in support of an environmental assessment follow-up program and subsequent licensing phases, staff recommends that OPG's proposed detailed geotechnical site investigation include elements such as baseline soil quality data collection, various site suitability related matters, and an assessment of settlement in various structures due to groundwater drawdown.

With respect to blasting from the adjacent St. Mary's facility, Phase 4 of St. Mary's operations will be located closest to the Darlington site and is planned to occur decades in

the future. Phase 4 operations at the quarry may overlap with the operations of a new nuclear power plant. As such, staff has recommended monitoring of the Phase 4 blasting and quarry slopes.

Finally, based on CNSC staff's review, staff concurs with OPG's conclusion that there were no seismicity related issues identified that would render this site unsuitable for construction of new nuclear facilities.

For surface water, OPG has consistently responded to the absence of liquid effluent information for hazardous substances by stating that bounding scenarios for hazardous substance could not be developed until a reactor design is selected.

OPG further agreed that it was committed to meeting all applicable regulatory requirements. This submission is not in conformity with the environmental impact statement guidelines.

However, generic environmental risk assessments completed by the Nuclear Regulatory Commission in the United States and site-specific environmental risk assessments and ongoing environmental monitoring required by the CNSC at all existing reactor sites in Canada,

demonstrate that significant adverse effects are not expected to result -- not expected as a result of a release of hazardous substances in liquid effluents to the environment.

To address this matter, CNSC staff recommend that once a reactor design has been chosen, OPG conduct a comprehensive assessment including, but not limited to, specific details of effluent releases, description of effluent treatment including demonstration of the chosen option, has been designed to achieve best available treatment technology and techniques economically achievable. OPG shall then conduct a risk assessment on proposed residual releases to determine whether additional mitigation measures may be necessary.

CNSC staff commit to completing this future review should the project proceed, and the determination of final effluent release limits in collaboration with other federal and provincial authorities as appropriate.

With respect to groundwater, OPG has predicted changes to the groundwater patterns as a result of the project. For example, dewatering during excavation and grading will lower

the water table substantially. With respect to groundwater quality, the predicted increases in groundwater are significantly lower than the current Ontario drinking water standard with approximately 500 Bq per litre being the highest concentration on site.

In its assessment, CNSC staff have identified aspects of the modelling that require enhancement. They relate to the methodology and sensitivity analysis.

At the time of an application for a licence to construct, OPG will have to demonstrate that the reactor design chosen will meet all applicable regulatory requirements in place at the time for drinking water and groundwater protection.

For groundwater, staff recommends that OPG undertake an assessment of wet and dry deposition of all contaminants of potential concern both radiological and non-radiological and gaseous affluence especially tritium on groundwater quality.

Number 2, enhanced groundwater and contaminant transport modeling, including sensitivity analysis and scenario of the impact of

future dewatering/expansion activities at the St-Mary's Quarry on the project.

And lastly, based on the groundwater and contaminant transport modeling results, if necessary, OPG should expand the Radiological Environmental Monitoring Program to include relevant residential and private groundwater well quality data in the local study area that are not captured by the current program.

With respect to the terrestrial environment, OPG has indicated that in 2007 an estimated 1,300 active burrows were located on the Darlington nuclear site. This represents approximately 50 percent of the active burrows located in Durham region.

In the January 31st, 2011 submission OPG indicates that the detailed mitigation plan will be confirmed once the final site layout is available. The layout may not require removal of all the bluff, particularly if once-through cooling is utilized.

The CNSC staff's assessment we ignored the extensive effort that has been made by OPG to characterize the baseline.

One of the primary mitigation

measures that OPG has proposed to mitigate a potential significant effect is the implementation of artificial nesting habitat, which has been assigned a low risk of failure by Ontario Power Generation.

This mitigation measure is most critical to the protection of the colony of bank swallows currently occupying the bluffs at the Darlington nuclear site.

Given the importance around the proposed bank swallow mitigation plan, CSNC staff had recommended that all bank swallow mitigation options put forth for the bounding scenario remain a consideration in the event that less than 100 percent bluff removal occur, including the acquisition of offsite nesting habitat.

Artificial bank swallow nest habitat could be constructed if you have the capacity to maintain a population which is equal to the number of breeding pairs supported by the amount of bluff that is to be removed and be constructed as close to the original bluff site as possible.

And the bank swallow mitigation plan should outline an adaptive management approach

to bank swallow mitigation.

With respect to the aquatic environment, OPG has proposed to infill Lake Ontario to an approximate four metre depth contour within the site study area. This would result in approximately 40 hectare infill.

OPG has concluded that no significant effects are likely to aquatic biota and habitat.

CNSC staff has determined that, as proposed, the bounding scenario may be a potential significant environmental effect because it includes directly covering a fraction of the lake bottom in the site study area at spawning depths of round whitefish.

Historical round whitefish studies had maximum catches at less than the four-metre depth contour and three indirect effects arising from the infilling to the adjacent habitat.

Similar concerns have also been expressed by the Ontario Ministry of Natural Resources and Fisheries and Oceans Canada regarding OPG’s proposed bounding infill scenario.

CNSC staff’s recommendation regarding OPG avoiding infilling beyond the two-

metre depth contour of Lake Ontario is in alignment with Fisheries and Oceans Canada's recommendation to the Joint Review Panel.

In staff's opinion, the implementation of an infill to a two-metre depth contour would not result in likely significant environmental effects to the aquatic environment.

An additional baseline information be forthcoming that demonstrates to the satisfaction of CNSC and Fisheries and Oceans Canada that the fish habitat beyond the two-metre depth contour is not valuable, consideration will be given in subsequent licensing phases to allow in a larger infill than is currently recommended by CNSC staff and Fisheries and Oceans Canada.

OPG in its January 31st, 2011 submission to the Joint Review Panel has indicated that a two-metre depth contour infill can accommodate a once-through cooling system. At that time, there was no mention of whether the other proposed cooling options such as cooling towers could be accommodated on the site if less than 40 hectares was infilled.

Yesterday, Mr. Sweetnam in response to questions from the Joint Review Panel

indicated that cooling towers would require greater than a 19-hectare infill area or greater than a two-metre depth contour.

Not knowing how much more infill area would be required nor having the analyses that supports this statement, such as revised site layouts, remains a gap on this matter.

OPG has concluded limited adverse effects to the aquatic environment. However, Fisheries and Oceans Canada and CNSC staff identified baseline aquatic deficiencies to the Joint Review Panel in the fall of 2010.

OPG conducted a fall gill netting survey at the request of the Joint Review Panel and has committed to conduct spring lateral fish surveys in 2011 in response to the Joint Review Panel's information request on this matter. CNSC staff have worked with OPG and other stakeholders in developing the scope of this survey.

In addition, in staff's opinion, additional data is needed as OPG's effect predictions were largely based on one-year data.

This is not sufficient baseline information to test effect predictions in an environmental assessment follow-up program,

especially with the uncertainty around some of OPG's conclusions such as the area not representing important habitat for round whitefish.

CNSC staff recommends additional baseline data collection from environmental assessment follow-up program purposes as follows: for fish and fish habitat, CNSC staff is referring to adult fish community surveys both gill netting in the site study area and electrofishing along the existing armoured shoreline.

For round whitefish, additional data collection is identified to better define the population structure and geographical distribution and; for impingement and entering another year of data is needed to deal with the inter-annual fish abundance variability and sample design inadequacies.

The data collection aspects related to the round whitefish are in alignment with OPG's proposed round whitefish action plan.

That concludes the key findings and recommendations made by CNSC staff. We will now summarize the Crown consultation activities undertaken for this project.

CNSC has acted as the Crown

consultation coordinator for the federal review in relation to the project. Engagement and consultative activities of Aboriginal groups have been ongoing since 2007. Communications have been through letters, phone calls, emails and meetings.

Based on all the information that has been received to date, CNSC staff are not aware of any adverse impacts this proposed project may have on the potential or established Aboriginal or treaty rights.

I will now pass the presentation back to Dr. Thompson.

DR. THOMPSON: Thank you.

To summarize, in CNSC staff's opinion the proposed project is unlikely to cause significant environmental effects taking into consideration mitigation measures and the recommendations outlined in CNSC staff's Panel Member Document 11-P1.3.

Subsequent licensing phases should the project proceed, will ensure the continued protection of the environment and human health and safety under the *Nuclear Safety and Control Act* and ongoing involvement of the public, Aboriginal people and other stakeholders.

