DARLINGTON NEW NUCLEAR POWER PLANT PROJECT

JOINT REVIEW PANEL

PROJET DE NOUVELLE CENTRALE NUCLÉAIRE DE DARLINGTON

LA COMMISSION D'EXAMEN CONJOINT

HEARING HELD AT

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Volume 11
REVISED

JOINT REVIEW PANEL

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Errata

Transcript:

Throughout the transcript the spelling Mr. Kavlevar was used when it should have read Mr. Kalevar.

Page 28, line 23

23 well as radioactive and I won't speak to the MESA

Should have read:

23 well as radioactive and I won't speak to the MISA

Page 71, line 4

3 correctness such as those used by Professor David
4 Parness (ph) in the control software for the

Should have read:

3 correctness such as those used by Professor David
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Page 130, line 19

19 second. That's when it has to be under computer
20 control.

Should have read

19 second. That's why it has to be under computer
20 control.

Page 131, line 13 and 20

11 One basic weakness of the CANDU
12 technology, as you very well know, is the positive
13 coefficient of nuclear radioactivity which means that
14 if a pipe breaks suddenly, as an example, it can
15 take off. The power can rise in one second to five

or ten times its normal value, and it can start melting down pipes.

I have the impression reading the CNSC documentation that this positive coefficient of nuclear radioactivity is not well seen in other countries like the US, the UK, France, and several others.

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Page 152, line 2 and 3

you have “Mass of highly active material”, the limiting factor is DC6.

It says here, “where used not in Environmental Impact Statement or Site Evaluation Studies”.

Should have read:

you have “Mass of highly active material”, the limiting factor is EC6.

It says here, “were used not in Environmental Impact Statement or Site Evaluation Studies”.

Page 152, lines 15, 17 and 18

MS. SWAMI: Laurie Swami. Dr. Vechhiarelli will be able to provide a more detailed response.

DR. VECHHIARELLI: Jack Vechhiarelli for the record.

Should have read:

MS. SWAMI: Laurie Swami. Dr. Vecchiarelli will be able to provide a more detailed response.

DR. VECCHIARELLI: Jack Vecchiarelli for the record.

Page 153, line 8

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Should have read:

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Page 241, line 11

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Should have read:

which would seem to be incredibly esoteric, but we

Page 241, line 23

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Should have read:

that is something that also has to be taken into

Page 267, line 24

retains over 99 percent of all the fusion products;

Should have read:

retains over 99 percent of all the fission products;

TABLE OF CONTENTS / TABLE DES MATIÈRES

TABLE OF CONTENTS / TABLE DES MATIÈRES

Courtice, Ontario

--- Upon commencing on Friday, April 1st, 2011 at 9:01 a.m./ L'audience débute vendredi, le 1er avril 2011 à 9h01

MS. McGEE: Good morning, mon nom est Kelly McGee. Welcome to the public hearing of the Joint Review Panel for the Darlington New Nuclear Power Plant Project.

Je suis la co-gestionnaire de la Commission d'examens conjoints du projet de la nouvelle centrale nucléaire de Darlington.

Secretariat staff are available at the back of the room. Please speak with Julie Bouchard if you are scheduled to make a presentation at this session, if you are a registered intervenor and want the permission of the Chair to have a question put to a presenter or if you are not registered to participate, but now wish to make a statement.

Any request to address the panel must be discussed with Panel Secretariat staff first. Opportunities for either questions to a presenter or a brief statement at the end of the session will be provided time permitting.

We have simultaneous translation; headsets are available at the back of the room. English is on channel one; la version française est au poste 2.

A written transcript of these proceedings will reflect the language of the speaker. Please identify yourself each time you speak to make the transcripts as accurate as possible.

Written transcripts are stored on the Canadian Environmental Assessment Agency website for the project. The live webcast can be accessed through a link on the Canadian Nuclear Safety Commission website and archived webcasts and audio files will also be stored on this site.

As a courtesy to others in the room, please silence your cell phones and other electronic devices.

I also want to note that there will be one change to this afternoon's agenda. The first item will be a presentation by the Nuclear Information and Resource Service, PMD-11-P1.189.

Thank you.

CHAIRPERSON GRAHAM: Thank you very much, Kelly, and good morning everyone.

Welcome for everyone joining us in person, through live audio link or on the internet. My name is Alan Graham and I am the Chair of the Joint Review Panel. The other panel members with me here today are Madame Jocelyne Beaudet to my right and Mr. Ken Pereira to my left.

The first thing in the morning we generally try and go into undertakings. We've gone through a lot of undertakings; we're up into 45 or 46 now. And I will ask Mr. Bourgeau, our legal counsel, to address the ones that are due today or undertakings that are given for today.

Thank you very much.

Mr. Bourgeau?

--- UNDERTAKING STATUS:

MR. BOURGEAU: Good morning.

I'd like to remind you the list of undertakings is updated daily on the CEAA registry. In the matter of the panel hearing undertakings that are due today, I'll address OPG in regards to undertaking 25, are there any existing programs in place to provide training for Aboriginal peoples to assist in gaining employment in the nuclear industry?

This undertaking has been received

in paper form and will be posted on the CEAA registry today. OPG, do you want to speak to this undertaking?

MS. SWAMI: Laurie Swami. We do have a comment. I would ask Donna Pawlowski to speak to that, please.

CHAIRPERSON GRAHAM: OPG, proceed.

MS. PAWLOWSKI: Donna Pawlowski, for the record. Good morning.

Employment in the nuclear industry involves a variety of skills and positions including skilled trades, engineering and applied sciences, corporate functions and security functions.

The majority of these positions require a minimum of a Grade 12 diploma plus some form of post-secondary school education such as a trade -- a trade-specific certificate of qualification or an accredited Bachelor of Engineering or Applied Sciences degree.

Given that, there are numerous programs in Ontario to encourage and support Aboriginal learners to achieve high levels of success in post-secondary education and training. This enables Aboriginal peoples to pursue careers

in the nuclear industry.

We have provided the Secretariat with three examples of this, the Ontario Ministry of Training, Colleges and Universities Aboriginal Post-Secondary Education and Training policy framework updated in 2011, a list of the Ontario colleges and universities which have programs which are responsive to and respectful of the needs, choices and aspirations of Aboriginal learners and an overview of the Ontario Power Generation programs that support recruitment and retention of Aboriginal peoples.

Thank you.

CHAIRPERSON GRAHAM: Thank you very much for that undertaking which I think was one of mine. And I appreciate your information.

Mr. Bourgeau?

MR. BOURGEAU: OPG, pertaining to undertaking 29 to provide site layouts incorporating two-metre lake infill and various cooling technologies. The panel has received a document that will be posted on the CEAA registry. Do you wish to speak to this undertaking?

MS. SWAMI: Laurie Swami. I would like to speak to that with permission and I'd ask

Don Williams to address that specifically?

CHAIRPERSON GRAHAM: You have permission. Proceed please.

MR. WILLIAMS: For the record, Don Williams, Senior Manager, Engineering.

For undertaking number 29, OPG committed to provide revised conceptual site layout drawings of the four condenser cooling options for each of the four reactor technologies with a two-metre depth contour overlay.

Sixteen (16) conceptual site layout drawings had been prepared for the Joint Review Panel as well as a summary of table of site impacts. Please note that a sample of site layout drawings with two metres of lake infill was previously provided to the JRP with OPG's response to undertaking number three on March the 22nd, 2011.

These 16 layout drawings illustrate the following for the bounding EIS envelope of up to four reactors or 4,800 megawatts. Number one, all four reactor technologies with once-through cooling can be accommodated on two metres of lake infill.

As mentioned in the OPG opening presentation, once-through cooling has the smallest

overall project footprint. It will provide OPG with the flexibility to optimize the site layout. It will permit us to reduce the extent of the excavation by approximately 40 percent. It will provide us with the ability to maximize preservation of the Bank Swallow habitat.

OPG has committed to achieving lake infill to the depth of two metres provided the project proceeds with once-through cooling. These layout drawings confirm this is possible.

Number two; all four reactor technologies can be accommodated with natural draft cooling on two metres of lake infill design as well. However, with natural draft cooling and two-metre lake infill, we are unable to protect the Bank Swallow habitat.

And in addition, natural draft towers have the most significant off-site visual impact. As we have heard earlier in these hearings, Durham Region does not prefer this technology.

And number three; the drawings provided indicate that hybrid or mechanical draft cooling for the ACR1000, the EPR and the AP1000 technologies would require additional lake infill

beyond the two-metre depth contour and we would be unable to preserve the Bank Swallow habitat.

During the detailed design with once-through cooling, the site layout will be optimized to maximize the protection of the Bank Swallow habitat and reduce the requirement for lake infill.

For your convenience, copies of the drawings, both electronic and hard copy, are available here today and they will be given to the Secretariat at the next break.

Thank you.

CHAIRPERSON GRAHAM: Thank you for that.

The panel members will probably need to discuss that further at another time. And we'll schedule that probably for next week when we have some time to review some of the undertakings.

Mr. Bourgeau?

MR. BOURGEAU: I will address CNSC in the matter of undertaking number 41 on contaminated site programs. Are you prepared to address this undertaking?

DR. THOMPSON: Patsy Thompson, for the record.

We are. We have, in consultation with Environment Canada, consulted the provisions under the Federal Contaminated Site program. And that program does not contain provisions for claims by members of the public for compensation. I would add that in the case of existing nuclear facilities in Canada, there are no levels of radioactive exposures that would -- that are causing health effects and would require compensation of members of the public.

And as we've seen over the last couple of weeks, that in the event of a nuclear accident, that the *Nuclear Liability Act* or the eventual successor of that *Act* would be triggered if there was an accident that required -- that had off-site consequences.

CHAIRPERSON GRAHAM: Thank you. Mr. Bourgeau?

MR. BOURGEAU: In regards to undertaking 44 to the CNSC on dissymmetry studies, the undertaking has been answered and the Panel will be posting the documents on the CEAA Registry.

In regards to undertaking 37 for the CNSC to describe information, if any, that CNSC has drawn from containment methods used by other

industries, this undertaking has also been answered and the Panel will be posting the document on the CEAA Registry.

I will be turning my attention to Health Canada in regards to undertaking 21 for Health Canada to provide recreational water quality regime -- quality regulatory regime, and undertaking 22 for Health Canada to confirm departmental policy regarding waiting, peer reviewed or single-source information. Both undertakings have been answered and the Panel will be posting the document on the CEAA Registry.

With respect to undertaking 17 to the Ontario Ministry of the Environment to provide the status of updated Ministry of the Environment storm water management documents, the Panel is not received it yet and will report back on it tomorrow.

With respect to undertaking 39 for Greenpeace to provide a copy of the report, Green Energy Coalition submissions to the Ontario Energy Board, the Panel has not received it yet and will report back on it tomorrow.

This ends the undertakings for today.

CHAIRPERSON GRAHAM: Thank you very much, Mr. Bourgeau, for the update and information that has been provided by CNSC and the OPG on their undertakings.

Now, I guess, we will now move to the first scheduled presentation of today, which is being presented by the Sierra Club Canada under PMD 11P1.169. I understand Mr. Bennett is here this morning along with Kristina Jackson who represent -- Ms. Jackson represents Sierra Club Ontario and I want to welcome you. And, Mr. Bennett, the floor is yours for your presentation.

--- PRESENTTATION BY MR. BENNETT AND MS. JACKSON:

MR. BENNETT: Good morning. Thank you very much for making this time available to us and giving me a chance to come down from Ottawa. It means that I will be able to see my grandson, Neil Guthrie Bennett Kitchen (ph) who's -- he will be three months old in a couple of days.

And it's a -- it's not ironic, but it's at fact that whatever decision this Panel makes, he'll be paying for it and all his life and he'll have no say in what this -- what he is forced to pay for, but he'll be paying for it.

Just as with the decisions we've

made in the past with forcing our children to pay for it now. And we need to keep that in mind that this isn't a short-term decision, this is a ten to 50-generation decision that you're about to make, and we should keep that in mind because do we have the right to saddle my grandson and your grandchildren with this power plant? And the cost -- and the need to protect the public from radiation for that entire time. I think we should always consider those importantly.

Just a few words on the Sierra Club. The Sierra Club of Canada is the Canadian Branch of the Sierra Club, which is the oldest and the largest environmental organization in the world. In Canada we're not quite so big, but we're -- we like to be small. In Ontario we have about 5,000 supporters.

Thirty (30) years ago, I pasted a banner onto the containment building at the Bruce and it -- on it, it said, "Nuclear power, it's not safe, it's unnecessary and uneconomic." And it was true then and it is true now. And we find it kind of hard to believe that we're still in this room talking about constructing yet another nuclear power plant, which will saddle our future

generations with unnecessary burden.

In terms of the presentation today, I'm going to ask Kristina to address some of the parts and I'll have a few more words and then if you have any questions, we can go from there. Is that okay? Kristina?

MS. JACKSON: Okay. Kristina Jackson, I'm the chapter coordinator for Sierra Club Ontario and as John mentioned, Sierra Club Canada is part of a larger bi-national organization including Sierra Club U.S. and including active chapters in New York State.

Our club in New York actually has the right to petition the Canadian Government to assess transboundary effects of this proposed project.

This is established in the 1991, Canada/U.S. Air Quality Agreement. Related language is in the Great Lakes Water Quality Agreement. And also in the Bi-National Toxics Strategy, which was passed in 1997.

So both countries have agreed to assess, avoid and/or mitigate transboundary pollutions. These obligations have been made effective in the domestic law under the *Canadian*

Environmental Assessment Act, specifically Sections 46 and 47.

The OPG does admit that there will be transboundary air and water pollution, but this EIS that we are discussing now does not account for nor assess the transboundary environmental or human health impacts of the proposed project.

Because the EIS doesn't specify the technologies for this specific Darlington project, therefore it cannot evaluate the discharges and impacts, either radioactive or conventional pollutions. Cannot outline the treatment modes that will take place and it cannot adequately describe the monitoring programs.

Even more concerning given the tragedy in Japan, is that OPG has failed to consider environmental and human health impacts should there be an accident or malfunction of the proposed radioactive liquid waste management system and this is contrary also to the CEAA in Section 16.

Without this information, this EIS can't be considered adequate. The EIS fails to comply with the requirements set out in the *Canadian Environmental Assessment Act* including the

most basic question, what are the environmental effects of this project.

The joint Panel has failed to ask for this information or require the information in EIS, so the Sierra Club will be requesting the Minister via the Canada -- the Canadian Nuclear Safety Commission to request a separate independent assessment of these effects. Our Sierra Club Chapter in New York, as well, is interested in seeing a real assessment. Thanks.

MR. BENNETT: Thank you. I would like to just -- sorry, John Bennett, Sierra Club Canada. I would like to just make a few comments about the intro of our presentation.

I find it very difficult that we don’t -- I don’t believe we have -- we can have an objective decision here.

I have great respect for the members of the Panel, but you have -- several of you have long associations with the nuclear industry. I’m certain -- I’m certain that I would not be an acceptable member of the Panel because of my -- my position on nuclear power. I think that it should also disqualify those who are advocates for it.