This concludes the staff's presentation; we're available to answer questions.

CHAIRPERSON GRAHAM: Thank you very much, Dr. Thompson and your colleagues.

I will start the questioning with Mr. Pereira.

--- QUESTIONS BY THE PANEL:

MEMBER PEREIRA: Thank you, Mr. Chairman.

Let's start with Section 2-11.2.2 in your PMD. In this part of your PMD, CNSC staff state that the present estimates of fish loss do not indicate adverse effects large enough to put populations at risk. However, a range of potential mitigation measures are recommended. Among these is a deeper location for the intake.

Given the information accumulated so far on possible fish habitat areas and the areas frequented by fish in the vicinity of Raby Head, is there a precautionary estimate that CNSC staff can offer on the location and depth of the intake that would reduce significantly the intake losses from the current predicted level?

DR. THOMPSON: I will ask Mr. Don Wismer to respond to your question.

MR. WISMER: Don Wismer.

We're working on that with our federal partners, Department of Fisheries and Oceans who are concerned about direct disruption of habitat and intake fish loss and then Environment Canada whose concerns are more with thermal effects.

The short answer appears to be beyond the thermal clime and the thermal clime varies from five metres up to beyond 20 so the preliminary answer is 20 metres depth minimum, but we're still sorting that one out. It's a bit -- it will be determined a bit from the results of the Round Whitefish Action Plan which you heard is ongoing with some sampling this spring.

MEMBER PEREIRA: And if we had to make an estimate -- a precautionary estimate now of a location, it would be around a depth of 20 metres, given the knowledge that we have now?

MR. WISMER: That would be my view, yes.

MEMBER PEREIRA: And the same depth would apply for the diffuser?

MR. WISMER: Yes.

MEMBER PEREIRA: Okay. Going on

to another topic, in Section 2.9.3 of your PMD, CNSC staff concludes that OPG has made a satisfactory case that the project is unlikely to result in significant adverse environmental effect on groundwater quality. Taking mitigation measures into account, what are the types of mitigation measures referred to in this statement for ground -- groundwater quality obviously?

DR. THOMPSON: Patsy Thompson for the record.

In this case the effects that were being considered on -- on groundwater quality were from the atmospheric releases and entrainment of -- from dry and wet deposition of tritium was one of the concerns that had been identified. And the mitigation measures are essentially proper plant operation to maintain the -- the levels of -- of discharges to -- and -- and atmospheric releases to levels that would be below levels that would result in unacceptable groundwater quality.

MEMBER PEREIRA: Thank you. Again, just switching topics, in Section 2.4.3.1 of your PMD and -- and the following Section, reference is made to possible provision of additional used fuel dry storage buildings on the

ND site. The PMD states that this may require updating of the safety assessment and a separate licencing process. Could this separate licencing process require consideration of environmental impacts that are not covered in the current environmental assessment?

DR. THOMPSON: Patsy Thompson for the record. Depending on the -- any amendments, if amendments were -- or new licences are required for the waste management facility, the staff would determine whether an environmental assessment under the *Environmental Assessment Act* would be required. In the event that no environmental assessments are required, those -- those considerations would be undertaken under the *Nuclear Safety and Control Act*, but for the purposes of waste management, the technologies and mitigation measures lead us to conclude that there would not be significant environmental effects.

MEMBER PEREIRA: And that’s also another function of the type of -- of reactor technology chosen because of the different types of waste?

DR. THOMPSON: Patsy Thompson, that’s correct. The assessment considered the

types of waste that would be generated by different technologies.

MEMBER PEREIRA: Thank you.

CHAIRPERSON GRAHAM: Madam Beaudet?

MEMBER BEAUDET: Thank you, Mr. Chairman. I'd like to start with ones that are on the PMD, but in relation also with the licence to prepare a site, if you look at page 42, Section 262, you propose something here that a condition of the LTPS be OPG shall have the requisite plans and mitigation plans before applicable licence activities.

Now, what I understand in PMD 1.2 is a lot of the plans -- the handbook that you're supposed to have, I think they're not all there because there are lots of Xs so OPG says that it can start the LTPS activities even if a vender or not chosen so we get in a chicken and egg thing here. I mean, how do you answer that? I mean, if -- if you don't have the vendor, you can't prepare the books and if you don't have the books, you can't have the LTPS and if you don't have the LTPS, you can't start your activities. I mean, where -- where the circle starts --

DR. THOMPSON: Patsy Thompson. In the case of that -- sorry, the example you provide on -- on Section 2.6 -- 2.6.2, the issues that are being discussed are essentially site preparation activities, environmental effects from site preparation activities that are not dependent on a technology being chosen, for example, dust control, and things like that. So any technology essentially the routine protection -- environmental protection plans that would be needed for construction of sites can manage issues such as dust, storm water, et cetera. But to explain better the links between the mitigation measures, the follow-up program and the licence to prepare a site, I believe Mr. Howden could better answer that question.

MR. HOWDEN: Thank you, Barcley Howden speaking. For the licence to prepare a site that OPG has applied for, they've actually applied to one that is -- is not required to have the technology because they're not asking for any work to be done that would related to a technology. So they're actually asking for a licence to prepare a site to just generically prepare the site; generically put in services and -- so from that

standpoint, there's no real requirements at this point for anything specific.

In terms of for this, what we're doing is we've put a licence condition within the proposed licence that's being proposed to the panel, licence condition 1.1, that requires OPG to submit and have accepted by the Commission or person authorized by the Commission, all the requisite documentation that is required in advance of doing any licence to prepare site work. So what we're proposing to the panel is that that condition be there such that OPG as they develop the project further and start to develop their documentation in more detail, that there will be a whole point that does not permit them to actually do any site preparation work until all the documentation has come in; has been reviewed to the satisfaction of staff such that they can actually undertake the work safely and will have actually put in the mitigation measures required.

Also within that same licence, we proposed licence condition -- I believe it's 10.1 which is the requirement for a follow-up program and in that the follow-up program would require follow-up and mitigation measures required for a

licence to prepare a site. The documentation required for that is also linked to the licence condition 1.1 that I just spoke of with the hold point. So OPG would have to have the follow-up program in place as one of the conditions of meeting the licence condition 1.1. So that's how we've put the regulatory hold point that we're proposing to the Commission.

MEMBER BEAUDET: Correct me if I'm wrong, but 2.6 I thought referred for mitigation measures for any type of effect and it doesn't cover just dust?

DR. THOMPSON: Patsy Thompson. No, I was giving those examples because essentially during site preparation the types of activities are essentially the types of activities that would happen on any construction site so it's earth moving, so it's essentially prevention of spills, dust controls and -- and things that are typical of construction sites where dirt and things like that will be moved, fences will be put up. None of the activities that are covered by the licence to prepare a site would allow OPG to do construction activities that are related to the reactor design, cooling -- the condenser cooling water and things

like that. The licence to prepare a site is very restricted and in terms of activities that would -- that OPG would be allowed to do.

So in this case, the licence and mitigation measures and the follow-up program that are specifically linked to that phase of the project are very limited because the project activities are limited.

MEMBER BEAUDET: I'm under the impression in this paragraph that it's mitigation measures for any effect. It's any effect covered in the environmental impact assessment. Two point six (2.6) is:

> "...effects, prediction, mitigation measure and significance of residual adverse effects."

And in order to make sure that there's no significant residual adverse effect you need the proper mitigation measures, and it says here, second paragraph of 2.6.2, that you would have the requisite plans.

I mean, we have to make sure before the project goes ahead that we have the proper mitigation measures; no?

DR. THOMPSON: You're right. So 2.6 does describe in general how mitigation measures would need to be implemented for all phases of the project. That's a general description.

MEMBER BEAUDET: But then you need a vendor in order to do that?

DR. THOMPSON: That's correct, but 2.6.2 specifically refers:

> "OPG has proposed a number of plans as mitigation measures as indicated, that details of such plans will be forthcoming at a later stage."

For example, during the vendor design stage, but this would be with a construction licence.

If you go to the next paragraph:

> "In order to address the absence of detailed mitigation plans during the site preparation phase, CNSC staff is recommending that in CMD 11-P1.2 to the JRP that

the condition of the LTPS be that OPG shall have the requisite plans accepted by the Commission for those licensed activities."

But what we're also recommending in the series of recommendations we've made to the Commission is that, overall, there are certain things that need to happen.