We don’t believe that there is a fair trial being taken place here. We would look -- we would ask that members of the Panel consider that. That there should be an augmentation of the Panel that there should be someone on the Panel who’s not clearly identified as a supporter and participant in the nuclear industry. It’s a fundamental question of justice.

You know, recent comments by the Chair or the President of the Canadian Nuclear Safety Commission describing questions about transportation of steam generators as just professional, anti-nuc people as though there is something wrong with wanting to protect our planet and make sure that our children are safe from radiation is unacceptable, and from a Quasi-Judicial Board.

Everyone has their own opinions, but when you’ve taken on a position such as that, you should keep them to yourself, but clearly this -- this Panel, as people who are at -- or part of the nuclear industry and you’re the ones who we’re -- who are being asked to make this decision. And no one like me is up there being asked to participate and we really find that offensive to

democracy and offensive to the sense -- a sense of justice.

Nuclear power in Ontario has provided lots of electricity, but it's also provided a lot of problems. It has bankrupted the second largest utility in North American, which was hidden in a restructuring, but it bankrupted Ontario Hydro.

Every bill in Ontario today has a -- has a line at the bottom that says, Debt repayment. And that's to pay for the nuclear experiment that failed before, yet here we are again contemplating redoing -- taking the same mistake and doing it again.

We don't understand that. We don't see what the point of it is.

We have produced, in the CR Club, by ourselves and in company with numerous other organizations over the last 20 years, numerous reports, papers, submissions all detailing how it is -- how it is possible and preferable to meet our energy needs through other means than nuclear power, yet that is never considered, and we're still here in a room talking about building a nuclear power plant that has implications for tens

of thousands of years.

I don't understand.

So that's all I'd really like to say today. If you have any questions about our presentation, I'd be glad to try to answer them for you.

CHAIRPERSON GRAHAM: Well, thank you very much.

While I appreciate your comments, I've been reading your brief, and your critique of the commission -- of the panel that's before us -- I wasn't going to answer it unless you had brought it up.

I'm just going to take a moment, not to defend the panel, but to just put a few facts on the -- on the record.

I think it's wrong to make -- to make an opinion of someone unless you have all the facts.

I don't think in my tenure as being on the commission that I ever demonstrated that I was a proponent nor an opponent of nuclear energy, of nuclear power. And I am -- go into this every day with an open mind, and I've demonstrated that.

I don’t speak for the actions of others, but I can speak for myself.

And I’m going to just take a moment to give you a little example.

Back in another life when I was a minister of the Crown in New Brunswick, one morning the newspaper carried a headline that I was -- I had a hit list on certain wildlife because there was a regulation change within the department.

So I knew that that was totally wrong, that I had no hit list or anything, so I went and met the editorial board at the newspaper the next day.

And, you know, I said, you know, you’re -- you’ve drawn a conclusion without checking the facts and so on. And I said, in my life as a farmer, which -- I do a little bit of farming. I said, I will not even cut a field of hay until after the bobolinks are hatched.

And the editorial board said, oh, you’re a farmer. Oh, you practice that. And the next day they wrote a great article about the minister being a farmer and doing this, that.

But it was them making a statement without having the facts.

And I suggest to you and your organization that I've never demonstrated that I am biased one way or the other.

I take great responsibility in going into this and chairing this panel along with my colleagues, who, I believe, are going in this with an open mind.

We haven't made a decision, and we haven't -- we're not ready to make a decision.

We still have another week of hearings. We still have other information that we don't have.

And to suggest that we are biased I think is doing that without all the facts, and I suggest that I accept everyone's point of view and respect everyone's point of view.

But I just want you to understand that we're here to do a job that is given us, and we'll make that decision once we have all the information.

So I want you to go back and rethink that because of -- just because I was a member of the commission for a number of years, all my actions and all my questions over those 12 years or 11 years that I was there were never -- one way

or the other, they were to get the facts and to make a decision in the right way.

And I believe that speaks for my colleagues.

And I would suggest that before someone takes an opinion that they look a little deeper into the background of how people have demonstrated their activities and their actions over the years.

And I am not challenging you, but I am saying that I live by what I do every day, and I hope you will accept that.

So with that, I am going to go to my first colleague on the panel, Madam Beaudet, for questions with regard to the presentation that is before us today, which, by the way, has a lot of information in it and a lot of questions. And we're going to review those the same as we do everyone's -- every other one.

So, Madam Beaudet?

--- QUESTIONS BY THE PANEL:

MEMBER BEAUDET: Thank you, Mr. Chairman.

I'd like to go to your written submission, PMD11-P1.169, on page 3, paragraph 1,

2, 3, 4. I'd like to understand a little bit more about the statements you make here, have standing to file the section 46 petition because we have an interest in lands on which the project may cause -- do you mean -- you referred here to a First Nation in the States that would have interest in the land. What do you mean exactly here?

MS. JACKSON: I'm actually reading comments submitted by one of our -- a volunteer leader, who is a lawyer.

I believe that she's speaking to the State of New York, not necessarily a First Nations group within, but we -- by having members and -- who are interested in this issue, we believe it's relevant that the transboundary effects in the US within a 100 kilometres of the boarder are relevant.

MEMBER BEAUDET: The reason why I'm asking that is that because we have to issue a license to prepare a site, and we have to make sure that the duty to the Crown for consultation of First Nations has been done properly, and if there's any group that was omitted from the consultation by either OPG or by CNSC, we have to know because we have to pass a judgement if the

consultation was adequate. And that's why I was asking this question.

MS. JACKSON: This is Kristina Jackson.

I would -- I would hope that the consultation, the research would have been done. There may very well be some First Nations groups, but I would think that it would be addressed by staff.

MEMBER BEAUDET: The lists were drawn, and, believe me, it was very extensive.

But, you know, we have public hearings to hear from people, and sometimes you realize there's an overlook somewhere. And you get groups coming to -- you know, to bring to our attention that something was forgotten.

MS. JACKSON: I see.

MEMBER BEAUDET: My other question relates to transboundary releases and impacts.

And under the commission for environmental protection of NAFTA, there is a possibility if any group, whether in Canada or in the States, find that there's a litigation concerning the non-compliance or non-respect of the agreement, they can bring forward such an item.

And I was wondering -- I'm trying to understand here when -- you know, you mentioned certain things about transboundary release and that you've -- you know, in terms of not having any standards or capacity to monitor.

And I was wondering if you were referring to some groups in the United States that would contest the EIS because you say that the EIS doesn't take into account this aspect.

MS. JACKSON: Yes. This is Kristina.

That is what we're saying, that it's relevant to our CR Club members in New York State who would, in fact, like to see a greater evaluation, a real evaluation of impacts, monitoring, and mitigation and avoidance.

And we believe that the EIS doesn't cover that, and so we believe they do have standing.

MEMBER BEAUDET: Now, from the evaluation of air pollution -- and I'd like CNSC to address this.

There was an evaluation of exceedances to standards, and I think the main concern was with particles, and this is going to

happen during the license to prepare the site, and that as a mitigation measure, there would dust abatements and a committee to inform the citizens, et cetera. I'd like CNSC to cover a little bit more the exceedances possible with SO2. The requirement for the Canada-USA Quality Agreement usually, as it is here, it's within the 100 kilometre, if you have any new source of pollution. But I'd like CNSC to comment if there's any of -- of the air pollutants mentioned in this agreement that they consider would have quantities exceeding the limit quantities, either for pollution source or any new source, like this project is. And -- because if there's a need for notification in conventional pollutants, I think it should be addressed.

DR. THOMPSON: Patsy Thompson, for the record. I'll provide a brief overview, and then I believe Environment Canada would be prepared to -- to speak to that issue.

The assessment considered the -- both radiological and non-radiological pollutants, and when the assessment is done the modeling takes into consideration a number of years of monitoring of materialogical data to validate and build a

model. And the model that is used and the data that is used indicates that the -- with a predominant wind direction, that there's very little possibility for pollutants to reach the US in concentrations that would be a cause for concern. And I will ask, if you wish, Environment Canada to provide more information in terms of the substances of interest.

CHAIRPERSON GRAHAM: Do you want to -- I think perhaps that should be given as an undertaking, and we'd give that undertaking --

UNIDENTIFIED SPEAKER: They're here.

CHAIRPERSON GRAHAM: Oh, they are? Oh, I'm sorry. Yes, I did see you here a while ago, I didn't see you at the mic, so go ahead, sir.

MR. LEONARDELI: Sandro Leonardeli for the record, with Environment Canada. A couple comments. We did take a look at the possible implications under the Canada-US Air Quality Agreement. The substance that we identified as potentially exceeding the one-tonne threshold as a release from the facility would be ammonia. Now, that's based on a bounding value. It hasn't been finalized. We'll have to re-evaluate the entire

list of substances when we get a detailed design. But of the substances that were discussed the highest value that came close to the threshold was ammonia. So potentially ammonia could be something that would trigger that notification under the Canada-US Air Quality Agreement.

We did not see values of NOx and SOx, that’s nitrogen-oxides and sulphur oxides, that would be released from the facility that would trigger the requirement. Now, it’s a much higher threshold for those substances. I don't have the number offhand available to me, but it would be close to -- I believe it’s 90 metric tonnes, 100 metric tonnes. It’s a much higher value for NOx and SOx to trigger the reporting requirement.

In terms of radionuclides, the Canada-US Air Quality Agreement does not specifically mention radionuclides in it. It doesn’t exclude them, nor does it include them. The annexes to that Air Quality Agreement, though, are -- that set thresholds for specific substances do not include any radionuclides on that list.

In terms of dispersion, you know, the wind does blow from the northwest, which could potentially disperse contaminants into -- into the

United States, as would almost any other industry in Canada. So the potential does exist, but, of course, with distance you have increasing amounts of dispersion and a much lower concentration, as you move away from the -- from the source.

MEMBER BEAUDET: I believe we had a discussion of the session about considering radionuclides as toxic substances, and it was a recommendation by the International Joint Commission, and it was never agreed upon. And I think, Environment Canada, you did mention that it was a responsibility of CNSC and not Environment Canada; am I correct in this?

DR. THOMPSON: Patsy Thompson, for the record. No, Environment Canada has some responsibility under the International Joint Convention, the Great Lakes Commission, and Environment Canada can speak to that. What I did say was that the Government of Canada did respond to both reports that made recommendations to consider if radionuclides were toxic, to deal with them as they would -- as other toxic substances would be dealt with. And the assessments that have been done under the priority substance list to the second priority substance list demonstrated that

none of the releases of radionuclides, either to the atmosphere or to -- in liquid effluent, would result in concentrations or that would meet the definition of toxic in the *Canadian Environmental Assessment Act*, which is Section 64. So the assessment was carried out for -- under the provisions of the *Canadian Environment and Protection Act*, and the conclusions were that radionuclides released from nuclear facilities for the radiological aspects were not SEPA toxic. The only radionuclide that was SEPA toxic was uranium from certain uranium, but for its chemical toxicity, not its radiological properties.

MEMBER BEAUDET: And this would be normal operations. I mean, there was never an evaluation, for instance, if there was an accident or serious malfunction?

DR. THOMPSON: Patsy Thompson, for the record. The assessment was conducted based on a combination of information derived from models, but also we reviewed all the environmental monitoring data that was available to do the risk assessment. And so it looked at existing environmental concentrations and what we would anticipate with the continuing operations of

facilities, but they were not for -- it wasn't a scenario of what if an accident happened. And that is not normally how substances are assessed under SEPA, but if a substance is found to be toxic under SEPA there are expectations that environmental emergency plans be developed for those substances. And under the *Nuclear Safety and Control Act* the regulations do have requirements for emergency response plans for radionuclides -- for operating nuclear facilities essentially.

MEMBER BEAUDET: Environment Canada, do you have a comment on that?

MR. LEONARDELI: Not on that specifically. Patsy captured that well. I did have a clarification on the Canada-US Air Quality Agreement. Page 82 of the Environment Canada submission has a summary of the agreement, and I think I'll just point something out.

For the new pollution sources, air pollution sources within 100 kilometres, for the substances, sulphur-dioxide, nitrogen-oxides, carbon monoxide, total suspended particulates, volatile organic compounds, the threshold is 90 tonnes per year for requiring a notification.

As for hazardous air pollutants,

such as the ammonia that I mentioned earlier, the threshold is one tonne. Other substances that would be considered on that list are any of the substances that are reported on the National Pollutant Release Inventory.

And so we did a comparison of the existing emissions from the Darlington facility and didn't see emission values that would trigger these other substances on the NPRI. Again, we would have to re-evaluate based on final design of the proposed project, but we would then take a look to ensure that there -- whether there is or not a triggering substance. Thank you.

MEMBER BEAUDET: Thank you. Related to that we might as well look at two items that concerns air pollution. And there was an element that was brought to our attention by the Ontario Lake Waterkeeper regarding plume and entrapment of emissions –- air emissions, and I was wondering if you had any comments on that?

MR. LEONARDELLI: Sandro Leonardelli for the record. We did take a look at the Waterkeeper's comments on the dispersion modeling. In general, although they do raise a valid issue about plume entrapment, to some extent,

it is a valid concern, but when you take a look at the overall dispersion modeling results where we looked at the predicted values versus what's actually been measured, Environment Canada felt that the dispersion modeling did a –- was proper, was adequately conducted, and provided a valid representation of dispersion characteristics.

Now, the –- I would add, though, in terms of the hot plume analysis that was talked about in the first week of the hearings, that had to do with the accident and malfunction scenario, which raised –- when you have a hot plume, there is a potential for –- for the shoreline fumigation, which we didn't feel would be a valid issue for normal operations because you don't have a hot plume, okay. So I would add that as a further clarification.

But we will be issuing a –- an evaluation of the Waterkeeper comments on the dispersion modeling before the record is closed on this.

MEMBER BEAUDET: Would you also –- did you get a chance to look at the response to our undertaking to PNNL regarding breeze from the lake when –- when they say that this was not evaluated,

and they do have, in the last paragraph of the response, a comment that –- I mean, it's not clear to us if we should go ahead and insist on this being done or not, and I was wondering if –- I don't know if you had the chance to look at it, but maybe you should look at it and come back with some advice to the panel on that, please.

MR. LEONARDELLI: Sandro Leonardelli for the record. We could do that. I don't have the PNNL details fresh in my mind at the moment, so we could have our meteorologist take a look at that and provide any comments that you'd be seeking.

MEMBER BEAUDET: Because you did the –- the evaluation –- re-evaluation and passed the judgement on the modeling used by OPG, and I think you have the specialist at Environment Canada that is probably the most appropriate person because he's looked at it in detail.

MR. LEONARDELLI: That's right. Okay, so we'll do that as an undertaking, then. Sandro Leonardelli for the record.

CHAIRPERSON GRAHAM: That will be Undertaking Number 49 to Environment Canada for the topics that have just been discussed and the

information we require.

MR. LEONARDELLI: And so for clarity, the –- are we speaking about the PNNL report specifically, or –-

MEMBER BEAUDET: I'm speaking about the response to an undertaking we –- I can't remember the number –- that we had given to PNNL, and I think it's a one- or two-page document that is probably already on the registry, and it's –- I've lend my document this morning and I don't have it here, but it's either page 1 or page 2, it's the last paragraph. I think page 2.