So we've assessed that there are not likely to be significant environmental effects at all stages of the project given the mitigation measures that have been identified by OPG.

But for the first phase of the licence -- licence to prepare a site, there are certain mitigation measures that need to be in place. They need to be developed before OPG's allowed to do their work under that licence and the same thing would happen for future phases of the licence.

DR. THOMPSON: Is it before we're signing the licence or after?

MEMBER BEAUDET: I will ask Barclay Howden to explain how the process would -- hold points would work for the commission.

MR. HOWDEN: Yes, for this particular licence, OPG has applied for a number of activities, none of them related to any reactor technology. So, in essence, they've just applied to be able to do some generic site preparation activity unrelated to any technology, so they wouldn't have to choose the vendor.

From the standpoint of the licensing process, the proposal is -- and this is a standard licensing proposal -- is that the panel -- if the EA went through and was acceptable and the panel was able to make a decision on the licence to prepare site and chose to issue the licence to prepare site, that we put in a series of what we call "licence conditions" dealing with the various issues and certain licence conditions we call our "hold points" where the panel has issued the licence recognizing that there's more work that needs to be done.

And then within the licence condition, the panel can either choose to have the Proponent or licensee, at that point, to come back to the Commission to seek the Commission's approval to lift that hold point such that they would be able to do the work.

The panel also has the option to authorize CNSC staff to actually lift that condition if they chose to do that, in which case we will be preparing a review. And then based on the authority provided to us, when we were satisfied we would lift that, but the panel needs to be satisfied that if they provided that delegation of authority to staff that staff understood the panel's requirements for us to lift that hold point.

So this is a standard licensing-type condition that allows some things to be done and others not. In this case because OPG is still working on the documentation, we've put in that particular hold point.

MEMBER BEAUDET: I have a second aspect about this.

If you look at page 87 and 88, you make recommendations here that I feel should be done before the LTPS activities are initiated. And I come back to the figure -- the first session we had in the evening.

For me, the LTPS includes also shoreline stabilization and lake infilling, and I don't see how you could start to do your lake

infilling if you haven't done enough research; for instance, on the round whitefish.

DR. THOMPSON: Patsy Thompson, for the record.

Just to clarify, the proposed licence to prepare site does not allow lake infill. There are no lake infilling activities that would be authorized by the licence.

MEMBER BEAUDET: How can you do flood protection if you don't even know where your lake infill is going to be? If you do it when the shoreline is going to finish, how are you going to do shore protection?

DR. THOMPSON: Patsy Thompson, for the record.

You're right that shore protection when the shore is undefined would be a rather difficult task. Essentially, our understanding is that the activities that have been -- that CNSC staff proposed be authorized by the Commission under the LTPS would be those activities that are not linked to the choice of the technology, be it reactor design or cooling water.

If, for example, OPG has requested the authority to be able to do shoreline protection

or flood protection, if the -- moving forward to construction licence, the shore or the infill zone is different than the one that OPG has been working with during the site preparation licence, then that would be at their risk because they may have to redo some work or undo some work.

But it's something -- could I propose that we clarify this for the panel for tomorrow? It is confusing.

MEMBER BEAUDET: I understand that there could be hold points, but we have to be clear where we put the hold points.

DR. THOMPSON: Perhaps, Mr. Chair, if you allow -- I agree that clarity is needed and we obviously can't provide it tonight.

CHAIRPERSON GRAHAM: I agree that I think we should call this Undertaking Number 6 because I think this is probably the whole part of what's required before we go forward, so if we could have that tomorrow that would be fine. So we'll go with -- do that as Undertaking Number 6.

MEMBER BEAUDET: My last point on this is on page 95, Section 214.2. It's in that section, paragraph 1, 2, 3, 4. The last sentence:

"CNSC staff expect that the

Proponent obtain the sheer strength of the overburden materials and the dynamic properties of both overburden and sedimentary rocks to confirm the site's suitability."

Now, I'm not an expert in this, but do you have confidence that the site is suitable? No -- I mean, this is something also that we have to make sure before the licence to prepare site, would you say, is given?

This is a study also that should be done before site preparation, but you have recommended that it should be done at site preparation and pre-construction, not before site preparation.

I mean, there are certain things you recommended that it should be done before the project goes ahead, but this is not one of them.

DR. THOMPSON: Patsy Thompson, for the record.

You're right, the recommendation is Recommendation Number 19, and it's on page 98. And these were identified as site preparation and

pre-construction activities, essentially to ensure that all the information that is required to provide guidance for design of the plant would be available before any licence to construct would be applied for and issued.

And perhaps I could ask our geotechnical -- I will ask Dr. Grant Su to provide the details of the intent of the information we are proposing that the -- we're recommending to the panel that ---

MEMBER BEAUDET: What I would like to know is to what extent -- is he confident that the site is okay?

DR. SU: Grant Su.

(Non-English). And because given the site preparation, there would be some of the cut slopes and we need to make sure the cut slope is stable during the site preparation. So currently, OPG has to conduct an analysis under the parameters they used, therefore, the standard to analyze this is or should be to set parameters.

So we need to get the site-specific parameters to verify the slope stability but we haven't been sent that, so without the site-specific parameters and they use just assumed

parameters. They assumed the parameters and has demonstrated the slope is stable, but we still need the site-specific parameters to verify it.

So -- but without that parameters for site preparation, this slope steel cap could be, you know, built and by, for example, flattening the slope.

MEMBER BEAUDET: So is this in terms of the slope? It's not that you feel that there's certain things that, you know, you're not sure about the site itself. It's just standard that you have to insist on certain things.

Is that what I understand?

DR. SU: Yeah, we just need to make sure the slope is stable and the ---

MEMBER BEAUDET: Okay, thank you.

DR. THOMPSON: Perhaps if I could add that the assessment that was done in terms of the seismic risks and the other characteristics of the site that would have an impact on the design and the designing of the reactor and other elements have been identified and confirmed as the site being suitable as well as, for example, emergency planning and other things that are considered to determine whether the site is suitable for a power

plant.

In terms of this, it's a standard practice that limited -- that information is obtained as we progress and that information is considered by the proponent or the licensee at the time and by the CNSC staff to ensure that we have the best information as the site is investigated and the project moves forward.

MEMBER BEAUDET: Thank you.

THE CHAIRPERSON: Mr. Pereira, do you have some other questions?

Yes, go ahead; you're next.

MEMBER PEREIRA: Thank you, Mr. Chairman.

In PMD 11-P1.3, CNSC staff recommend that OPG be required to conduct a comprehensive assessment of effluent releases to provide a description of proposed effluent treatment and the risk assessment of residual releases.

What would be the criteria applied to judge the acceptability of residual releases relative to possible environmental consequences over the entire lifetime of the reactors?

DR. THOMPSON: Patsy Thompson.

Essentially, one of the deficiencies that CNSC staff identified to the Joint Review Panel when the Joint Review Panel raised an Information Request was on the lack of information in terms of the hazardous substances that would be used or produced in the course of the activity and under what conditions they would be discharged in the environment.

The expectation is that that work will be done, that OPG will use best industry practices to either prevent, minimize or limit the amount of substances that will be used and the amount that will be released using the technology that would give us the environmental performance that we expect from a site that would -- a plant that would be operating in a few years.

The standards that are being used to judge the performance of effluent limits, for example, effluent standards, would be in compliance with either national or provincial standards for air, water, sediment quality, and the expectation would be that the plant would be operating in a manner that there will be no significant environmental effects on water sediment, air quality, and that bio and human health would be

protected.

Over the -- essentially, the expectation is that OPG will be able to move forward should the project go ahead in phases, and the expectation is that they would identify best industry practices now.

We know, for example, that the hydrazine requirements are changing. There's been new assessments done by Environment Canada, so we expect the licensee to take into -- the proponent to take into consideration changes in legislation, for example, changes in standards and design facility to those standards.

In terms of the long term, it’s like any other industrial plant or any other nuclear plant. Over time, the licensee is expected to review its performance, its designs against new modern standards and determine whether it’s cost-effective to bring improvements to the plant.

So it’s the same process that the CNSC has used for refurbishment, for example, for integrated safety reviews.

MEMBER PEREIRA: Thank you.

Now, just some clarification on some -- on another recommendation.

In Section 2.4.5.3 of PMD 11-P1.3, CNSC staff recommends that the performance of quantitative cost benefit analysis for the full range of condenser cooling water options applying the principle of best available technology that is economically achievable, and I realize that this is probably some approach that is premature.