CHAIRPERSON GRAHAM: That, I think, was Undertaking Number 14. Was that –-

MEMBER BEAUDET: Yes.

CHAIRPERSON GRAHAM: PNNL is to provide us, which we haven't got that information yet on plume versus air quality.

MEMBER BEAUDET: No, we did receive, Mr. Chairman, the response, yes.

CHAIRPERSON GRAHAM: You have got that? I haven't –-

MEMBER BEAUDET: And that's what I'm referring to.

CHAIRPERSON GRAHAM: Okay, that

report.

MR. LEONARDELLI: Okay, thank –- Sandro Leonardelli for the record. Thank you. We'll –- we will look for that on the registry and provide you with comment.

MEMBER BEAUDET: Thank you.

CHAIRPERSON GRAHAM: Thank you very much, Madame Beaudet. You have some further questions?

MEMBER BEAUDET: Just one more questions. Regarding software complexity, we have somebody coming later to present, and so we'll reserve our questions to –- sorry, I'm in the wrong document here.

Yes. Regarding monitoring and follow-up programs. I don't know if you had a chance to look at the review of CNSC with respect to that. It has a proposal for follow-up programs and monitoring, and it's –- it will be done over the different licencing to be issued.

One point here, and I think at the beginning, it's a little bit confusing that you –- you know, you have the environmental assessment and you don't even have the vendor or the technology. However, the licencing process has –- the first

phase is a license to prepare the site, and we did discuss this at length the first week, that the panel who has to remit that license has the possibility in the environmental monitoring program to –- has the possibility to develop and make recommendations for all the other licencing phases.

And this legally, I did check if this is a possibility. So it –- in our license, we will be able to ensure that for the operation, for instance, of whatever technology, and, I mean, at that point, I hope there will be a choice, that we can ensure that certain things would be looked at and standards would be met, et cetera.

I don't know if –- for you, if you were aware of that possibility because this process is very different from just a CEAA panel, but it is very clear in our minds that if there's anything that we have to look at further down the process, it can be taken care of and the regularity –- there are regulatory instruments to ensure that.

MR. BENNETT: If I had any confidence in that, I wouldn't be signing an Affidavit today asking for a judicial review on the decision on the steam generator transportation to Sweden.

In that case, there was an environmental assessment in which the –- it was a clear description of what would be done with those steam generators was discussed and was presented. A few years later, the proponent changed its mind, and the CNSC rubber stamped it without questioning whether or not we needed to revisit the environmental assessment.

So I have no confidence that you can impose anything beyond the decision you make because the CNSC has actively encouraged at least one proponent to undermine the environmental assessment process by granting a license to do something outside an environmental assessment. And it’s going to be up to the courts to determine who’s right and wrong on that, but we don’t have any confidence that you can regulate beyond the decision you make here, and that’s our precedent to believe that, and that’s not my impression or my opinion.

MEMBER BEAUDET: Thank you. We –- it’s noted. Thank you, Mr. Chairman.

CHAIRPERSON GRAHAM: Thank you, Madame Beaudet. Mr. Pereira.

MEMBER PEREIRA: Thank you, Mr.

Chairman. My first question concerns comments made by the intervenor on page 8 of their submission when they comment on the proposed Radioactive Liquid Waste Management System, and they comment that there's not enough information provided in the environmental impact statement to understand the possible impacts of the operation of the liquid –- Radioactive Liquid Waste Management System in the lake.

So I'll turn to Ontario Power Generation and ask for the standards that they will follow, the limits that they will impose on releases arising from the operation of a Radioactive Liquid Waste Management System and the monitoring that they will put in place to confirm that there are no undue impacts or no undue exceedences [sic] of expected or target limits which releases to the lake.

MS. SWAMI: Laurie Swami. The Radioactive Liquid Waste Management System is a regulated stream. There are several regulations that apply. I will mention its conventional as well as radioactive and I won't speak to the MISA requirements or the certificate of approval requirements as part of this answer.

The stream is regulated by the Canadian Nuclear Safety Commission. We look at our emissions from the site, whether water, air, whatever the radionuclide may be. We do an assessment to determine what the -- the requirement would be in order to meet the regulatory requirements. So on a radioisotope specific limit is established for each of the radionuclides that would or potentially could be emitted through a water-borne release as an example. That material is done through CSA standards on how to do calculations and assess the requirements, the information is provided to the Canadian Nuclear Safety Commission. They do a detailed technical review; comment and either approve or not what those specific limits for each of the radionuclides would be.

Once there is a limit in place, OPG operates the -- to the ALARA principle and so we would look for opportunities to be well below what those limits and we constantly look for improvements in those areas, whether it’s through treatment systems or some other means of reducing to ensure that we’re within the limits.

Not only do we have the legal

limit, we have action limits and internal investigation limits, which are directed through the CNSC so that we would have reporting requirements, action levels where we would have to take actions to reduce. And so we monitor against those limits more specifically, be on the ALARA program. And I think that -- yes, and then the standards for monitoring; there are standards that are established on the frequency of monitoring and the type of equipment that would meet the expectations in terms of availability, reliability, what types of monitors are required to understand exactly what is monitored as it leaves the plant.

It includes not only an assessment of what the release would be, but provides for action should the radionuclide that’s being emitted, exceed a certain level. So if there was something that was emitted and we hadn’t captured it through our existing pre-discharge monitoring program, valves would close to prevent the emission from taking place and those are through redundant systems. So that’s the type management system around it.

But beyond just the discharge monitoring and control monitoring, as well as

performance monitoring that we use, we also go to the radiological environmental monitoring program so that we can ensure that what we have actually discharged we're monitoring in the environment so that we understand fully the potential impact of a release. So it's a fairly heavily regulated stream right from setting limits to how we monitor it; how we control discharges and then finally checking through the environmental monitoring program to ensure that we hadn't exceeded any particular limit.

MEMBER PEREIRA: Thank you for that response. A couple of questions arise. You referred to a CSA, Canadian Standards Association Standard that governs -- that polices the overall framework of releases, could you give us a reference to the standard?

MS. SWAMI: Laurie Swami. I'm searching my memory. CSA N288.1, I believe is the standard, but if I'm wrong I'll correct the record afterwards.

MEMBER PEREIRA: I have one further question. You talked about the standard -- limits and standard, but then you referred to action levels and reporting levels. Could you

indicate what those are relative to the limit and the standard, at what point would there be action -- an action level triggered and what point would be a reporting requirement triggered in general? Obviously, these vary depending on what the substance is, but could you indicate how those relate to the limit?

MS. SWAMI: Laurie Swami. I have the correct reference now. I'm sorry, not N288.1, it’s N288.4 for clarity. The investigation limit that I spoke about and the action levels are developed by looking at our performance over time so that we understand what the limits would be. The internal and -- and I believe that I should check the requirements of when the reporting kicks in versus when the -- you know, just to be very clear on this. So if I could, I’ll take that as an undertaking to check our references to make sure I'm giving you the correct information.

CHAIRPERSON GRAHAM: We’ll give that an undertaking. I guess that will be undertaking number 50.

Is that clearer Mr. Pereira; your undertaking number 50 and you’ll -- timeframe?

MS. SWAMI: I can do that this

afternoon if that's helpful.

CHAIRPERSON GRAHAM: Okay. Proceed, Mr. Pereira.

MEMBER PEREIRA: Going on to the next question. Oh, before I go on to that, I'll turn to CNSC staff to comment on the response that Ontario Power Generation has given us on the control of releases from the liquid waste -- radioactive waste management system and the action levels -- the question of action levels and reporting levels just to get from CNSC the perspective on how those controls operate?

DR. THOMPSON: Patsy Thompson for the record. The regulations establish a process for both control and monitoring of effluent including liquid effluent. And the -- there is first a release limit that is established and then action levels are set at a small fraction of the release limit so that -- and it's to provide an indication well before the limit would be reached, that the system -- there's a loss of control on the system.

And this reaching an action level triggers a reporting requirement to the CNSC and a requirement for the licencee to take measures to

restore control on the system. And so by having both internal investigation levels that are below the action limit, the action limit and the derived limit, it ensures that action will be taken by the licencee well-before any releases would reach legal limits.

In addition, the regulations require that the licencees have an environmental management system and effluent control and monitoring system as well as an environmental monitoring system which Ms. Swami described. There are Canadian Standards Association requirements, documents that we use and N288.1 is the standard on calculating release limits, whereas N288.4 is the new standard on environmental monitoring programs.

And so what -- the process is that the licencee submits their proposed programs for environmental management systems, effluent control monitoring and environmental monitoring; the CNSC staff does a detailed technical review of those programs and there's a back and forth until we're satisfied that the program will meet the regulatory requirements. And then we follow up with inspections and audits to make sure that the program is actually implemented the way it's been

described in program documents. And if there are gaps or deficiencies, then action -- corrective actions are raised and there's a requirement for the licencee to correct gaps and deficiencies in a timely matter depending on the seriousness of the gaps.

MEMBER PEREIRA: Thank you. And you made reference to the Canadian National Standards, how -- and the Canadian National Standards in my understanding are developed by industry -- committees that involve participation by industry and regulators and government departments. How do we assure ourselves that those standards are rigorous enough for protection of the environment? Is there anything else in the regulatory framework and in the regulations under the *Nuclear Safety and Control Act* and other environmental protection legislation that ensures that what is in the standard is stringent enough to protect the environment that we live in?

DR. THOMPSON: Patsy Thompson, for the record.

The standards development process is as you've described. And CNSC staff specialists have participated in the development -- the

revision of both of those standards which were standards issued many years ago, and have been recently updated to current standards.

And one of the things that CNSC staff did was to ensure with other participants that the revisions to the standards aligned with international good practices.

And so we've ensured that current science has been included in those standards and we have, over the years, accumulated a lot of environmental monitoring data so that we can have actual data to validate the model predictions in the case of 288.1 to make sure that the model predictions are very conservative.

And the monitoring data, the environmental monitoring program requirements are designed to ensure that all pathways that are of importance either for public exposures or exposures to non-human species are identified and monitored at the right frequency and at the right time of the year.

And there's also a review process for those standards that include other government agencies for example with expertise in these areas.

MEMBER PEREIRA: Just one more

question on that same topic.

How would that standard compare with what would be applied on the other side of the lake for say a nuclear generating station in New York State?

DR. THOMPSON: Patsy Thompson, for the record.

I don't have that information. We would have to take an undertaking to have it.

MEMBER PEREIRA: Thank you. We'll take it as an undertaking.

CHAIRPERSON GRAHAM: Yes, and that will be Undertaking number 51 and that will be by CNSC to give us a comparison with U.S. -- on the U.S. side of Lake Ontario.

MEMBER PEREIRA: For liquid releases, radioactive releases.

CHAIRPERSON GRAHAM: Yeah, on releases.

DR. THOMPSON: Patsy Thompson, for clarification.

Would you like the comparison on the methods by which release limits are set or also requirements for monitoring?

MEMBER PEREIRA: Let's do both.

DR. THOMPSON: Thank you.

CHAIRPERSON GRAHAM: Could we get an indication of some timing of getting that information?

DR. THOMPSON: Patsy Thompson.

If it's okay, we will check with people back in the office so that we can contact the U.S. NRC and have an idea of when we can get the information.

CHAIRPERSON GRAHAM: We'll put it down for next Tuesday for you to report whether you have it or not; then we can look at another time of extending. We'll put it down for Tuesday morning.

MEMBER PEREIRA: Thank you.

DR. THOMPSON: That would be fine, thank you.

CHAIRPERSON GRAHAM: Are you finished, Mr. Pereira?

MEMBER PEREIRA: No, I've got another question.

CHAIRPERSON GRAHAM: Go ahead then.

MEMBER PEREIRA: Again, in the intervenor’s submission on page 6, there's a report of some deliberations by the U.K.’s committee

examining radiation risks of internal emitters. And there's a statement here which says that despite the European guideline, CERRIE, which is the U.K. committee, concludes that the dose coefficient for tritium needs to be revised and then there's a comment: “the risks of exposure to tritiated water and they are submitted by a factor of 15”. That I presume is a conclusion from the CERRIE report.

I turn to CNSC staff and ask for their comments on this conclusion and what our thinking in Canada is on this issue?

DR. THOMPSON: Patsy Thompson, for the record.

I will need to confirm. My recollection is that the CERRIE report identified some of the same issues that the CNSC identified in our tritium study report on health that the factors -- the factor considering the relative biological effectiveness of tritium could be in the range of 2 to 3 rather than 1 as is used by the ICRP.

I don't recall seeing a factor of 15 but I will check and get back to the panel.

MEMBER PEREIRA: So is that another undertaking?

CHAIRPERSON GRAHAM: I take it as one and I will give it number 52 for CNSC to provide -- to check and provide the comparisons.

DR. THOMPSON: We can do that quickly so we could come back this afternoon.

CHAIRPERSON GRAHAM: Okay. Thank you. So it's April 1, p.m.

Okay. Thank you very much.

Mr. Pereira?

MEMBER PEREIRA: Thank you, Mr. Chairman. That's all.

CHAIRPERSON GRAHAM: Thank you.

Mr. Bennett, do you have anything you want to ---

MR. BENNETT: I'd just like to make a couple of quick comments I couldn't get in and across there.

In terms of tritium, despite all the very complicated description of the monitoring processes, there was a leak from Pickering just in the last two -- last week.

The report that we quote in our submission "Tritium on Tap" was described by the CNSC within an hour it had been released as junk science. And it only -- its real purpose is to

raise the question that there are differences of opinion in terms of what is an allowable amount of tritium that we should be releasing in the environment.

We released that paper to raise those questions. We would have thought that the regulator would welcome a public discussion rather than discard it which takes me back to your opening statement, sir.

I apologize if you took it personally but I think you were feeling it the same way I was feeling it when Dr. Binder treated me the way he did when I testified for the steam generators with the first -- to try and denigrate me in the first question and then in subsequent comments.

I'd like to also point out that we actually said in it we don't have an opinion of any individual but there's a perception of bias which we have to be concerned with.

And with this we have a perception and it's a reasonable perception. It's not an accusation but it's a reasonable perception that there's not balance in how these panels, not just this one but panels in general, are chosen.

As I said, I probably wouldn’t qualify to be on one of these panels because I'd be seen to be biased. And I think that people can be seen to be biased as well despite whatever their own personal motivations are.

So I didn't mean it as a personal insult. So I apologize for that. But I still stand by the point that there's a perceived bias here and clearly that the comments from the President of the CNSC, there's a bias there.

CHAIRPERSON GRAHAM: As I said at the outset, I don't speak for the actions of others. I speak for what this panel, what we believe in and I think I expressed that.

I listened to your comment in the exchange with my colleague Madame Beaudet with regard to steam generators and the decisions that were taken and whether there should be a new environmental assessment and so on and how our decision, no matter what that will be, will be judged years from now, whether it refurbs or whatever it is.

And I guess -- thank goodness for the system we have in this country that there are checks and balances.