Just for my own edification and perhaps for maybe members of the public present in this auditorium, how could these techniques be objectively used to rank economic benefits alongside -- associated economic benefits alongside aquatic biota mortality and how would you make this comparison, socio-economic on one side, like visual effects, and impact on social environment against fish mortality, for instance?

DR. THOMPSON: Patsy Thompson.

We identified this as a deficiency in OPG's assessment.

Essentially, the guidelines require that OPG consider alternative means for the project. Alternative means were considered for, for example, reactor design, reactor technology, waste management options and also for various options for condenser cooling water.

In the case, for example, of reactor design, OPG did an assessment of alternative means but did not identify a preferred option.

In the case of condenser cooling water, OPG did the assessment, but went further and determined that one option was the preferred option.

In essence, the assessment that OPG did was not transparent and objective, and many assessments that have been done both under CEAA and outside of CEAA where various factors, social factors, economic factors, environmental impacts are identified and the process calls for a weighting of the relative importance of each of the factors and then comparing each of the options and rating these options for each of the factors, and then it's essentially a compilation or a scoring.

And that is a tool to aid decision-making.

There are at least two environmental assessments that were done by the CNSC using this multi-factorial method for choosing their preferred option. One was the comprehensive study that was done for decommissioning of

Whiteshell and something similar was also done for the environmental assessment, the comp study for the decommissioning.

Assessments under the CEAA have also used similar methods for similar purposes.

MEMBER PEREIRA: Another question. In Section 2.4.2 of your PMD, CNSC staff refers to consideration by OPG of full off-site on-land disposal of excavated material.

Could there be off-site environmental impacts that arise from recourse to off-site disposal?

And secondly, could off-site disposal of all of the excavated -- surface excavated material be an option that should be considered to avoid lake in-fill?

MS. THOMPSON: Andrew McAllister will respond to your question.

MR. McALLISTER: Andrew McAllister, for the record.

OPG in its assessment of managing its excavated materials, we felt, had identified the anticipated suite of environmental effects that would be expected as in their response to IR No. 11.

It should be noted that as the amount of materials would be increasing off-site, we would expect the subsequent off-site effects to be -- their magnitude, et cetera, would be greater.

For example, the number of truck trips for soil disposal, dust, those sorts of things would be identified the suite of effects that were anticipated.

The full off-site disposal, meaning not into the lake, but OPG examined this in more detail in their aquatic compensation report.

It was part of that package that was submitted to you in, I believe, August of 2010 where they went through at the -- working with Fisheries and Oceans Canada, CNSC and other stakeholders went through a bit more detailed examination of alternatives on options for in-filling.

One of them was, I believe, and I could stand to be corrected on this, would be the full off-site disposal, though I believe they deemed that to be economically not feasible. But I would -- that's my understanding and OPG perhaps could correct me if I've misstated that.

MEMBER PEREIRA: Just a quick

clarification.

You said economically not feasible, but is the cost benefit, is it economics against in-lake environmental impact?

We're talking about environmental impacts here, so it is not an environmental issue; it's an economic issue for on-land disposal.

MR. McALLISTER: Again, that's my understanding. I don't have OPG's report in front of me, but that's my understanding.

And if that's -- again, if I'm incorrect, I look to OPG to clarify that for the panel's benefit.

CHAIRMAN GRAHAM: Yes, I wonder if OPG might like to comment?

MS. SWAMI: Laurie Swami, for the record.

We do have the report with us. We're just trying to locate it in our large volume of work here, if you could just give us a moment.

MEMBER PEREIRA: I'm aware of -- you haven't addressed it in an IR, but I'm trying to determine now whether there's an environmental benefit from eliminating lake in-fill by

considering on-land disposal even if it is a more expensive option. It's the cost you pay for avoiding environmental impact.

MS. THOMPSON: Patsy Thompson, for the record.

We have the information you've been looking for.

The option for no lake in-fill with off-site on-land disposal was Option 2 that was assessed. And it was deemed to be not acceptable on the basis that it was more expensive than Option 1 which was the bounding scenario for the 40 hectares and unable to achieve maximum power as described in the scope of the project.

Those were the two factors that ---

MEMBER PEREIRA: Unable to?

MS. THOMPSON: To achieve maximum power as described in the scope of the project.

And I believe that was because of the no lake in-fill, the size of the site.

MEMBER PEREIRA: Okay.

CHAIRMAN GRAHAM: OPG, you still wish to comment?

MR. PETERS: John Peters, for the record.

The issue is an important one from our perspective, and we did look because we were asked to consider the possibility of no lake in-fill.

It is a very difficult thing, as we've indicated, to have no lake in-fill from the point of view of achieving the project as we had defined it in the environmental assessment.

And so it created not only the challenges as you suggest of off-site disposal, the costs and effects of doing that truck traffic over many more years as a result -- or more years as a result of much larger volumes off-site, but also did not meet the goals of achieving a site that could meet the project as it was defined.

And for those reasons, it became not an economic option.

MEMBER PEREIRA: Thank you.

Switching to another subject, in the CNSC PMD 11P1.3 on page 157, on the subject of out of core criticality, we're talking here storage of used fuel, is the information reported in the international community on criticality

events involving the handling and storage of used fuel and could any of this information be relevant with respect to impacts on site and across site boundaries?

MS. THOMPSON: Mr. Vladimir Khotylev will provide that information.

MR. KHOTYLEV: For the record, my name is Vladimir Khotylev, Physics and Fuel Division, CNSC.

As far as CNSC staff understands, criticality safety accidents reported internationally involved much higher infringements than typically used for nuclear power plants.

Nevertheless, for purposes of dry storage facility, if it is located on the same site and if OPG applied for licence to construct and for the licences, they would have two choices, either according to existing regulatory requirements which are spelled in regulatory document RD-327 either they have to prove that criticality accident at dry storage facility is not possible or they have to prove that regulatory requirements held in Section 2.3 of regulatory document RD-327 with respect -- regulatory requirements with respect to off-site consequences

of criticality accident to the public are met.

MEMBER PEREIRA: So what you are saying is that these risks would be avoided because of licensing requirements for the dry storage facilities. Is that correct?

MS. THOMPSON: Patsy Thompson. That's my understanding.

MEMBER PEREIRA: I'll go on to another topic.

In the same PMD, 11, P1.3, in Section 2.23.3, it is stated that the methodology used by OPG for analysis of radiological releases is a consequence of reactor base accidents is acceptable to CNSC staff for EA purposes.

However, in the same document it stated further that core damage frequencies and large release frequency data are not as yet available for all the reactor technologies that are under consideration as part of the definition of the plant parameter envelope.

What is the basis for the CNSC staff conclusion that the approach used for the analysis of releases from the plant can be accepted for the purpose of an environmental assessment?

DR. THOMPSON: I'll ask Dr. David

Newland to respond to that.

DR. NEWLAND: For the record, Dave Newland.

Could you repeat the question please?

MEMBER PEREIRA: It is stated in your PMD that core damage frequencies and large release frequency data are not as yet available for all of the reactor technologies under consideration.

What is the basis for the CNSC staff conclusion that the approach used for analysis of releases from the plant can be accepted for the purposes of an environmental assessment?

DR. NEWLAND: For the record, Dave Newland.

I think the basis for that is the -- our general understanding of how those analyses are done, so analyses are done by using conservative calculation methods, conservative assumptions that will produce a conservative result.

And on that basis we feel that the methods that are available, if you like, well established and we would understand them and they

would be broadly acceptable to us, but that would have to be verified at the time of licensing.

MEMBER PEREIRA: So this is an issue that when it comes to licensing, the application for a licence to construct is part of your review of the design, you'd be confirming that what you're accepting does, in fact, fall within the bound of what was accepted for an environmental assessment for the entire lifecycle of the plant?

DR. NEWLAND: For the record, Dave Newland.

Yes, exactly, and we would be verifying that, for example, those criteria, safety goals are met with margins using methods that are acceptable to us.

MEMBER PEREIRA: Thank you.

CHAIRPERSON GRAHAM: Madam Beaudet?

MEMBER BEAUDET: Thank you, Mr. Chairman.

On page -- in PMD 1.3, page 48, second paragraph, last sentence where it starts with:

> "CNSC staff expect additional baseline and wanted quality

data to be connected for all shoreline and shore locations" ---

--- et cetera, et cetera.