If an interpretation, whether it be by CNSC or by a regulator, is not deemed to be in -- by any individual or any group is not deemed to be correct, then there is a process. And you chose the process of going to court, challenge and the courts will decide.

So there is a level of checks and balances. We cannot judge how our interpretations will be or guarantee how our interpretations will be taken 10, 20, 30, 40 years from now.

But at least there is a system that another body higher than ours can judge our decision of the day, whether it's this year or when we make it in the context of whether the interpretation by another group down the road is right or wrong. And that's one of the advantages and I think we have to respect that system that there are checks and balances.

We do our job, then how it's interpreted afterwards, if it's not to the liking of some people or some groups or even to the regulator or anything else, then there is a system to do that and I think -- and you've chosen a system. And we respect that, so I just want to say that even though how we're interpreted, and you've

questioned that, there are other means of dealing with it, so -- and that's the confidence of the system that we live in, so put that on the record also.

Do you have any other comments --

MR. BENNETT: Yes.

CHAIRPERSON GRAHAM: -- with regard to either my colleagues questions with regard to any of the subjects raised this morning?

MR. BENNETT: No, but at least we can end on agreement then.

CHAIRPERSON GRAHAM: That makes me feel very good. Now, we go to -- now, we go to the floor and first I go to OPG. Do you have any questions for Mr. Bennett or the Sierra Club -- on behalf of the Sierra Club?

MS. SWAMI: Laurie Swami. We have no questions.

CHAIRPERSON GRAHAM: CNSC, do you have any questions.

MR. HOWDEN: Barclay Howden. No questions, but one comment.

CHAIRPERSON GRAHAM: Go ahead, Mr. Howden?

MR. McALLISTER: I'll take that.

It's Andrew McAllister for the record. There has been a lot of discussion around transboundary environmental effects this morning and I just want to put something on the record.

Based on intervention by the Sierra Club, in CNSC staff's opinion, we do not believe that the transboundary provisions of the *Canadian Environmental Assessment Act* are applicable to the environmental assessment being conducted by the Joint Review Panel.

The transboundary provisions of the Act, Sections 46 to 48 apply in situations where there is no Section 5 trigger under the *Canadian Environmental Assessment Act*.

In the case of this project, there are number of Section 5 triggers. There is a need for a licence under Sub-Section 24(2) of the *Nuclear Safety and Control Act*, as well as a need for authorizations under the *Fisheries Act* and permits under the *Navajo Waters Protection Act*.

Give those circumstances, as we said, we don't believe the transboundary provisions in the *Canadian Environmental Assessment Act* would be applicable. Thank you.

CHAIRPERSON GRAHAM: Thank you,

CNSC. Do you have a question, Madam Beaudet? You most certainly --

MEMBER BEAUDET: No, I just want to bring up something. When you evaluate a project, I mean, you have to look at the impacts, whether it's provincial, national or international and I didn't want to give the impression that I was relying mainly on the -- on this *Transboundary Act*.

I think my question was directed to have a clear picture on exactly what would be the impact, whether it's this side of the border or the United States. Thank you.

CHAIRPERSON GRAHAM: Thank you, Madam Beaudet. I'll now go to government agencies. The Environment Canada is here. Do you have anything else to add, question the intervenor or any other information to provide? Environment Canada shakes their head.

Is there any other government departments, federal or provincial? If not, then, we'll move to intervenors and I believe we have one intervenor. And, Mr. Kalevar, you have a question to the Chair, please?

MR. KALEVAR: Through you, to you, Mr. Chairman, we haven't had an update on the

undertakings recently and we don't know where the undertakings stand.

We had agreed last week that we'll get it on a daily basis, but certainly a weekly basis is a good idea. It's the end of the week, if you can get the list of undertakings?

CHAIRPERSON GRAHAM: Oh, yes, I'm sorry. The first thing on the agenda each morning, we do undertakings. I believe the Secretariat at the back has a list of all those undertakings. We were dealing with undertakings up to number 48.

The ones that were due today, those were addressed before the intervenors started this morning. If there is any one specific that you are questioning, you can see the Secretariat and see which ones have been answered today, but they -- there is certain ones that are due. They were answered today.

There's some that are only on the 6th or 7th of April and each one will be answered as we go forward and if more time is needed, but those were addressed this morning at the very first of the undertaking.

MR. KALEVAR: She doesn't have a list. I just asked and I --

CHAIRPERSON GRAHAM: She doesn't have a list? Well --

MR. KALEVAR: If you can just make it --

CHAIRPERSON GRAHAM: -- we'll -- yeah, I guess it's on-line and if -- I notice you use your Blackberry there and so on, you may be able to get it on-line. If not each morning, we'll go over them and I suggest you check the transcript tomorrow morning and we'll give you transcripts of today. Thank you.

MR. KALEVAR: Thank you.

CHAIRPERSON GRAHAM: Okay. Thank you very much. I believe that concludes the presentation by Mr. Bennett and the Ontario Chapter on their views on this intervention and I thank you very much for coming.

And as a father of a large family, I -- we have lots of debates and if you get consensus at the end, that's pretty good. And I think we got consensus. Thank you very much.

We will now go to the next intervenor, which is covered under PMD11P1.182 and it's Mr. Louis Bertrand. Mr. Bertrand, you are to come forward, please.

Just a couple of logistics, the microphone button is in front of you. And identify yourself each time you speak for the benefit for those doing the transcripts. Thank you very much. You may proceed.

--- PRESENTATION BY MR. BERTRAND:

MR. BERTRAND: Good morning, Mr. Chairman, and members of the Panel. My name is Louis Bertrand. I'm a professional engineer and I live in Bowmanville.

My engineering experience is in electronic product design, including embedded software as well as information technology and information security.

Monsieur le président et membres de la Commission, je vous souhaite bonjour. Je m'appelle Louis Bertrand. Je suis ingénieur professionnel et j'habite Bowmanville.

Mon expérience en génie comprend le design de produits électroniques ainsi que l'informatique et la sécurité des données.

My presentation this morning will deal with my concerns regarding the safety and reliability of instrumentation and control systems based on embedded microcontrollers and the software

running them.

Ma présentation ce matin traite de mon inquiétude au sujet de la sécurité et de la fiabilité des systèmes de saisie de données et le contrôle à base de logiciels pour microprocesseur impliqués.

À cause des termes techniques, je dois continuer ma présentation en anglais. Mais si on me pose une question en français, j'essaierai dans la mesure du possible d'y répondre pareillement.

The new Nuclear Darlington Environmental Impact Statement, Section 7, submitted by proponents considers the mitigation and effects of accidents, malfunctions and malevolent acts.

It is my observation that the language used to describe these potential events shows that the designers consider them highly unlikely.

However, the increased complexity and failure characteristics of software-based instrumentation and control systems leaves me to ask whether or not some new scenarios for accident-initiating events have been overlooked or

underestimated?

The Environmental Impact Statement and additional responses provided by the proponent made reference to several software quality assurance standards such as CSAN290.14, which is the qualification of pre-developed software and CSAN286.7-99 quality assurance of an analytical scientific and designed computer programs, as well as AECB Draft Regulatory Guidelines, C138E, software and protection and control systems.

However, the guidance in those documents is prescriptive and they cannot provide the level of detail and completeness currently required to develop safety critical software and firmware systems.

I have here a coffee mug dating back from 1982 or so and it's basically Murphy's Laws for computer programmers. And the one that really struck me is -- it's called Weinberg's Law. If I may read it?

> "If builders built buildings the way programmers wrote programs, then the first woodpecker that came along would destroy civilization."

It also concerns me that an article on forensic engineering, which is the discipline of failure analysis in January, February 2011, the edition of *Engineering Dimensions, The Magazine of Professional Engineers Ontario*, does not mention software as a potential failure -- factor in failures. There is not a single mention of the word “software.”

Yet software failures occur on a regular basis and occasionally lead to serious injury or death, as the 1985 to 1987 Therac-25 accidents demonstrated. In a summary of the accident review, the Therac-25, a computerized radiation therapy machine, massively overdosed patients at least six times between June 1985 and January 1987. Each overdose was several times the normal therapeutic dose and resulted in a patient’s severe injury or even death.

Overdoses, although they sometimes involved operator error, occasion -- occurred primarily because of errors in the Therac-25 software and because the manufacturer did not follow proper software engineering practices.

Overconfidence in the ability of software to ensure the safety of the Therac-25 was

an important factor which led to the accidents. A predecessor of the Therac-25 employed independent protective circuits and mechanical interlocks to protect against overdose. The Therac-25 relied more heavily on software. Moreover, when that manufacturer started receiving accident reports it, unable to reproduce the accidents, assumed hardware faults, implemented minor fixes, then declared that the machine's safety had improved by several orders of magnitude. The design of the software was itself unsafe.

Obviously, since that series of tragic accidents, the discipline of software verification and validation has made great strides. However, regulatory agencies are still required to maintain oversight of providers of safety critical software, as occurred in a recent case of radiation therapy equipment malfunction.

This is from the *New York Times*, April 8, 2010. "The Food and Drug Administration said Thursday that it was taking steps to reduce overdoses, under-doses and other errors in radiation therapy by strengthening the agency's approval process for new radiotherapy equipment."

In a letter to manufacturers the

FDA said its action was based on a recent analysis of more than a thousand reports of errors involving these devices that were filed over the last ten years.

I'll skip to the relevant paragraph. "Most of the reported problems, 74 percent, involved linear accelerators, which are computer controlled machines that generate high powered beams of radiation that target and destroy cancer cells. Problems with computer software were most frequently cited as a cause for errors."

Software quality assurance standards promoted by the CSA, the US Department of Energy and other public safety agencies are part of the requirements for safety critical software. Nonetheless, it is reasonable to ask if current methodologies have kept pace with increased complexity.

The problem of identifying postulated initiating events, PIE's, has been considered as a key issue in the safety of new nuclear reactors. Since the PIE's drive the design and acceptance criteria, it is important to identify as many of them as possible.

Chapter 7 of The Environmental

Impact Statement details several postulated accident scenarios, but they involve physical accidents or mechanical failures, not software, not firmware malfunctions.

Since 1993, when the Darlington Nuclear Generating Station was completed, software and computer technology has blossomed to provide us with a globe spanning Internet, mobile devices and new integrated circuit technology. The complexity of software systems is ever increasing, as is the pace of change in the platforms for development and operation.

Safety approaches in the nuclear industry have been to make cautious incremental changes in the design and operating procedures.

And here I quote Professor Levenson from MIT. “Licensing is based on the identification and control of hazards under normal circumstances and the use of shut-down systems to handle abnormal circumstances. Safety assurance is based on the use of multiple independent barriers, so called defence in-depth, a high degree of single element integrity and the provision that no single failure of any active component will disable any barrier.”

With this defence in-depth approach to safety, an accident requires a disturbance in the process, a protection system that fails and inadequate or failing physical barriers. These events are assumed to be statistically independent because of differences in their underlying physical principles. A very low calculated probability of an accident can be obtained as a result of this independence assumption.

The substitution of software for physical devices invalidates this assumption. This has slowed down the introduction of computers, although it has increased in the last few years.

The entire support system for the software operating devices and systems in the generating station, including the physical hardware, networking environment, operating system and development tools, is in itself a complex system that must be examined as an extension of the generating facility itself.

The development tools include editor, compiler, a testing suite, as well as the library of pre-existing modules necessary to support the actual programs. Those library

modules, which may be developed by third parties, provide communication, user input, display and computation for the control software, as well as device drivers.

Taken together, this collection of hardware, software and network components is at least as complex as the operation of a nuclear reactor, the generating apparatus and new auxiliary systems.

I believe there is cause for concern about the specifications, design, validation and verification and long-term maintenance of this collection of systems.

Now I would like to deal with some specific issues that are a concern to me. One is hardware and soft errors.

Integration densities are such that entire microprocessor systems can be built on a system on chip. However, constantly shrinking integrated circuit geometries and lower operating voltage means that these systems are more susceptible to soft errors caused by ionizing radiation and electromagnetic interference. They should be flagged as a common cause risk that could potentially affect any software/hardware system or

device.

Contemporary system on-chip microcontrollers integrate CPU EPROM to store the program binary code, sufficient RAM to run the program, as well as the necessary peripheral devices and communication interfaces. The level of integration comes from reducing the geometry of transistors and interconnects on a chip, as well as reducing the power dissipation of individual transistors by lowering the power supply voltage. These operating voltages are significantly lower than earlier standards.

With smaller ICE geometries and lower voltages, the risk of soft errors caused by ionizing radiation is increased. A single event upset occurs when an ionizing particle injects a current in a transistor sufficient to change the state of a memory element.

These are two modes -- there are two modes for a soft error to occur. The first involves the direct change of a binary memory element to its opposite state, a zero to a one, or a one to a zero.

In the second, the ionizing radiation causes a combinational circuit to exhibit

a transient incorrect output. If the transient persists across a clock edge, this transient state can be latched by a memory element and become a single event upset. The higher the system clock frequency, the more likely the transient will be clocked in by a memory element.

Although the major concern about radiation exposure is for military or space-based systems, exposure at ground level is expected from background radiation as well as cosmic rays. Operation inside a nuclear facility increases the likelihood of soft errors.

The reduced size of the transistor, low operating voltages and the increased CPU clock frequency can increase the probability of soft errors in embedded microcontrollers powering mission critical devices.

A system with many similar devices with the same microcontroller type, or even the same semiconductor process technology, could be vulnerable to common cause failure due to the internal operation of the microcontroller.

My next topic is software complexity. As the number of microcontroller based instruments and control systems increases, so does

the complexity of the software operating each one. The need to validate and verify the software becomes more important, while at the same time becoming more difficult.

The first challenge is validation, which asks if the software correctly models the desired behaviour. Subsequently, the challenge is to verify that the software is developed to the specifications required by the model.

The validation challenge involves the subject matter experts in nuclear operations communicating their requirements to software developers, and in turn, the software developers successfully translating those requirements into correctly operating programs.

Testing requires several concurrently applied techniques. Regression testing, which involves over time a test and procedures are developed to test for the resolution of known problems and defects. The collection of tests is systematically applied to new versions to ensure that previous issues were not inadvertently reintroduced by the latest modifications.

Code inspection, the source code is verified by others independent of the original

programmers.

Formal methods, methods to prove correctness such as those used by Professor David Parnas in the control software for the existing Darlington station.

And randomized testing, a randomly selected sequence of inputs is presented to the software under -- under test in an effort to flush out the most likely failures.

However, there is no guarantee that these methods will detect and prevent all potential initiating events due to software defects.

The next topic is network complexity. An unforeseen consequence of network safety critical systems with other systems was discovered as a result of a scram incident at the Browns Ferry 3 reactor in the United States.

The -- this, I believe, happened in 2006. And I'm quoting a report from 2007.

"Excessive network traffic caused a variable frequency drive controller for a pump to malfunction.

The abnormal network traffic was due to the failure of another device, a condensate

demineraliser on the same network that flooded the network with packets."

A word now about how network devices operate. When a device receives a data packet, it must read the packet from the network and examine its destination address to decide whether or not it is the intended recipient and if it should receive the packet.