Your Recommendation 5 does not include that, is there a reason? Because I consider this to be a recommendation but I don't find them in the recommendations that you put forward for this section or am I wrong or is it covered? It's not clear.

MR. McALLISTER: Andrew McAllister, for the record.

Recommendation Number 5, which you had mentioned when highlighting that last sentence on page 48, it is somewhat different.

We noted that Recommendation Number 5 in OPG's proposed follow-up program, that it had elaborated on, and I believe the response to IR Number 260, I believe -- no, sorry, the -- the follow-up IR, that they would collect or they would conduct water sediment quality monitoring in the abatement area.

We had noted an absence of baseline data and therefore our recommendation going forth was the need to collect that baseline

data for environmental assessment follow-up purposes.

The sentence that you highlighted on page 48 is an expectation of CNSC staff for the -- should the project proceed, for the application for a licence to construct. So we would expect those additional details that we've highlighted there as part of that subsequent application.

DR. THOMPSON: And just to add, on page 51 of Recommendation 5, has the recommendation to the panel to collect baseline water and sediment quality data in the areas that you just mentioned.

MEMBER BEAUDET: But this includes offshore on page 48? I'm just trying to make sure that what you expect here and what you expect us to ask is well-covered in one of the recommendations. It doesn't have to be five, but it is well-covered.

DR. THOMPSON: Perhaps if we could come back tomorrow, I know it's one of the recommendations but I can't quite remember which one.

MEMBER BEAUDET: Thank you.

Page 51, if you look at Recommendation 6, okay, this is pre-construction and you have, as you know, a full table which is in

the Appendix B, I think and you have presented in your presentation.

There's a full series here of recommendations that will be done before the project goes ahead, pre-construction, pre-operation, et cetera, et cetera. And on page 159, I think -- let me see, is it 159? No, that's the follow-up program.

On page -- I can't find it here -- you say somewhere, I can't find the page, and you said it in your presentation that you will make sure that everything that is recommended here for future licensing phases will be taken into consideration.

Some of the things -- each -- and correct me if I'm wrong, each licensing phase has a document that says exactly what the Proponent is supposed to submit and what is expected of him.

I haven't done the cross-referencing to all this, but somebody would have to make sure that everything that is proposed here is realistic compared to legally what the Proponent is supposed to present.

And for me, what I'm saying is that some of the things here may happen 10 years

from now. I mean, I understand that you will be there to make sure that what is in the EA is going to be taken into consideration.

But who's going to be -- I mean, somebody has -- what if we are not here? You know, somebody has to make sure and how legally can we make sure that everything that's recommended here will be taken care of at each licensing process.

DR. THOMPSON: Patsy Thompson, for your record.

Essentially, you're right. Reliance on people's memory is probably not a good way to regulate the -- but more seriously, the *Canadian Environmental Assessment Act* puts requirements on responsible authorities to ensure implementation of mitigation measures and follow-up programs.

The CNSC has a licensing and compliance process and we have a mechanism to legally capture requirements -- the CEAA requirements essentially for mitigation and follow-up through our licensing process with licence conditions as appropriate.

You're right that not all recommendations, not all mitigation measures or

follow-up programs are for the first licence that the JRP -- should the project go ahead -- would be issuing.

And we have similar cases, for example, for projects where recommendations were for refurbishment, operation and decommissioning where we have a process where the information is captured and is brought forward at the appropriate time.

So there's an action tracking tool that the CNSC uses to track commitments and actions like this so that they’re not forgotten and they are dealt with appropriately at the right time.

MEMBER BEAUDET: Thank you.

I would like to go back on the cost benefit analysis that my colleague has brought up in the question.

Page 80, there's a long paragraph there if we go just about the middle. It says here:

> “The assessment as to whether a risk control measure or suite of measures is best available technology economically achievable is

not determined on the basis of a specific project but rather at the industry level. The consideration is whether the proposed risk control technology can be or has been successfully demonstrated as economically achievable and bearable within the industry."

When you do a multi-factor analysis and you come with a solution that the best available technology or what is on the table because you've realized that a threshold is always exceeded or whatever and you have to change something to improve your technology.

I'd like to understand what happens here if we refer to the industry level. What is that supposed to mean?

DR. THOMPSON: Patsy Thompson, for the record.

If you allow me, I would first deal with what is meant by best available technology that's economically achievable because the term is often used on a site-specific basis or

on a plant-specific basis.

The intent of that terminology and when it was started to be brought forward for environmental protection purposes, it was in the sense that we should tend towards pollution prevention measures rather than managing or minimizing risks.

From that point of view, when expectations started to be developed for pollution prevention for various industries, often regulations are brought into force that would apply to a range of -- for example, within -- I'll give an example, the pulp and paper industry in the late 80s, early 90s in Canada.

When the pulp and paper regulations came into force, there were many complaints that the technology would not be implementable, for example, for plants that had been built in the 30s and 40s and never modernized.

And so through the course of time, in various countries, best available technology economically achievable has started to mean technology that is readily available and can be effectively implemented by plants that are well maintained, well operated.

It's not intended to be a manner of letting plants that have been either not maintained or not upgraded remain in that state.

And so when we look at best available technology as economically achievable, it's not intended to reflect what is possible on a site but what can be implemented by an industry sector in general.

Having said that, when staff makes recommendations on a better assessment of alternative means to identify a preferred option, it's not necessarily in the assessment of preferred options linked to best available technology that's economically achievable.

Of course, we would expect any technology -- any plant that would be built and operated in the next foreseeable future to reflect the standards in place currently at that time.

But essentially to be able to do an exercise where all factors are weighted in a manner that is transparent so that anyone going through the process would have an understanding of what happened and how the decision on what technology is preferred has been done.

MEMBER BEAUDET: Is that the

equivalent of what they call in Britain “best practical means”? Are we following the British system is some ways?

DR. THOMPSON: My understanding is that the British practice that you’re referring to is a practice that is no longer in use or is not the preferred practice in Britain but they’re moving towards best practical technology or best available technology as well.

Best practical technology tended to maintain plants in a state of status quo essentially. And so the -- our assessment -- the CNSC has done the review of practices internationally for the purposes of setting effluent release limits and our assessment is that, in most countries, the regulations of discharges to the environment are using or moving towards best available practical technology -- best available technologically available, the TEA; sorry.

MEMBER BEAUDET: I realize it’s getting late.

So in other words, there's a possibility for retrofits?

DR. THOMPSON: Patsy Thompson, for the record.

That is correct and for example the process that the CNSC requires plants to undergo for refurbishment, the Integrated Safety Review, requires the licensees to review their plants against modern standards and to propose upgrades where the risks and the economics justify it.

MEMBER BEAUDET: Thank you.

I move to another point here. When the EC-6 was included in the PPE, there was an understanding that there was a technology review by CNSC. They were doing Phase 1.

When we look at the analysis starting page 135, you notice that some of the technology on the table needs an update. You know, some technology have done Phase 1 in the States and -- could we have exactly what's happening? I mean are there any reactor that is ready to go ahead?

DR. THOMPSON: Patsy Thompson.

I will ask Dr. Dave Newland to explain what the CNSC staff has done in terms of preliminary design reviews, as well as what is being done in other countries.

MEMBER BEAUDET: And what is left.

DR. THOMPSON: Yes.

DR. NEWLAND: For the record, Dave Newland.

So let me start by saying that the pre-project design reviews are not something that we require a vendor or a licensee or an applicant to do. They're an optional service provided by the CNSC for vendors in order that they can get a level of comfort about their designs and that their designs will meet regulatory requirements in Canada.

The way that we have organized the reviews is in essentially three phases.

Phase 1, they do an assessment against RD-337 or an assessment in principle against the requirements of 337 across all technical areas.

In a phase 2 we do an assessment of what we refer to as potential fundamental barriers to licensing.

Following that, a vendor has an option to come back and do a phase 3 to resolve technical issues with CNSC staff.

All this work is done with CNSC staff and it is not done with the CNSC as a licensing body and, therefore, is if you like

outside of the work of the Commission.

With respect to the technologies that we have looked at, we have done a phase 1, phase 2, phase 3 for the AECL 1000; we have done a phase 1 for the Westinghouse AP 1000 design; we started a phase 1 review of the EPR design, but AREVA has since put that on hold and has requested that we do no further work.

And then we recently, last year, completed a phase 1 review of the EC6 and we are currently undertaking a phase 2 review.

With respect to -- the other thing that I would add is that those reviews are relatively high level. We don't expend a lot of resources doing them. And I would say that they're significantly less than what is done certainly in the U.S. for design certification that is far more extensive, and it’s less than what is currently being done in the U.K. under their generic design assessment process.

MEMBER BEAUDET: So if I understand well, a vendor would take a risk if he doesn't go through these three phases in risk chosen and then he has to go through all the specification that you would request of him at the

different licensing phases?

DR. NEWLAND: Dave Newland for the record.

I wouldn't characterize it as a risk. I think that the pre-project vendor design reviews give vendors an opportunity to come and learn about how we regulate and do licensing and understand our regulatory requirements in Canada. That is their option.

If a technology was chosen for which we hadn't gone through one of -- a pre-project design review, I could see that it might take us longer for staff to get up to speed. It might add a little time to the overall licensing, but I don't believe that it would substantially change the risk to either a vendor or an applicant.

MEMBER BEAUDET: So when the government chooses its technology, there's nothing anywhere that will guarantee what is chosen can be appropriate before you start your different phases of licensing?

DR. NEWLAND: Dave Newland for the record.

So maybe we should take a step back and look at the level of safety associated

with these four technologies and other technologies that are being proposed in other countries. That level of safety is characterized against or benchmarked against our own regulatory requirements in RD-337 and similarly in other countries and against our safety goals for beyond design basis accidents and against those criteria.

In addition, we have a number of design requirements. All of those technologies at the level to which they have been proposed I think would likely meet the grade. And then the devil is in the details once you get into licensing.

So I wouldn't like to think that our framework would exclude any of those technologies.

MEMBER BEAUDET: Thank you.

I would like to check also pages 143 and 153 -- sorry, 145, second paragraph, last sentence:

> "Overall good agreement between the OPG data and the CNSC staff results was observed."

And the same is said on page 153, just the last paragraph before "out of core

criticality, safety":

"Overall good agreement between the OPG data and the CNSC staff results was observed."

Can we have that document?

I mean, what does it mean here; I mean, okay, you say that, but what do I rely on to agree with this?

DR. THOMPSON: Patsy Thompson.

Could I propose, Mr. Chair, that we take this as an undertaking and we will provide the information to the panel?

CHAIRPERSON GRAHAM: Thank you. Yes, I agree that will be Undertaking No. 6 I believe.

DR. THOMPSON: I think it's 7.

CHAIRPERSON GRAHAM: Or 7 now.

DR. THOMPSON: And could we ---

CHAIRPERSON GRAHAM: Madam Thompson, I'd like ---

DR. THOMPSON: Excuse me, if you'll allow us, sir, we could maybe come back tomorrow and propose a time by which we could come back.

CHAIRPERSON GRAHAM: That's what I was going to ask, what time -- you'll give us that time tomorrow.

MEMBER BEAUDET: When we look at the section -- I'll change the subject now -- on the terrestrial, I think terrestrial effects, it's page 62, you're proposing here if the lake infill is limited where -- I've asked a question already to OPG on this -- a two metre depth contour line, then the three ponds that were proposed as a mitigation measure will have to be rebuilt somewhere else.

You seem to suggest on Recommendation 9 that the ponds should be compensated like for like preferably in the SSA, which is the site study area along the waterfront trail.

Can you indicate to us where? I believe there are riparian owners outside OPG property and so I was wondering how realistic this proposal is.

DR. THOMPSON: Patsy Thompson for the record.

Just to clarify, the site study area is on the OPG site.

And I will ask Dr. Mulye to explain the basis of staff's recommendation.

MEMBER BEAUDET: Yes, site study area there's trail, but it's possible on the western side of the site that it's going to be used also for replanting to compensate for the hectares of vegetation that are going to be lost.

DR. MULYE: This is Dr. Mulye for the record.

I guess the expectation here is that the ponds could be integrated in the within the landscape. It isn't for having a like for like placement is because of the fact that these ponds are considered important in terms of landscape connectivity and that's an important function that we would like to have preserved onsite.

MEMBER BEAUDET: So you're suggesting something on the east side or on the west side?

I think it would be good if OPG could bring a figure and then we'll come to you and ask also. Can somebody bring up a figure that would show us terrestrial effect TSD --

CHAIRPERSON GRAHAM: I don't believe they have it tonight. Do you? Are you

saying that you have ---

MR. SWEETNAM: We don't have access to the system, so --

MEMBER BEAUDET: Oh, okay. Well, it's Figure 3.4.2, I think, that you would have.

MR. SWEETNAM: Can the staff have it?

THE CHAIRPERSON: Can your staff bring up 3.2.4?

MEMBER BEAUDET: Which is TSD terrestrial effects.

CHAIRPERSON GRAHAM: I think maybe Mr. Haddon is trying to

DR. THOMPSON: Perhaps while the figure is being loaded, our recommendation was for the northwest side of the site.

MEMBER BEAUDET: The northwest side already has an old landfill, how can you propose to build ponds on it? I don't think you should move anything with the old landfill.

MR. MULYE: Actually, it should be a little bit south of that site.

The exact layout will depend on how the site layout is designed, and that is -- right now is not known. So the actual placement of

these ponds will depend on –- after –- will be developed after the site plan is fully developed.

MEMBER BEAUDET: Well, we have to replace three ponds here and there's only the Coots Pond there.

I'd like to hear OPG on –- because if we try to compensate with something and we can't do it, then it's –- the mitigation measure proposed is irrelevant. I mean, it…

MR. PETERS: John Peters, for the record.

Thank you, Mr. Chairman. Madam Beaudet.

I have the figure in front of me, and I just ---

MEMBER BEAUDET: Is that this one?

MR. PETERS: That is the same figure, that's correct –--

MEMBER BEAUDET: Okay.

MR. PETERS: –-- that we're looking at on the screen.

And I think it's a simple confusion that we should be able to clarify.

We are referring here to the replacement of three ponds that are –- currently

three small ponds that we installed.

These are man-made ponds that we installed north of the CN Rail line on the east side of our property. And they currently function, as we've said, for aquatic habitat –- I'm sorry, not –- to have no fish in them but to provide wet areas for frogs and other species that we were trying to encourage on the site.

We assumed that we will be able -- as part of the restoration plan with the large soil stockpile we are going to put in the northeast quadrant in the area that is currently a flat farm field -- that we would create three ponds very similar to the ponds that we have –- we have to remove from further south.

And that the waterfront trail which we've assumed will be redesigned with community input in this area associated with that large soil stockpile will incorporate those ponds into a wildlife corridor running east/west across the site.

They are not shown on this figure. This figure was trying to illustrate the potential construction storm water management pond in the northeast quadrant but did not get into the detail

of these three small ponds.

We are referring to ponds that are less than a half an acre in size. They're very –- they're very small.

MEMBER BEAUDET: But there were –-

-

MR. PETERS: But we will replace them.

MEMBER BEAUDET: They were man-made –-

MR. PETERS: Correct.

MEMBER BEAUDET: –- in order to mitigate, I –- correct me if I'm wrong -- the existing site. I mean, you've been doing –- trying to do certain ---

MR. PETERS: Let me explain that.

MEMBER BEAUDET: –-- activities to restore the site, and now we can destroy them, you know, for the next one.

MR. PETERS: Well, we characterize it as a big part of our biodiversity commitment to the community to try and enhance the site diversity, and it is –- it was a site that we received in very poor condition; essentially open agricultural land of low diversity and we have

improved that year after year.

Because we installed these ponds less than six, seven years ago, we are very familiar with how we did it, and we will be able to reproduce those ponds with even higher qualities than we had in our first experiment, if you like.

And so this is a commitment to continued performance and an enhancement of wildlife habitat associated with areas that the public will have access to over the life of the project once we finish construction.

And that’s the intent here is to not –- it is a like for like, at least that was the intent when we examined the option.

MEMBER BEAUDET: So your commitment is to replace these three ponds somewhere?

MR. PETERS: That’s correct.

MEMBER BEAUDET: Thank you.

One more last point for tonight. I don’t think we can cover everything that I wanted to cover, but anyway.

We’ll change the subject again, and it’s archaeology.

I know CNSC staff hasn’t presented

any recommendation regarding this because they believe OPG has committed to legal detailed protection plan in the archaeological sites.

We got your report for -- I think it was the Brady Site –- no, there’s still the Crumb site, Stage 4, excavation of the Crumb site because it was identified also as a site that should go through the Stage 4, so what’s happening with that?