If not, the device simply discards the packet.

Even though most of the network traffic in this incident was not intended for the VFD controller, it had to devote some processing time to examine each incoming packet.

The extra processing load overwhelmed the controller and caused it to become unresponsive.

The VFD controller was thus unable to process a command to increase the flow of cooling water, and the control procedure -- room procedure called for a manual scram.

The problem was later resolved by partitioning the network with firewalls to isolate safety critical systems from the rest of the network and limit the amount of traffic the device

could see on its own wire.

However, it's only in hindsight that the solution at Browns Ferry 3 seems obvious. It is now standard practice to compartmentalize networks using firewalls and routers to isolate subnets within an organization to limit the spread of computer worms and automated attacks.

This begs the question, what about the future? What network problems will arise in new networks as more data is transferred over their IP networks instead of discrete wiring? What happens to real-time requirements with more diverse traffics?

Networks nowadays can carry voice and video in addition to the traditional instrumentation and control data streams.

The number of network devices is far greater, multiplying the number and nature of network interactions between software-based devices.

Programmable logic controllers, PLCs, as they're called, are ubiquitous in process-controlled applications, and they are not immune to the ramping up of software complexity. Most now use embedded microcontrollers to execute programs

compiled from onscreen representations of lateral logic.

The lateral logic compiler used by the designer must meet the criteria set out for design programs, for example, CSA N286.7-99.

In addition, there must be assurance that the PLC firmware will execute the compiled program correctly.

A common-caused fault in the PCL firmware that executes the simulated lateral logic diagram could cause all controllers with similar firmware to fail under the same circumstances.

PLCs are networked with dedicated embedded controllers as well as control consoles and data recorders bringing an additional level of risk to their operation.

The next issue is maintenance over the lifecycle of the station.

The operating span of the -- the new nuclear Darlington is expected to be 60 years before the decommissioning.

60 years ago stored program computers were experimental oddities mostly powered by vacuum tubes.

Programmers in the 1970s would

have scoffed at the idea that their COBOL programs would still be in use a quarter century later and causing anxiety at the possibility of programs suddenly finding themselves in the year 1900, the day after December 31st, 1999.

The point is that the pace of technological change is so fast that the current design would have to be future proof, an impossible task.

Another serious issue is maintaining the development system for the devices in use at the generating station over the life time of the devices themselves if any maintenance, bug fixes, or other modifications to the running programs are required.

The woes of maintaining obsolete hardware and operating systems are compounded by the need to maintain the programming environment virtually frozen in time.

The development knowledge of the original programmers must also be captured as part of the developing environment.

The next topic is threats and attacks. The common cyber attacks reported on the news would not be expected to affect safety

critical systems, as it -- as it is assumed that they are isolated from the internet in elementary precaution.

However, the possibility of a successful attack, though remote, cannot be dismissed as not credible.

Several factors could enable such an attack. The increased availability of small wireless personal devices, such as smart phones and tablets -- as those devices become smaller, yet more powerful, it is not unrealistic to postulate an attack from inside mediated by wireless access unwittingly installed against network management rules. This happens all the time.

Ubiquitous small portable memory devices are able to introduce malicious programs into a protected network environment.

Or even, what’s called, a publicity attack, it’s an attack on a non-safety related computer, let’s say an air sampling computer beyond the fence line. This could damage the proponent’s reputation for safety.

Any protestation that the system in question was of trivial importance would be lost in the noise resulting from a screaming newspaper

headline saying, Nuke plant computer attacked or hacked.

Future threats and attacks, it talked about future proofing.

Cryptographic protocols that depend on computationally expensive attacks for their security must not only offer protection against current attacks, but those expected in the futures when exponentially faster processors become available.

A recent development is widely distributed computing over the internet as pioneered by the SETI@home project. Thousands of otherwise idle computers could be harnessed to recover inscription keys for secured communications, for example, those that enable virtual private networks' access to internal network computers over the internet.

Section 7 also deals with malevolent acts.

Although the proponent has spelled out mitigation measures for various accidents, malfunctions, and malevolent act scenarios, the use of expressions like not credible or beyond designed basis would make an information security expert

cringe.

Such language gives the impression that events will unfold in an orderly and predictable manner.

And generating station personnel only need to refer to their training scenarios to respond to any foreseeable emergency.

Software faults don’t follow obvious rules. A software error in a critical section of code can have unpredictable effects.

A common-cause error triggered by a rare combination of inputs could affect a number of devices running similar hardware or firmware.

Attackers don’t follow rules. Actually, they deliberately break rules.

Computers have given them the tools to make complicated attacks easy by automating the procedure into attack scripts.

The internet has made it easy to attack any other computer on the internet since they’re all virtually next door to each other.

Isolating safety critical networks from the internet is a natural precaution, but there can be no guarantee that the supporting systems are sheltered from attacks.

It is not sufficient to test for an expected condition because security flaws are often in code, it is rarely executed, or conditions that never naturally arise.

A word about what-if thinking, the only way to identify postulated initiating events due to malicious software is to change one's frame of mind from not credible to start asking open-ended stimulating questions like if it were to happen, how could it start?

This what-if thinking requires designers to put themselves in the roles of attackers, similar to what penetration testing professionals do to audit network security for their clients.

This kind of thinking is creative, it's playful, and it hopes to break rules.

By engaging in this kind of exercise, the mind is freed of preconceived notion of what's possible and what's not. One in a million events can suddenly become much more probable, or links between apparently unrelated events and conditions can be seen as part of a larger chain of causality that could potentially lead to an accident.

To illustrate this let me describe a common-place programming error known as the buffer overflow attack, so called because it causes data to be copied beyond the allocated bounds for a string of text characters. The text characters copied beyond the bound in memory are likely to overwrite data that belongs to another part of the program unrelated to the text buffer itself. This behaviour is what makes software errors difficult to analyze with consequences even harder to predict.

Let’s take a hypothetical programmer. He or she expects that programmers -- that passwords are never more than 100 characters long. For safety we allocate 1,000 characters for the buffer. The attacker asks, what happens if the password contains more than 100 characters? Well, the program is safe up to 1,000. Well, what happens when the attacker supplies a 10,000-character password? Attackers break rules.

This technique has been one of the most prevalent attacks in the internet and is devastatingly effective, often leading to a complete takeover of the system by the attacker. Conventional testing would not detect this error.

In normal operation a reasonable life password is presented and either accepted as valid or rejected. It's only when absurd input is provided that the program fails.

What if the compiler on a software developer's workstation was compromised? To inject malicious code in all programs processed by the compiler, at the binary code level the effect of the change would be hard to detect because the code is not human readable. It is important to foresee all possible attacks because as defender, all defences must be impenetrable. For the attacker to succeed, only one attack needs to work.

My conclusions and recommendations. My submission presented concerns that I believe are credible and realistic considering the current state of the art of software development, the complexity of embedded operating systems and control programs, and ubiquitous networking. Therefore I strongly recommend that this panel reject the proponent's application unless the proponent can supply a realistic and practicable plan for safety critical software and firmware that tests the finished software and firmware against unusual or absurd

input conditions or states. In order to flush out hidden defects, they could be exploited by malicious attacker. Runs probabilistic test to simulate soft errors due to single-event upsets, caused by ionizing radiation in low power high integration digital integrated circuits. Detail the threat and risk assessment methodology to identify software-based postulated initiating events. Outlines the management approaches that would be in place to ensure that the configuration of software and firmware-based devices and that of the network itself is documented, and that changes to individual components and networked apology are managed to a suitable review and deployment process. And maintains the software development tools throughout the lifecycle of the software itself, and that future replacement software be developed respecting the original requirements and any additions or adjustments thereto. If the development tools are upgraded or migrated to a newer development platform, the plan should detail how the upgraded tools will be tested to produce binary code.

With your indulgence, Mr. Chair, I have some final thoughts that were not in my

original written submission.

CHAIRPERSON GRAHAM: You have about three minutes according, so certainly, go ahead.

MR. BERTRAND: Thank you, sir. There are several people -- there's some people in this province who have convinced themselves of some pretty remarkable things. Some have convinced themselves that nuclear is unquestionably safe, while others have reviled wind power as harmful to health and environment. Beliefs such as these stand reality on its head.

Without presuming what this Commission will decide or how, I would ask that a critical look be applied to the unspoken assumption that the nuclear industry has thought of all the threats and risks. The discipline of risk assessment itself should come under scrutiny. To my understanding, in its simplest form, risk assessment attempts to model the likelihood of a harmful event and the consequences of such an event, it's just simple multiplication. The result is then balanced against a potential benefit to society, and provides the basis for a go/no-go decision, or the expense and effort of additional

mitigation.

In information technology, if I have a web server that services, let's say, 100 clients, and I know that the probability of a successful attack is one per year, and I also know that it costs me $10,000 in staff, time and compensation to my clients for down time for each attack, I can quantify this risk into a dollar amount, and use that to estimate the worth of prevention or mitigation measures. In this case it would cost me $10,000 a year.

It would make sense to buy a backup tape drive for $5,000 if I knew that it would mitigate by restoring my server faster. However, could I justify spending $20,000 on a firewall and intrusion detection system.

With nuclear this calculation goes off the rails. The probability of an accident is admittedly very low. The consequences would not only be tragic, but extremely costly to the station, the surrounding area, and to the economy of the province and Canada. The simple multiplication no longer applies. You're multiplying infinitesimal probabilities with enormous damages to get an intermediate number.

However, because of the difficulty in estimating either factor, the result is meaningless.

At a presentation to Clarington council in 2009, Dr. Chris Olsen (ph) from Stantec, this is in relation to the incinerator, told the council in response to a question that risk assessment is not the science to tell you that it is safe.

And finally, a word about Fukushima. In the news there's talk about the 50 or is it 300 nuclear workers who are desperately battling to restore the failing systems in the damaged reactors. Their families are justifiably concerned for their health and safety. To me, this personalizes the nebulous side effects of nuclear power. Normally we know that someone somewhere will get sick because of radioactive emissions, but we can't tell whether or not a particular case affecting a specific person was caused by nuclear power. In the case of Fukushima the causes and effects are tragic and my heart goes out to those workers and their families.

CHAIRPERSON GRAHAM: Could you summarize as quickly as possible.

MR. BERTRAND: My last paragraph,

sir. The accident also demonstrates that we are playing with forces that, if they escape the normal control parameters, are clearly beyond our ability to control, especially with something as fragile as computer software.

Mr. Chairman, members of the panel, I thank you for your attention and welcome your questions.

Monsieur le président, commissionnaires, je vous remercie de votre attention et j'accueille vos questions.

CHAIRPERSON GRAHAM: Thank you, and merci, Mr. Bertrand.

Just one caution before we get into questions, that security issues are something that we deal with in-camera because of the sensitivity of this application, and so on, and I know my colleagues do that.

But if some security issues are not addressed it's not because of lack of interest, but they will be dealt with in another forum.

So with that I will move to my colleagues.

Mr. Pereira?

--- QUESTIONS BY THE PANEL:

MEMBER PEREIRA: Thank you, Mr. President.

Merci Monsieur Bertrand, votre présentation est vraiment intéressante. Maintenant, mes questions.

To CNSC staff, the intervenor has brought up a number of questions concerning software and the implications of widely-used safety critical software and firmware at modern nuclear generating stations.

You briefed us yesterday on the regulatory documents that apply to safety analysis and accident analysis. In your new standards or regulating documents, are software-based postulated initiating events considered and discussed?

MR. HOWDEN: Barclay Howden speaking. I'll ask Dave Newland to respond to that.

MR. NEWLAND: Dave Newland for the record. The short answer is yes. There is a full suite of accidents considered, both from the perspective of controlling the plant and design-basis accidents.

The note prescribed as such in any specific regulatory document, but what I would say

is that we have been following with a lot of interest the work that is being done by other regulators, the U.K., France, Finland, with respect to digital instrumentation and control and, in particular, the challenges associated with the complexity of that technology.

We -- we have a multinational design evaluation program that allows us to share information with other regulators and this is one specific topic that is very much at the top of the agenda for all of the regulators.

I would add one other thing at this point and that is that the digital I&C plays a role in a broader scheme of safety, so there is the instrumentation and control itself. There are systems and components which are designed in a failsafe way so that if the I&C does not behave as expected, then there is a failsafe action.

On top of that, there is a -- a level of, if you like, physical security and cyber intelligence to address some of the issues around things like the claims of things that can occur with respect to, like, for example, stuxnet.

MEMBER PEREIRA: Thank you. I'll turn to Ontario Power Generation. And in looking

at safety critical software and firmware systems, what approach does OPG have to manage the configuration of these systems to ensure that changes are done in a controlled and defensible fashion?

MS. SWAMI: Laurie Swami. I'm going to ask Don Williams to provide a more detailed response, but Ontario Power Generation has a very detailed process for engineering change control which would apply to software changes, not only physical changes to the plant, but Don can provide much more specific details.

MR. WILLIAMS: Don Williams for the record. Yes, I can speak to what the current OPG practices for change control on software -- OPG does have a very rigorous QA process and procedures in place. Essentially the software is categorized depending on the safety significance and depending on the level of software. There's the higher levels of process and -- and control are put in place.

A typical software change would look at, you know, clearly defining requirements, laying out software development plans as the software is -- and -- and validation of the -- of

the software as it’s written -- clearly documented. There's a very rigorous verification process you would go through as the software is written. It -- it’s tested independently, verified, and there's a number of hours of commissioned testing that would go on with software before you would actually have it ready through the -- the change control process to use.

As it’s installed, it’s put onto the first control computer, operated for a period of time to further debug it before it’s put on the second computer, and then -- then fully put in service. So those processes are in place now in our current processes.

The new vendor would be required to meet the requirements of RD-337 and, in particular, I think it’s section 7.9.2. As our role is -- is on authority and oversight of the vendor, we would be looking to see that those same software controls and processes are -- are in place for the new plant as well. Thank you.

MEMBER PEREIRA: Thank you. And -- and just back to the CNSC in terms of accident analysis. The intervenor was talking about what is in the documents that have been issued and mainly

prescriptive type of requirements and have we gone towards an approach that's appropriate for dealing with software -- critical software and firmware for looking at accidents scenarios? And I guess this relates to your previous answer, but are -- have we started doing that now for all generating stations or is it something that's evolving?

MR. NEWLAND: Dave Newland for the record. I think I would prefer to take an undertaking on that one just so that I can seek some guidance from my specialists.

CHAIRPERSON GRAHAM: Thank you. We'll give that undertaking number 53. Mr. Newman, when did you -- when would you -- when would you be able to report back?

MR. NEWLAND: We'll report back on -- hopefully later today as to when we will be able to get it to you.

CHAIRPERSON GRAHAM: Thank you. We'll note that as such then. Is that satisfactory, Mr. Pereira? Okay. Thank you.

MR. NEWLAND: One final question to Ontario Power Generation. All -- all licensees in Canada, the power -- licensees have a requirement to report to the regulator on

significant events. And then having reported -- and there's criteria defined on what a significant event -- what constitutes a significant event. And then there's a process for investigating the causes of -- of these events.