CHAIRMAN GRAHAM: OPG, would you like to respond?

MS. SWAMI: Laurie Swami.

I’ll ask Dr. Aamir to speak to that on behalf of the project.

DR. AAMIR: Dr. Aamir, for the records. I am the Section Manager for the design.

We are progressing Stage 4 archaeological investigation for the Crumb site this year.

Basically we have hired Archaeological Services Investigation (ASI) for this purpose and did the same for the Brady site.

MEMBER BEAUDET: So this will be done when?

DR. AMIR: This is expected to be

completed within this year.

MEMBER BEAUDET: Thank you.

Thank you, Mr. Chairman.

CHAIRPERSON GRAHAM: Thank you, Madam Beaudet.

Three –- we have three more topics on the agenda which we're going to try and get through as expeditiously as possible.

I have on the list here OPG may have some questions to CNSC. If you do, we'll do that.

The next on the agenda would be any government participants from various government departments that might have questions to CNSC, and then we have two intervenors that have asked to ask several questions.

So, first of all, OPG, do you have any questions to CNSC?

MR. SWEETNAM: Albert Sweetnam, for the record.

We have no questions.

CHAIRPERSON GRAHAM: Thank you.

And I'm not sure who I direct this to, but if there's any government participants that have questions to CNSC, would you indicate at this

time?

Okay, well, that's very good.

Then the next is the two –- we have two interveners; I suggest one at a time at the table. And we're permitting them to go to the table simply because of the lateness of the hour and to try and accommodate.

So Brennain Lloyd from Northwatch –- no, pardon me, from –––

MS. LLOYD: Yeah, Northwatch.

CHAIRPERSON GRAHAM: You're ready to go ahead and have the floor.

--- QUESTIONS BY THE INTERVENERS:

MS. LLOYD: Thank you, Mr. Chair. Brennain Lloyd from Northwatch.

I have two questions and I think we can be brief.

My first question for CNSC is with respect to Table 1 at Section 2 of the PMD 11-P1.3, the Panel Member Document about –- from CNSC about their review of the environmental impact statement.

Table 1 outlines –- it summarizes the CNSC staff review, and it takes an approach which I found helpful in its succinctness where they have 24 categories –- 25 categories.

One they don’t evaluate in the same manner, but they evaluate them, they give them a grade of satisfactory or below expectations.

And of the 24, Mr. Chair, 10 of them were below expectations. And when you do the math on that, it comes out to 58 percent, which is a –- I think a D grade when we were in school.

And my question for CNSC, I was –- that made an impression on me, that it was a D grade.

I think you as a panel should have an A plus document to work from. And my question for CNSC, Dr. Thompson mentioned this afternoon, and I don't remember the exact number she used, I think it was in the 40s. She was describing the number of environmental impact statements or environment -- number of environmental assessments that CNSC has managed or -- or reviewed. And I’m wondering if Dr. Thompson could give us some sense if a -- if a D grade is typical of the environmental assessment that they have reviewed, or if this is a particularly problematic piece of work before you.

CHAIRPERSON GRAHAM: Please silence your cells phones and if you have to use

them, leave the room.

Dr. Thompson, you would like to respond to -- to Ms. Lloyd's question.

DR. THOMPSON: Patsy Thompson for the record. We essentially compiled table 1 to be helpful, so I'm happy it was helpful.

The -- when we identified a topic as being satisfactory the meaning was that there was sufficient information for the purposes of the environmental assessment, and when it was below expectations, there was either -- there were two cases where mitigation measures, if not implemented, could result in significant environmental effects.

And the other -- in terms of below expectations were in terms of the need for a follow-up program based on information and things like that.

So for those below expectations we made recommendations to the Joint Review Panel in terms of addressing those deficiencies in terms of the -- the 27 recommendations that were made.

In terms of the -- there's more than 40 assessments that have been done since 2003. Essentially the process is different. The CNSC,

when we reviewed technical support documents and EISes from proponents, we'll go through a similar process, identify information requests, provide comments, work with our federal department colleagues, and essentially do the same thing.

The difference is we have a lot of interactions with the proponents in terms of resolving issues, so that once we get to the commission with requests for the commission to make admission on the EA. A lot of the issues have been dealt with between staff and the proponent, so that the -- what we're finding is below expectations have been resolved through the process of the review.

MS. LLOYD: Well, I'm not -- I'm not clear from Dr. Thompson's answer whether a D grade is typical of the work they review or not. That -- we'll let that go given the lateness of the hour.

My second question is Section 2.4.3.2. And, you know, Mr. Chair, we have a particular interest in radioactive waste in this review. And in this section CNSC staff comment that the documentation was not clear for -- in the EIS for the evaluation of alternatives for low and

intermediate level, and for fuel waste it -- fuel waste storage, the alternative was not clearly stated. Staff goes on to incorporate the IR responses into their commentary, you know, word for word in both cases.

In the second response, the response around used fuel, I was puzzled by it when I read the IR response. This is the second time -- well, this is -- yeah, this is the second submission, I think, of IR response number 11. And OPG had responded that they couldn't, as I understand it, just to paraphrase, that they couldn't do the evaluation because each reactor was different, and because the reactor hasn't been selected they couldn't do the evaluation. But then they went on in the IR response to say, the CNSC restates it word for word that regardless of which reactor type is selected by the province, used fuel will be managed in the way that -- that's similar.

To me those two statements, to say that each reactor design is different so they can't talk about the used fuel in detail, and then to say, each -- the way they're going to deal with the waste is going to be the same every time, I'm puzzled as to how those two statements make sense

together. And I was puzzled when I read the IR and I'm puzzled when I read it in CNSC's panel member document.

So if CNSC staff could help me with that?

CHAIRPERSON GRAHAM: Dr. Thompson, would you like to clarify?

DR. THOMPSON: Yes, I could. On page 22, the -- well, the paragraph above Section 2.4.3.3 says that regardless of which reactor type will be selected, the manner of managing used fuel waste will be similar. And then it goes on to say that the first period would be in water-filled fuel base for at least ten years, and then in dry storage.

So regardless of the reactor technology and the type of fuel, it would be first in water-filled fuel base and then in dry storage in either case -- in all cases or either case.

MS. LLOYD: If management is always similar, why is it different for each reactor design? The two statements to me are in incongruous, but ---

DR. THOMPSON: Perhaps another qualification is that the actual dry storage

containers may vary depending on the fuel type, but it's dry storage and fuel pools.

THE CHAIRPERSON: For high level fuels?

DR. THOMPSON: Sorry. For used fuel and the fuel that is typical of each reactor design identified by OPG.

MS. LLOYD: Thank you, Mr. Chair.

THE CHAIRPERSON: Thank you very much for good questions, but also for being to the point and cognisant of the time.

Mr. Mattson, through the Chair, please.

MR. MATTSON: Thank you, Mr. Chairman.

It's been a long day, and just note how much I care, and I apologize getting energized earlier, but it's World Water Day and it was my honour to be invited to the ROM to sit with the Right Honourable Jean Chretien tonight, and I missed that to be here to ask these three questions.

So I hope you know I care, and I'm here for the process.

THE CHAIRPERSON: Knowing Mr.

Chretien ---

MR. MATTSON: He wanted me here to talk to Dr. Thompson.

I guess, Dr. Thompson, you heard the questions I asked of OPG yesterday with respect to the once-through cooling water proposal and we are bringing on a number of experts, including Doug Howell, a biologist and former district manager of the OM&R, Dr. Henderson, ecological expert from Oxford University. And both of them conclude that the once-through cooling has the most negative impacts on the environment for Lake Ontario.

They include killing millions, tens of millions of eggs and larvae, killing tens of thousands of fish and impingement, serious thermal impacts on fish habitat and unnecessary discharges of other additives.

Your evidence, which is very much in line with OPG's evidence today, is that the once-through cooling has no significant impacts.

I'd like to give you the opportunity to list for the panel the evidence that you used to support that in light of the evidence you know that's coming forward.

THE CHAIRPERSON: Dr. Thompson?

DR. THOMPSON: Patsy Thompson, for the record.

I think the staff's assessment is quite clear in the panel member document in terms of our assessment of the impacts of the once-through cooling water in terms of fish entrainment, impingement and some of the questions that we had in terms of the modelling and the predictions for the thermal impacts. And we've identified this area as below expectations and have made recommendations to the panel on how to address those issues.