In Ontario Power Generation's experience, is there a track record of -- of reliable operation of software? Are many of these failures -- do many of these failures indicate issues of systemic problems with software -- use of software -- critical -- safety critical software and firmware systems at generating stations?

MS. SWAMI: Laurie Swami. I believe we'd also require an undertaking to confirm our records. We don't currently see that as a systemic problem within our operation, but we do have through our -- as -- as you mentioned -- not through necessarily that we would report these events, but we -- through our station condition record program would identify if there was ever any difficulties with our software or any particular component and we would go through the corrective action program where we would look for causes that would include looking for extentive condition and extentive cause which would look to see if there

was a track of consistent failures or something of that nature that needed to be addressed. We can confirm that, but I -- I'm not aware that that's a significant concern.

MEMBER PEREIRA: Thank you. And I'd also like to turn to CNSC staff to provide us with a perspective from your regulatory oversight of issues of concerns with operation of nuclear power reactors in Canada, whether software issues feature as an area of concern or an emerging area of concern. So do you have -- are -- are you able to comment on that now or would you like to come back to us? Thank you.

MR. HOWDEN: Barclay Howden speaking.

CHAIRPERSON GRAHAM: Mr. Howden, just before you do, I just want to clean up one other matter.

Your undertaking to OPG will be undertaking 54, and you're going to review the status of reporting significant development reports, SDRs, and so on, on this issue. So when can you report to us on your findings or -- or when you'll get findings?

MS. SWAMI: Laurie Swami. We will

be able to respond by Monday.

CHAIRPERSON GRAHAM: Monday? Thank you very much.

Now, we go to Mr. -- Mr. Howden and see if we need an undertaking here or not.

MR. HOWDEN: Barclay Howden speaking. I -- I don't think we need an undertaking. I think our view -- the -- the intervenor's comments regarding the challenges posed by software and firmware are -- are valid in our view.

What they do is they -- they emphasize the CNSC's regulatory requirements for management systems, management oversight change control, design quality assurance and commissioning quality assurance when systems are put into place.

The CNSC, within one of our groups, does have a particular couple of individuals who look at this, so I'd say we've recognized that it is emerging by bringing these individuals in. We also have access to external experts as required to supplement our knowledge to be able to review issues such as this, but certainly it's an emerging issue.

The recognition is the current

fleet as a certain amount of digital I&C, and there's a clear separation between the safety systems and the operating systems, but the recognition is that this is growing.

Dr. Newland talked about the multi –- Multinational Design Evaluation Program, which is a major international program that we sit on with the major regulators, and there is the subgroup on digital I&C very much focussed on that, on things that the intervenor talked about, and also, how do you make sure that your operating system, safety systems, and safety support systems retain a level of independence so they can do their jobs to prevent common mode or common cause failures leading to the types of things that could happen.

MEMBER PEREIRA: Thank you. Thank you, Mr. Chairman.

CHAIRPERSON GRAHAM: That's sufficient information, is it, Mr. Pereira, you don't need an undertaking? Thank you. Madame Beaudet.

MEMBER BEAUDET: Thank you, Mr. Chairman. I'd like to ask a question of our presenter. You were talking about tests being done

at random, and randomness doesn't seem to appear, I don't think, in your recommendation, and I was wondering if you have any comments on the non-randomness of our random numbers and how can that be approached?

MR. BERTRAND: I believe you're speaking about the fact that random numbers cannot be generated through a computer without using a source of randomness elsewhere?

MEMBER BEAUDET: Yes.

MR. BERTRAND: Okay, sorry. Louis Bertrand for the record. No, I did not address that because it's –- well, there's so many issues that I could not address them all at once. The –- the importance of random numbers in –- it would be for –- for secure networks basically. When two computers communicate over the network –- and please correct me if I'm not answering your question correctly or mistake the –- the intent of your question.

When two computers have to –- to connect securely over the internet, there is what's called a key exchange, and a session key is generated at that moment to secure the communication and the key is refreshed, let's say,

every few minutes or every hour or so.

It is vital that that key not be predictable, and it is a problem in operating systems to generate these random numbers. Typically what happens is that the arrival time of packets at the network interface is used as a source of randomness because one computer cannot predict the –- the actions of others on the network, and that is –- that is used as what's called a source of entropy.

The –- as part of qualification of any secure communication, the source of entropy and how it is used would be –- would have to be examined, and for that, I refer you to a book by –- one of the co-authors is Bruce Schneier –- I'm just doing this from memory –- and it's called Practical Cryptography where the authors take a software developer through the whole process of applying theory to a practical system that would resist attack.

I hope I've answered your question.

MEMBER BEAUDET: As Mr. Chairman has said before, there are some elements that we'll have to look at in camera because of security

reasons, but I just wanted to understand a little bit more what you were referring to.

The other thing I'd like to look at, and this is a very simple matter, but it can have serious consequences, is the checklist. I'd like to ask OPG –- I've come across an incident where there's a plane crash because the –- sorry –- the checklist that –- when it was translated, one item was not included.

And when I was a consultant, I had to do for industries checking translations of checklists that you have to do when you start a system or whenever there's an operation that has to be done, and we were very much aware of this, that when you have a translation of a checklist, you have to make sure that all the items are there on –- whether it's in French or in English.

And we are a bilingual country, and there are some requirements that things have to be translated, and I'd like to know, at OPG, do you always function with the English version? Are they consistent with the versions that you are working with, or do you have personnel that, you know, insist to have a French translation, or how does it function?

MS. SWAMI: Laurie Swami. Our –- at Ontario Power Generation, we function strictly in English, so all of our documents, everything is in English language, so we don't have a translation situation, as you would describe, that we have documents that may come in that require translation and understanding.

That's the way Ontario Power Generation functions. When we talk about documentation, it's very important that all of our documentation is consistent, that it's understandable, and so we have a fairly intensive program in ensuring that we look at our documentation, when it's safety critical that we understand the steps. We test our –- our documentation by having operators go to our simulator, as an example, to make sure that it will function properly should it be necessary to use it in a real situation.

So there are many checks and balances around the way we set up our procedures and instructions to ensure that whether it's a translation consideration or some other consideration, that they will function as required during a specific event or during a critical task

execution in our plants.

MEMBER BEAUDET: My next question would refer to training. More and more now we –- we rely on the computer to tell us what we're supposed to do next, and, well, there's some rumours with Chernobyl that they wanted to sort of go a little bit faster on what they were supposed to do and wait for –- and I was wondering, within the training, the personnel, are they trained to –- or are you judging also the personnel that you would employ in terms of their reaction and how they can feel that what is going on is incorrect and –- and pass the judgement.

How would you select your personnel to work in this type of –- of environment for OPG?

MS. SWAMI: Laurie Swami. I think you're referring to our license training program. We do have an established program for operators and our shift control supervisors and our shift managers who would then go through a very regimented program of learning. And that's learning the understanding from a science principle base as well as task based, and they go through a series of exams and it takes a fairly lengthy

period of time.

As we select people into that program, there's an experiential based expectations as well as they do go through some testing to ensure that their type of reactions, et cetera, in a control room situation would be appropriate. So that is taken care of as part of the selection process.

As they get towards the end of their learning in a classroom setting, they're required to actually go into the plants and experience the control room environment to ensure that they understand how that works, and they go through simulators. And the simulator is essentially a replication of the control room, and as they go into the simulator, they're given scenarios that they have to react to, and there's procedural basis for their reactions, but they need to understand the events in order to assess their -- their understanding and their use of the correct procedures and the correct diagnosis of what that event would be.

We do that training program. They go through a series of tests to ensure that they can meet those requirements. The CNSC is involved

at the end of this process to ensure that they –- they can be licenced through the CNSC to meet the expectations, and then after they're actually licenced, they return to the simulator on a regular basis to practice events that they wouldn't necessarily see in the plant, because obviously the plant is operating.

They use the simulator to test critical steps, so they can go back into the simulator to test the procedures, if there's a critical step that's coming up in our planning horizon.

So they go and they do that. And then their re-qualification program also requires them to be retested periodically.

So it's a fairly extensive program for our existing staff and it would be a similar program to that, that would be implemented for new nuclear.

MEMBER BEAUDET: What's the rate of success of people that you select for that? How many complete the entire training?

MS. SWAMI: I know we have that statistic and it's been discussed, I know, during other Commission proceedings. I just don't have

that right off the top of my head and if you need that, I can certainly get that information.

CHAIRPERSON GRAHAM: Yes, that would be with regard to shift supervisors and shift workers. We'll give that an undertaking number of 55 and if you can provide that information to Madam Beaudet. When -- or to the panel. When would you have that, Ms. Swami?

MS. SWAMI: Laurie Swami, I believe we could have that for Tuesday. Just for clarity, it's our licence staff, whether it's --

CHAIRPERSON GRAHAM: Yeah, regardless -- all licences.

MS. SWAMI: Yeah, thank you.

MEMBER BEAUDET: Thank you, Mr. Chairman.

CHAIRPERSON GRAHAM: With that, I'm going to declare a 15-minute break and the Chair will resume at about 11:30. Thank you very much. Sorry, sir?

MS. BERTRAND: Louis Bertrand, for the record.

I just had one comment about the concern that was expressed by the panel members, yourself included, is that confidential issues to

be discussed in-camera. First let me say that nothing in my presentation or my submission was of a confidential nature. All of this information is available either in textbooks, the internet and the above-ground internet, and those academics, as well as the underground internet.

The other comment on that is that in information security there's a principle in play called, full disclosure, that if you know about a threat, let people know because others, facing a similar threat, need to know that they have to protect themselves because these faults, these software failures are generally not obvious and are hidden.

So Microsoft, for instance, used to consider these things confidential and more and more of their customers were being hit by the same vulnerabilities over and over again. And finally they got beaten over the head so many times that they now are a leader in that field when a disclosure is discovered or when a problem is discovered, they will tell as many people as possible, this is what it is; we're working on it, or this is how to fix it; in the meantime, take these precautions. So I just wanted to make sure

that information security is discussed in an open manner. Thank you.

CHAIRPERSON GRAHAM: Thank you. We realize that your presentation did not generate security issues, but it may generate questions that we might have to put that may be of a security nature and that's why I referred to that, but I appreciate your comments and we'll resume at -- again, at 11:30. Thank you.

---Upon recessing at 11:13 a.m. /

L'audience est suspendue à 11h13

---Upon resuming at 11:30 a.m. /

L'audience est reprise à 11h30

CHAIRPERSON GRAHAM: Will everyone please take their seats again.

Mr. Bertrand, are you still here? If you are, would you come up, please? Thank you very much.

We will now resume our schedule and next on the schedule generally in this forum is we go to the different parties and we'll go first to OPG.

Do you have any questions on this presentation?

MR. SWEETNAM: Albert Sweetnam for

the record, no questions.

CHAIRPERSON GRAHAM: Thank you very much, CNSC, do you have any questions?

MR. HOWDEN: Barclay Howden speaking, no questions, just one comment. We wanted to say that we agree in principle with some of the recommendations made by the intervenor on the type of work that needs to be done to demonstrate the robustness of software and firmware and we'd expect the proponent to bring this forward within an application to construct.

CHAIRPERSON GRAHAM: Thank you for that. Now we'll go to government parties, any government parties that are available for questions? If not, now we will go to intervenors and I have -- pardon me, questions from the floor, I meant to say, and I will go to Mr. Haskill is the first one. We have three and we'll close it at that. So we have three and, Mr. Haskill, you're first.

--- QUESTIONS BY THE INTERVENORS:

MR. HASKILL: Thank you, Mr. Chairman, and it's going to be two farm boys talking this time because all my talk will be directed to you, sir, but I'd like to make a short

statement first. I've been going to CNSC hearings and their predecessor since the day you started in 1999. And this is the first time at hearing I ever see two young people here and I think it's absolutely fabulous that these people were brought here to see what process we go through. And I really applaud this gentleman for bringing them.

My question to you, sir, is I want to be clear on when you go in-camera. You have a background in politics and I have a background in municipal politics. Usually when you going into camera, you come out of camera and make a statement. Is that true when you go into camera for something?

CHAIRPERSON GRAHAM: Our decisions in-camera will be incorporated into our report and for those that will be made public, they will be in that report. And for those that need follow-up or -- they will be relayed to the various parties. But our in-camera sessions, what can be made public will be and will be in the report. The others will be recorded and kept by the two parties involved.

MR. HASKILL: And will that specify that this report was from camera in your report? Will it say, this was made in-camera, this

decision?

CHAIRPERSON GRAHAM: I'm not sure, but I would think that the reports are generally quite long and I would think that -- that there will be an indication that certain things were discussed in-camera and they may be given topics, but not the recommendations that would come out of that.

MR. HASKILL: Thank you very much.

CHAIRPERSON GRAHAM: Thank you and I also want to welcome the two young people that are here this morning. I think it's a good time to start and welcome, and I hope that you don't find all of this talk boring, but maybe educational and an excuse not to be in school today.

Anyway, we'll now go on to our next questioner, and it's Vicky Obedkoff, right.

MS. OBEDKOFF: Obedkoff, right.

CHAIRPERSON GRAHAM: Obedkoff.

MS. OBEDKOFF: Mr. Chair, I have a question for Mr. Bertrand, should I direct it through you?

CHAIRPERSON GRAHAM: I'm sorry, yes, you direct all questions to me and then I direct them.

MS. OBEDKOFF: I would like his response to the various statements made just prior to the break from OPG, from the government officials. When I hear a word like fail-safe I get nervous because Mr. Bertrand's point was that things are changing so fast, we can't guarantee any system. So I'd like his fuller consideration to some of the points raised.

CHAIRPERSON GRAHAM: Mr. Bertrand?

MR. BERTRAND: Louis Bertrand for the record. It's kind of an open-ended question, but I'll do my best to answer it. First of all, as they say in the financial industry, is that past performance is no guarantee of future profits or whatever. And this is relevant to this case because the level of complexity is rising exponentially. We are having -- we have more devices on the network and with each device or each additional device, the number of possible interaction increases. You now have additional time constraints for real time processing because of the mixed signals on that wire, video, voice, you know, surveillance cameras, for instance, as well as the traditional instrumentation and control.

Furthermore, the rapid pace of obsolescence of the development platforms is a concern as well because now something that was current, well, you know, in -- just a few years ago, let's say Windows XP is now completely obsolete and somebody who's developing software would have to make sure that their platform, their development platform kept up. So -- and an additional factor is the trend towards what's called COTSS, commercial off-the-shelf software, where the expense in developing, let's say, a real-time operating system, the expense and complexity would be beyond the ability of the proponent or any, let's say, prime contractor, at which point they would have to go and delegate this task and buy a commercial off-the-shelf software, which in turn needs to be validated.

And when you're dealing with this -- this COTSS you have a conflict between the manufacturer, the vendor, trying to deliver stuff on time, so they can, you know, they can make a sale and make a profit and stay in business, and the requirement to thoroughly vet the operation of this. So factor after factor after factor chips away at my confidence, the confidence that is

expressed by both CNSC and OPG, that they have things under control. Thank you.

CHAIRPERSON GRAHAM: Thank you. The next one -- I said we're only going to have three. We've got a late request from Mr. Gervan and we're going to do that also, but I'll go to Mr. Kalevar first.

MR. KALEVAR: Thank you, Mr. Chair. Through you to my engineer friend, Louis, you -- I think you are the first intervenor I know that brought in the question of how the state of a memory bit can be switched by radiation, say, in the device or in transmission or in the computer or whatever. I was just wondering if you can tell us that what precautions OPG has taken in -- with respect to this are adequate or not, and if there are some precautions you know that they should, well, take?

CHAIRPERSON GRAHAM: Mr. Bertrand?

MR. BERTRAND: Louis Bertrand, for the record. Yeah, the single-event upsets I mentioned due to ionizing radiation are a known fact. In fact, let's say an internet server, right, commercial grade internet server uses what's called error-correcting memory or ECC, error --

yeah, memory. And this is a mitigation measure because a server with, let's say, four gigabytes, four billion bytes of memory, as you know, four times -- four times 824 billion bits, and the -- at that kind of quantity, a rare event is actually quite commonplace. So the -- so this is -- for example, an example of what -- what is currently industry practice.

What is -- but this ECC ram is more expensive, and it's okay to bury it in the price of a commercial server, which has to, you know, support, let's say, web services 24/7. Putting that kind of software into -- or that kind device into a small, let's say a thermostat or a VFD controller, to go back to that previous example, changes the cost equation, and buying a commercial off-the-shelf device, you may not end up with that particular mitigation measure, this error-correcting measure.

The other measure that I would recommend is basically randomizing inputs. Hackers do this. Hackers and penetration testers do this. It's called fuzzifying input, where you basically, over the network, throw judiciously chosen random input at the device and see what it does. And this

parrots out some interesting failures.

The last thing is there's various techniques, one, for instance, is called a watchdog timer. So if the device all of a sudden becomes unresponsive, a hardware timer, and this is similar to some of the failsafe measures that were mentioned by CNSC, this hardware timer. But even then, as an accident investigation for the Toyota ABS brake system done by NASA, I believe last year. The watchdog timer was being misused. So the watchdog timer normally, if the software becomes unresponsive, will trigger a reset of the entire device and the operating system -- the operating firmware begins anew, running anew. But if the -- that particular mitigation measure is misused, it's useless.

Another example of a mitigation measure that -- that has trouble, is an uninterruptable power supply. And uninterruptable power supply with a weak battery would trip on a power glitch, and if the battery was -- was poorly maintained, would not be able to switch -- to hold up the device and would actually fail, whereas a normal -- without the UPS, without the uninterruptable power supply it might have resisted

this particular brown-out.

So when we add mitigation mechanisms we have to make sure that they are -- that they are used appropriately and that they truly do address the problem. I hope I've answered the question well.

CHAIRPERSON GRAHAM: Thank you very much. Mr. Gervan -- or Gervan. No, Mr. Gervan, please.

MR. KALEVAR: One more question.

CHAIRPERSON GRAHAM: Mr. -- no, Mr. Kalevar.

MR. KALEVAR: All right.

CHAIRPERSON GRAHAM: You've -- you have a question on every intervenor and I think we're being overly fair, and the time is going on, so Mr. Gervan.

MR. GERVAN: Thank you, Mr. Chair. I would direct this question, I guess, through you to the OPG people. I'm most interested in the human element of potential failures and risks, and I wonder to what extent -- you were speaking earlier about the rigorous training and testing of operators and critical staff in the nuclear facility. I wonder, do those staff undergo routine

compulsory drug, alcohol, and mental fitness testing?

CHAIRPERSON GRAHAM: OPG, would you like to respond, please.

MS. SWAMI: Laurie Swami, for the record. Our program does not include random drug and alcohol testing, but we have other programs for monitoring the behaviour of our staff, which we find to be very successful in identifying any potential problems that may exist. We are currently working with the CNSC requirements to understand more precisely how to implement any changes that may be required.

CHAIRPERSON GRAHAM: Thank you very much. And with that I want to thank Mr. Bertrand for coming this morning and providing this panel with a lot of information, a lot of overview, and we thank you very much for your input in helping us work towards a decision. Thank you very much for coming, sir.

M. BERTRAND: Merci bien et bonne journée.

CHAIRPERSON GRAHAM: A personal intervention on Mouvement Vert Mauricie. Monsieur Duguay is here to present under PMD 11-P1.232. And

avec Monsieur Duguay is Gordon Edwards, so I'd ask Mr. Duguay and Mr. Edwards to come up and take a place at the -- at the front here.

Bienvenue tout le monde. Bienvenue Monsieur Duguay. Je vous cède la parole.

--- PRESENTATION BY MR. DUGUAY AND MR. EDWARDS:

M. DUGUAY: Le premier à présenter sera Gordon Edwards.

MR. EDWARDS: Hello. I'm very glad to have this opportunity on behalf of the Mouvement Vert Mauricie which is a Quebec organization that is concerned about all aspect of the environment, and in particular about the impact of nuclear power on the -- on Quebec and on the world.

One of the principal recommendations, which the Mouvement Vert Mauricie wishes to advance is to reconsider the idea of siting such a potentially dangerous facility on the Great Lakes, which is -- supplies drinking water for some 40 million people.

To reconsider the idea of siting such a potentially dangerous facility near such large population centres as Toronto, recognizing in light of the events at Fukushima, for example, the

catastrophic potential, the ruination potential for this province and for this country recognizing also that the -- that if there were to be, God forbid, such an accident resulting in emissions on that scale or even greater, that these materials would quickly find themselves in Quebec.

The prevailing wind blows that way would have deposition in Quebec. The Great Lakes would empty into the St. Lawrence River. It would flow past Montreal and Trois Rivières and Quebec City. And we feel that it is -- would be irresponsible in light of what we now know to site such a facility on the Great Lakes or in such a -- such a position.

Unfortunately there is a tendency on the part of society to deny problems and especially when a huge amount of public money and public -- political will has been invested in a technology such as nuclear energy, there is a temptation to simply turn a blind eye to the problems and say, well, we're doing the best we can.

And therefore you can't ask us to do any better. Well, are we doing the best we can? Has, in fact, the nuclear industry -- let me just

put this into a historical context. The last time that a nuclear reactor, power reactor was ordered in Canada was the original Darlington reactors and that was in 1978, one year before the Three Mile Island disaster.

Now, we're talking about for the first time in 30 years making another decision to build new nuclear reactors right in the wake of the Fukushima disaster. Do we learn from the past or do we not?

Now, in following the Three Mile Island accident, there was a review of nuclear safety and a publication in 1980 called *The Safety of Ontario's Nuclear Reactors* based on months of cross-examination and evidence.

And one of the paragraphs in that report says, quote -- this by the way is a -- as you know is a Parliamentary Committee from the Ontario Legislature. "It is not right to say that a catastrophic accident is impossible. The worst possible accident could involve the spread of radioactive poisons over large areas, killing thousands immediately, killing others through increasing susceptibility to cancer. Risking genetic defects that could affect future

generations and possibly contaminating large land areas for future habitation or cultivation.

The Atomic Energy Control Board should commission a study to analyze the likelihood and consequences of a catastrophic accident in a CANDU reactor directed by recognized experts outside the Control Board, AECL and Ontario Hydro."

This type of study has never been done in Canada. We've never really had a -- an examination of the nuclear question at the federal level from a truly independent point of view.

For that reason, we are now calling for a Royal Commission of Inquiry into the future of nuclear power at the federal level. A commission of inquiry, which would be independent of the nuclear industry, independent of the Canadian Nuclear Safety Commission. And which would address the question of whether -- and to what extent Canada and Canadians wish to expend the nuclear power industry or phase out the nuclear power industry.

I think that it is incumbent upon all governments in the world in the wake of the Fukushima disaster to take this very seriously indeed and not to just plough ahead with business

as usual.

Now, we, Mouvement Vert Mauricie -- by the way we submitted this on February 22nd and I'll just read from our February twenty -- this is of course more than a month before the Fukushima -- from page 3 of our report, I'll just read you a couple of paragraphs.

> "It seems particularly irresponsible to consider siting such a plant on the shores of Lake Ontario as I've said. Darlington is dangerously close to the largest city in Ontario and right on the doorstep of one of Ontario's most significant manufacturing centres. Water laden with radioactive fallout would be carried down the St. Lawrence River passed Montreal, Trois Rivières and Quebec on route to the Atlantic, so we are very aware of this possibility. And we feel that the nuclear

industry has been lulling itself and the population and the politicians into a false sense of security about this possibility."

And it's the 1978 report -- remember 1978 was a year before the first commercial reactor accident. The Ontario Royal Commission on electric power planning having spent three years of testimony, cross-examination.

I myself spent three months cross-examining experts from Atomic Energy of Canada Limited from Ontario Power and from the Control Board. And this is what they said, quote, "Assuming for the sake of argument that within the next 40 years, Canada will have 100 operating reactors. The probability of a core meltdown might be in the order of one in 40 years if the most pessimistic estimate of probability is assumed." That's on page 78, 79 of *A Race Against Time*, the interim report on nuclear power.

Now, they're not talking about a tsunami and an earthquake, they're just talking about accidents. They're talking about accidents, things not working correctly. A pipe break. A

failure of an electrical system. A failure of a backup cooling system. Working out probabilities.

These probabilities were worked out in 1974 by a 12-volume study published by the U.S. Nuclear Regulatory Commission called the Reactor Safety Study also known as the Rasmussen Report. And they found that the probability of a core meltdown in a reactor just from accidental causes alone would be about one in 20,000 per reactor year.

If you work that out for thousands of reactors as Alvin Weinberg said in 1977, that could translate into a reactor core meltdown somewhere in the world at a rate of about one every four years for the large population of thousands of reactors.

He said at that -- I had the good luck of attending that talk by him. He said, we nuclear scientists have to face up. We have not faced up to the prospect of complete success.

If we build these reactors in the thousands, we have to anticipate that these kinds of things are going to be happening and therefore we should not be building these reactors near large population centres.

Also the Royal Commission on electric power planning in the text of their report recommended that this was not one of their main recommendations, but it was in the text. They recommended that serious considerations should be given to building these reactors underground. It shows you how seriously they were taking this concern.

I personally feel that the nuclear industry, the Federal Government, the Provincial Governments and the CNSC have failed in their responsibility to educate the public and the politicians about the hazards of nuclear power because they have been too preoccupied with reassuring them about how safe it is.

The recent annual report of the Atomic -- of the Safety Commission has right on the cover, “Nuclear Power in Canada is Safe.” That’s the message they’re putting out.

The CNSC has been there, the president of the CNSC has written letters publicly denouncing people who raise questions about the risks of nuclear power saying that this is scaremongering and that this is not responsible.

At the same time, the president of

the same organization has taken no efforts to publicly correct people who make false statements in the other direction.

For example, there was recently a letter in New Brunswick saying that CANDU reactors cannot possibly meltdown because of their construction and so on. This is false, but it's not corrected. It goes uncorrected.

So I do feel that we have to have a serious consideration here. I would like this Environmental Assessment Panel to endorse the recommendation for a Royal Commission of Inquiry at the federal level, so that politicians and the public can truly air these issues.

We see the Japanese Government struggling to take measures. They are at the mercy of the industry because they really do not know what's going on. They have to get their information only from the industry and only from the regulatory agency. And it has been woefully inadequate.

I don't want to see that happen in Canada. God forbid if we have an emergency in Canada, I would hope that our political representatives and our society would be able to

respond with a better information base to begin with. And that's lacking at the present time.

I'll now let Michel Duguay address his concerns.

MR. DUGUAY: Okay. Thank you, Gordon. So my name is Michel Duguay, otherwise known as Michel Duguay from Laval University.

First I would like to thank the Joint Review Panel for its invitation to us to present our views. And I would like right away to recognize the excellent work that the CNSC has done over the years in studying and documenting CANDU technology.

For the sake of transparency, and in line with the comments made by Chairman -- Chairman Graham a while ago, I wish to inform the Panel that I have a PhD in nuclear physics from Yale University and I have lived for 26 years in the States. And all the time I was there, I was a supporter of nuclear power, and I used to follow it very closely, follow its development very closely.

However, over the last 10 years in Canada, I have become an opponent of nuclear power having been recruited in particular by Gordon Edwards and Michel Fugère.

So in my written presentation, I discussed ten points where I argued that CANDU technology would not be a good choice for generating new electricity in Ontario.

I don't have to explain these ten points to you because you know them very well. You know more about these ten points than I do.

So I will -- what I will do instead is argue very briefly for a smart network. I'm a professional in electrical engineering. And what's in fashion these days is a smart network.

And a smart network needs reliable sources of electricity that are predictable.

And the problem with a nuclear reactor like the CANDUs that when it goes down, it can be down for days, weeks, even years. So it's not a very good predictable source of electricity in additional to all its other problems.

But because of Fukushima, we'll do, as the CNSC itself is doing -- I will condense my report as a sort of -- taking off on Fukushima -- what happened in Fukushima.

So now the world has learned in a very vivid fashion through the media that one can have a core meltdown.

The reactors in Fukushima did. As soon as they sensed the beginning of an earthquake, they shut down right away.

And people don't know enough, not even the media, not even Radio Canada, that when you shut off the fission reactions, you still have the radioactivity to deal with.

In a small-sized nuclear reactor like you have in Pickering or in Gentilly, you have about 100 megawatts of nuclear thermal power being generated, and that heat has to be taken away.

And so that was a big surprise for people to learn that you have to keep cooling down those reactors.

And the other big thing, of course, that people have learned is that you can get into the core meltdown condition.

And I've been in the media quite a bit over the last two weeks, and they keep asking me what's going to happen now that the core has melted down?

Well, I've referred them to the CNSC. Countless times I've told them, well, the CNSC has modeled that. They know a lot more about this than I do. Why don't you call them up?

So I'm not sure how far the CNSC has gone into explaining to the people what happens in a core meltdown.

But I have noticed that the French company AREVA, which is building a large nuclear reactor in Finland, already has taken into account the possibility of a core meltdown, and they have put under the reactor, what they call, a core catcher.

In French they call that a "receptacle", core catcher, so that if the core melts down, it will get on that plate, which is made of a refractory metal, which can take very high temperatures, and that big, huge metal plate will spread out the heat everywhere, and things won't -- will not go out of hand.

So that's a good thing, and I would think that that would be a feature that would be looked upon with interest on the part of the -- of the joint-review panel.

Now, another thing, I think, that we learned from Fukushima is that in the last news, they were saying they were going to build a tent over the reactor site.

Well, the tent is something. But

the Russians felt in Chernobyl that they had put -- they had to build a sarcophagus, and they had constructed a new one, which they will roll over Chernobyl in a short time.

Well, I think that one can argue that a new reactor, even a refurbished one, should right away have a very strong physical containment that would, not only contain a possible nuclear explosion or a hydrogen or a steam explosion, whatever, but also take care of terrorist attacks, malevolent attacks.

And as far as I've been able to tell, especially from French studies, this would take about 3 metres of reinforced concrete. The 1 metre of reinforced concrete that is now over reactors is not enough. And especially over these pools where the spent fuel is stored, you just have a very ordinary roof, and that is totally -- there's almost no protection at all against airplane crashes or missiles or whatnot.