We further stated that, in our view, the alternative means assessment conducted by OPG in terms of identifying a preferred cooling water -- condenser cooling water technology had deficiencies.

If you'd like I could ask Don Wismer to identify and go into details in terms of the assessment that CNSC staff did in terms of fish loss and why we have concluded that this is not likely to be a significant environmental effect. But nonetheless, we identified it as an effect that needs to be dealt with.

MR. MATTSON: Yeah. With all

due respect to Dr. Thompson, I didn't get an answer at all except that there's something in some documents.

DR. THOMPSON: Could you maybe ---

THE CHAIRPERSON: I just want to know as a cost, is it ---

DR. THOMPSON: Could you please let Don Wismer answer in detail?

THE CHAIRPERSON: Dr. Thompson, if you'll carry on.

MR. WISMER: Don Wismer.

The basis for the assessment in terms of the intake fish loss is there are fish going to be killed by once-through cooling system, but the information we have now for the present fish community is that the majority of the main types impinged and entrained would be species like alewife, round goby, that are lake-wide and widely distributed, too numerous for a population level effect. And that's what is important to CEAA.

But also under our Act, we require mitigation to minimize adverse effects, and that's why what Dr. Thompson says is relevant. We're recommending a cost benefit analysis of all

the options for cooling and we're also working with OPG and the *Fisheries Act* regulators on working out the best options for once-through cooling if that's the way things go.

The other qualifier is that the fish community is in transition and what we have now may not be the type of fish we see in 10 years. So whatever option is chosen for cooling needs to be flexible and able to be modified in case in future, once the facility starts operating, there's an interaction that wasn't foreseen.

Thermal effects were mentioned. We have Environment Canada here who's the expert agency in that area. And they can address that one if you'd like.

THE CHAIRPERSON: Yes, I think we'll have an opportunity as days go on to discuss the thermal effects.

Mr. Mattson, one more question.

MR. MATTSON: Yeah, that was my first. I had three. I asked for three. Is that okay?

THE CHAIRPERSON: Carry on.

MR. MATTSON: Thank you. But thanks, that was helpful, the costs and the value

of the fish.

My second question is, the CNSC experts tonight have suggested that after this hearing is finished they will get a list of contaminants from OPG that will be discharged to the environment, and at that time CNSC will look to approve them.

I heard my friend, Mr. Newman, said that he will judge whether these contaminants are acceptable to us. The word is "us".

My question is, how does the Canadian Nuclear Safety Commission as an RA who must clearly understand their responsibilities under the *Canadian Environmental Assessment Act*, how does that putting off this list of contaminants to the environment jive with their obligations and responsibility to consider and provide you with enough information to give government and share with the public your position on whether or not these contaminants will have a significant effect on the environment or can be mitigated?

Thank you.

THE CHAIRPERSON: Dr. Thompson.

DR. THOMPSON: Patsy Thompson, for the record.

What I believe I said is that the expectation of the CNSC is that hazardous substances will be appropriately dealt with within the licensing process.

We have identified a lack of an assessment of hazardous substances within the assessment to be a deficiency. Our experience from currently operating plants in Canada and what has been done elsewhere in the world is that hazardous substances released into the environment are not likely to be significant.

That's the basis for our recommendation to the Joint Review Panel. That recommendation, moving forward, if the project goes ahead, the CNSC has a responsibility under the *Nuclear Safety and Control Act* to protect the environment and we also have a responsibility, if the project goes ahead and depending on the recommendations of the JRP and the government decision, to work with other federal departments as appropriate to set the limits on discharges to the environment from a future OPG facility at Darlington.

We will ensure, working with federal and provincial agencies as appropriate,

that federal, provincial air-water assessment quality standards are met and that the public and the environment are protected.

THE CHAIRPERSON: Thank you.

Mr. Mattson, you have one more question and I would ask you please to keep the preamble short.

MR. MATTSON: Yeah. Thank you, Mr. Chairman.

And I think you can note the transcript from tonight from that answer you'll be hearing it many times verbatim as just said by Dr. Thompson.

The last question is, this new concept of a hold point in a licence. The licensing, as you know, you're the Joint panel to deal with the *Canadian Environmental Assessment Act* and the licensing issues, and tonight I heard of this new interesting concept that the CNSC has conveniently come up with; a hold point in giving a licence for site preparation and that this hold point, again, I guess holds things until after this hearing is over until they feel that there's enough information even to give the licensing for site preparation.

So, again, my question to Dr. Thompson. As an RA and responsible authority under the *Canadian Environmental Assessment Act*, how do you jive your reticence to give a licensing authorization -- sorry, and then recommend that this panel, the joint panel, give a *Canadian Environmental Assessment Act* approval?

DR. THOMPSON: Perhaps to clarify.

CNSC staff is not the responsible authority under the CEAA. It is the Commission and a panel of the Commission. The Commission is the responsible authority of the CEAA.

CNSC staff are the technical and scientific staff of the Commission.

The second point I would like to make is that hold points are not new to the CNSC, and I believe Mr. Mattson should be well aware of that because he participated in the public hearing on the Port Hope area initiative at least two years ago where many hold points were proposed to the Commission on a licence.

But I will ask Mr. Barclay Howden to speak to the licensing process, and I

believe we have a presentation to the JRP specifically on the licence to prepare site.

MR. HOWDEN: Thank you. Barclay Howden speaking.

Yes, we'll be preparing the -- presenting our licence to prepare site presentation tomorrow which will talk about the proposed licence, which includes many licence conditions including a licence condition that contains a hold point.

The hold points are used under the *Nuclear Safety Control Act* licensing process, and it's a manner in which the Commission can go ahead and provide approvals for projects to go forward. But many projects are phased through time, and as that time progresses, initially some of the information is not available.

However, when the panel allows a hold point, it does make it very specific what the criteria would be to release the hold point.

You will see tomorrow that when the licence to prepare site is presented in our licence conditions handbook, which we use to provide clarity on what our compliance program will be, we have listed in great detail all the

documents that will have to be submitted.

Up to this point, OPG has submitted a portion of those documents, the high level ones, and they're starting to drive down to the lower level ones. And we actually have many of them, but we haven't completed our review.

But this is a standard approach that we've used under the licensing under the *Nuclear Safety and Control Act*, and we're not introducing any new concepts in process.

Thank you.

MR. MATTSON: Mr. Chairman, my question was about the hold point for the environmental assessment.

THE CHAIRPERSON: No, Mr. ---

MR. MATTSON: It was about the environmental assessment, not about licensing. I'm well aware that they use hold points of licensing.

The question was specific. How does this jive with the *Canadian Environmental Assessment Act*? And I know that they’re not the responsible authority tonight but they are often and I’m asking -- and they didn’t mention yet in their answer how this jives with the *Canadian Environmental Assessment Act* responsibilities that

they know of because they have been RA millions of times and the whole point has never been used that I know of in a CEAA.

And that was my question; I got nothing.

CHAIRPERSON GRAHAM: Mr. Mattson, I ---

MR. MATTSON: Well, I'm just going to keep asking until I get a responsive answer.

CHAIRPERSON GRAHAM: If the answer of Mr. Howden is not satisfactory to you, you will have an opportunity tomorrow because they are before us again under licence to prepare a site.

I want to thank everyone. I said at the outset that 12-hour days can't go on every day because it's not fair to staff, not fair to intervenors and not fair to the people in this room that cater to this panel.

I want to thank everyone today and I'm going to ask my co-manager to make a closing statement with a bit of information.

MS. MYLES: Thank you, Mr. Chair.

I just want to point out that our last scheduled presenters today, CNSC, OPG and Pacific Northwest National Laboratory, have agreed

to return tomorrow morning to make their presentations.

Also I'd like to note that in the interest of protecting the right of everyone who wishes to present to the panel, people attending the balance of this hearing will notice increased security measures beginning tomorrow morning.

Thank you.

CHAIRPERSON GRAHAM: Thank you very much. We are adjourned for the evening.

--- Upon adjourning at 9:18 p.m.

C E R T I F I C A T I O N

I, Alain H. Bureau a certified court reporter in the Province of Ontario, hereby certify the foregoing pages to be an accurate transcription of my notes/records to the best of my skill and ability, and I so swear.

Je, Alain H. Bureau, un sténographe officiel dans la province de l'Ontario, certifie que les pages ci-hautes sont une transcription conforme de mes notes/enregistrements au meilleur de mes capacités, et je le jure.

Alain H. Bureau