Now, I was quite impressed by the presentation of Louis Bertrand earlier.

And I have taken notice of the fact that major airlines don't allow pilots to fly on the automatic pilot, the computer as pilot, on

takeoff or landing. There's been quite a few accidents that were caused when this had been done against the rules.

But also I've noticed that -- an example that everybody can figure out for himself that as far as I know, operating a nuclear reactor is far more difficult -- it takes years of training. It is far more difficult than driving a car.

Now, who would let his car drive him or her along? Who would give over the control of your car to a computer program?

So when you're talking about a nuclear reactor which is extremely complex, one is playing a dicey game by giving it over to a computer.

And the public must be informed that a nuclear reactor can go out of order in 1 second. That's why it has to be under computer control. And there has been many instances in the past where things got haywire, and the operator said, well, it doesn't look good, and he shuts it off manually.

So I think that Louis Bertrand -- I'm glad that you people have taken -- are going to

take into account his testimony. That's a very important aspect that I hope will slow down the -- the -- this head-long effort to build more nuclear reactors.

So one last thing I'd like to come to is the fact that Nicolas Sarkozy, President of France, that has the -- 80 percent of its electricity produced by nuclear power, has said that we need international standards and mandatory standards.

One basic weakness of the CANDU technology, as you very well know, is the positive coefficient of nuclear reactivity which means that if a pipe breaks suddenly, as an example, it can take off. The power can rise in one second to five or ten times its normal value, and it can start melting down pipes.

I have the impression reading the CNSC documentation that this positive coefficient of nuclear reactivity is not well seen in other countries like the US, the UK, France, and several others.

So there could be an imposition on the part of the international community to hike up the standards, the ruling -- the ruling standards

of Canadian nuclear power.

I will conclude by coming to Ramzi Jammal's letter sent on March 17th to the CANDU owners. I think this was a very proper reaction.

Mr. Jammal made a reference to Fukushima, and he mentioned the possibility with nuclear reactors of severe accidents and called for the companies to present their plans for a better defence in depth against major accidents.

I've been on television quite a few times, and one of the first things they asked was, well, aren't you an alarmist telling us that something could go haywire with a CANDU reactor?

And fortunately I keep referring them to the CNSC documentation which talks about the power pulse and the fact that pipes can start melting down and the fact that the modeling is not good enough to predict exactly what's going on.

You probably have more information about these core -- these melted down cores than I do, and you should answer the questions that the media are asking.

So I applaud Ramzi Jammal's letter. I think it was quite proper.

And -- but I think one should go

further. I firmly believe that the CNSC deserves a higher status, really. You need to be very high -- have -- what I have is permanence d'emploie. Sorry, the -- sometimes the French words come over. Permanence d'emploie, job security.

I have job security. I was very sad to see that Linda Keen was fired on a -- for doing her job.

I would wish to see everybody at the CNSC have permanency, permanent job, no matter what you do. Even when you're wrong, you should still keep your employment.

But your standards need to be raised. And I think this could be done by a Royal Commission, a Royal Commission of Inquiry.

We can't have the CNSC be influenced by the nuclear lobby. The nuclear lobby used to be very powerful in Canada.

A colleague of mine told me last year that I was risking my career by speaking against CANDU technology.

Well, I don't believe this is the case because we have a very good union at Laval University, and I don't think I could be fired for that.

So in conclusion, I think, you know, we should have this Royal Commission of Inquiry. It's important enough what's going on.

You know, Japan's economy is being menaced by this disaster and just the perception. Your great lawyer Jacques Lavoie told us in Quebec City just a few months ago, talking about the CNSC, that sometimes the perception of what's going on is more important than the reality.

Even if the CANDU reactor was secure, if people feel that it's a menace, well, it's a menace on all of Toronto and all of the surrounding areas.

I'm very glad about Ontario going into renewable energy. That's what we're pushing for in Quebec. Anyway, my time is up and I leave the microphone to Gordon. Thank you.

MR. EDWARDS: I'd like to ask the Chair how many minutes are left, please?

CHAIRPERSON GRAHAM: You have about 10 minutes.

MR. EDWARDS: Excellent, okay.

CHAIRPERSON GRAHAM: I'm sorry, my mic wasn't on; about 10 minutes.

MR. EDWARDS: Thank you. Well,

the Mouvement Vert Mauricie is just a group of concerned citizens. They are not technical experts. They retained the services of myself, Mr. Duguay and a man who I have a great admiration for, Dr. Frank Greening.

Dr. Frank Greening cannot be here today partly because of his -- the fact that he's now working for Bruce Power and he feels that it would be inappropriate to be testifying at a hearing today.

However, I ask you to read carefully his three contributions to our brief, each of which I think is worthy of deep consideration.

And really in the context of a Royal Commission Inquiry, each one of those papers could be dealt with in days of testimony and cross-examination and deliberation. And I think if you read them you will see that there is much substance there.

One of his papers is on radioactive emissions. As I said, Dr. Greening worked for 23 -- or did I say this, Dr. Greening worked for 23 years for Ontario Hydro and subsequently Ontario Power Generation in the

nuclear division. He had a very high position in terms of questions of chemistry and pipe corrosion.

And over these 23 years, he became increasingly concerned and in some cases alarmed by the fact that problems seemed to multiply, and not being corrected in a permanent fashion, but simply a question of reacting to emergencies which arose.

And he feels and he expresses this in his papers, that we are not really on track to solving these problems. They keep accumulating and they are very troubling in terms of their implications for the future of the industry.

Now, one of the things with regard to the environmental assessment directly, he's concerned about emissions. He feels that none of the documents that he has looked at really reveal the source terms in a realistic way.

Where is the radioactive material coming from in each one of these reactor designs? And he talks about the fact that there are over 40 different radionuclides that should be tracked and each one of these should be accounted for.

And there should be the ability to determine which of these radionuclides are being released in which quantities. You cannot just make

sort of speculative assumptions and then use wonderful wind models to predict what the deposition is going to be, if you don't know what's being given off in the first place.

And in his view, there is nothing scientific in these documents that justifies the assumptions that are being made by the proponent in terms of modelling the emissions. Also there is too little engineering going into controlling emissions; limiting emissions.

Where is all the technical ingenuity in that direction? For example, holding tanks to hold up radioactive materials for lengthy periods of time; to ascertain their content before releasing them to the environment or instead of releasing them to the environment, and being able to get rid of some of the short-lived isotopes simply by retaining them, then being able to remove many more of those radioisotopes before releasing them.

He also talks about the fact that -- well, of course, here's where lack of education comes in. I think that the politicians and the public really have to be given better education about what these materials are. People are

completely mystified.

For example, iodine 131 is often compared to a chest x-ray in terms of how much dose of radiation you get. Well, I think that this is unscientific and absurd. There is no -- there is no background, naturally speaking, of iodine 131.

Iodine 131 did not exist before nuclear fission was harnessed. It's only through atomic bomb explosions and nuclear reactors that iodine 131 ever gets into the environment.

And iodine 131 goes to the thyroid gland and can have particular -- not just thyroid cancer, it can have particular effects on young infants. For example, it can cause developmental abnormalities leading to such things as mental retardation, stunted growth, et cetera, et cetera.

Any biomedical professional will tell you that at crucial times of development inferring with the functioning of the thyroid has specific medical effects. There's no information on this available to the public.

If you go on the CNSC website you find nothing explaining what this is all about. Only -- the only thing you find out is if you take thyroid pills it won't hurt you.

I think the public is entitled to more than that. And I think these -- comparisons with chest x-rays which do not leave any deposit of radioactive material in your body. I think it's quite inappropriate as a -- unless it's a company by a much more detailed explanation.

Each one of these materials has its own biological pathways; it has its own environmental pathways and the receptors may -- one has to think about the long-term accumulation of some of these materials.

Caesium-137, as we all know, has a half life of 30 years, it means it's going to be accumulating for decades over a period of time. That has to be talked about in detail. It's not in the existing environmental assessment.

We come to things which are released in large quantities even under routine circumstances and those are things like tritium, radioactive hydrogen and carbon 14.

Carbon 14 and tritium are of special interest because they are basically carbon and hydrogen, the basic building blocks of all organic molecules, and as such one has to be particularly careful about estimating their harmful

effects over the long term.

We have already doubled the radioactivity of Lake Ontario through our nuclear reactors. The Ontario Drinking Water Advisory Council has found that anything above two or three becquerels per litre is manmade and we're already at more than twice that, I believe, or about twice that in Lake Ontario. So twice -- two times the amount of tritium in Lake Ontario. We have doubled what nature has provided for that.

Now, carbon 14 is a special long-term problem because it gets into the resins and it has a 6,000 year half life. And there are serious problems about what to do with these wastes which are contaminated with carbon 14 dust. And we've also had some unfortunate episodes with carbon 14 dust in the past.

There were workers who, at one point, for several weeks, tracked carbon 14 dust into their homes and some of their bedclothes and furniture had to be confiscated and buried as radioactive waste because it took weeks for the authorities to recognize the weak Beta emission.

I'd just like to -- that's only the emissions paper. I'd like you to look at that

carefully and think about the implications of it. He also has a very good paper on economics which refers to -- not just the fact that it has a high construction cost, which is subsidized usually by government, but it also has an increasingly bad record in the maintenance cost.

The operating, maintenance and administration costs have really been climbing and they're much higher than other types of facilities. And they seem to be unable to get control of this.

Largely this is because of the radiation which prevents proper maintenance. It makes the maintenance very difficult when the radiation fields are too high for the workers to get at the pipes.

And finally with regard to his safety paper, this is something which he has intimate knowledge of. The -- he talks about the annulus gas system and the various problems they've had with that.

Kilograms of rust developing in the annulus gas system to such a degree that they couldn't even detect the necessary indicators for possible accident precursors because the rust and the accumulation of other types of junk in that

system were preventing the measurements from being reliable.

He talks about the pressure tubes which we all know are a great weakness. And of course, this is of the CANDU design. But really, when you look at the work that has been done over the years, they have not solved the fundamental problems.

In fact, more problems seem to keep emerging with regard to the pressure tubes. No sooner do they solve one set of problems, or think they have, than a new set of problems seems to emerge. He talks about that. The feeder pipes are something he particularly is concerned about. The cracking and wall thinning of the feeder pipes was not noticed until about 1997 in the Lepreau plant, and then later found to be endemic to all the CANDU plants.

And again, so many false assumptions which were later proven to be wrong, so many difficulties and impossibilities. It turns out to be impossible to monitor the actual condition of these feeder pipes because of the high radioactivity levels and the over-packing of the feeder pipes in such a way that you can’t get at

them.

And as a result -- now, this is very important because a loss of coolant accident can be caused by a rupture of feeder pipes, and it could be more than one that ruptures at a single time, so all of these things are of direct relevance to the probability of a core melt down.

Nobody wants a core melt down of course, but these backup systems do make certain assumptions. The probabilities that are used make certain assumptions. What Dr. Greening is testifying to here is that in his 23 years of experience those assumptions are not justified scientifically.

Thank you.

CHAIRPERSON GRAHAM: Thank you very much for sharing your observations and information.

I was told at the outset or advised that I pronounced Mouvement Vert Mauricie wrong, incorrectly, and I apologize. As for the name Duguay, that’s a very common name in l’Acadie in New Brunswick, so I got that right anyway.

Anyway, we will start off with questions from the panel members, and I will go

first of all to Madame Beaudet.

--- QUESTIONS BY THE PANEL:

MEMBER BEAUDET: Thank you, Mr. Chairman.

I would have first a comment, when you referred earlier to the need for Royal Commission to add the concerns of everyone, and I think our mandate has been put in such a way that we are concerned mainly to check if there is still significant adverse effects, and a Royal Commission would probably have a broader mandate in including a debate, a general debate, that we have noticed in many submissions that is not -- the concerns are not just with this project, but the general debate about nuclear or not.

The other thing is when you say that we -- we go on business as usual, I think when we reviewed the -- the motions for people asking us to stop this hearing, we considered that if we stopped for six months, a year, until we learned all the lessons from Fukushima, we -- we need to prepare an interim report. And I have always believed very strongly in the contribution of interventions at public hearings, and I think over the last two weeks we can see the quality of

interventions that we received. And I think for us we considered it's important to listen what people have to say before we say, well, we just close everything, we wait, and we prepare an interim report. We considered that the contributions that we can have over these three weeks were very important.

My first question refers to accumulation of radioisotopes in the near filled environment, and we have covered this topic in many ways over the last sessions.

And I'd like to have Environment Canada commenting. We had on two occasions the discussion as to what we recognize as toxic substances. As I referred previously with the joint -- the International Joint Commission, they asked to have the radio nuclides included as toxic substances, I believe. And for Environment Canada, when you do determine that an element is a toxic substance, you rely on, I presume, international community, World Health Organization, Health Canada? I would like to know what is the procedure, please?

CHAIRPERSON GRAHAM: Environment Canada?

MR. LEONARDELLI: Sandro Leonardelli, for the record.

I'm not an expert in that, but I can speak, generally speaking, and then if additional information is required, it could be provided.

My understanding is that when they do an assessment of the toxicity of a substance, we look at it under the *Canadian Environmental Protection Act*. It's done jointly between Environment Canada and Health Canada to determine whether it's a toxic substance.

So they will look at concentrations in the environment, potential sources, the inherent toxicology of the substance, so those are the type of things that are looked at.

I can only speak to it in a very general sense, so I -- we can, if you wish, as an undertaking, give you a deeper perspective on that.

In terms of the discussion about concentrations, you led off with a -- Madame Beaudet led off with this questioning about radionuclide concentrations in the local environment. There -- the substances that have been modeled, it's true, it's a fairly limited

suite of substances that have been modeled.

In the case of soil deposition, the only substance that I recall that was modeled was for Cesium, and it was only done for one location in Oshawa, so we had requested information around that, and I believe it is Information Request number 269.

Now, that information request pertains to secondary issues within the air dispersion modeling. It has to do with the deposition, the wet/dry deposition. It's a finer point within the overall context of the dispersion modeling, but I believe there was only one soil concentration provided for -- for Cesium.

MEMBER BEAUDET: Thank you. I would like, yes, to have the protocol that would be used in more detail, please, as an undertaking when you decide whether an element or substance is toxic or not.

MR. LEONARDELLI: We can provide that.

MEMBER BEAUDET: Thank you.

CHAIRPERSON GRAHAM: That will be undertaking number 56 by Environment Canada.

When would you be able to provide

that?

MR. LEONARDELLI: Sandro Leonardelli, for the record. I'd have to make an inquiry in it, but I would suspect we would be able to provide something sometime later next week, possibly by Wednesday or Thursday.

CHAIRPERSON GRAHAM: I will put you on the agenda for reporting on Wednesday, and if it's not ready then we can set another date.

MR. LEONARDELLI: If I may, could you set that for Thursday?

CHAIRPERSON GRAHAM: Yes.

MR. LEONARDELLI: There's a likelihood that I won't be here on Wednesday.

CHAIRPERSON GRAHAM: We will do it on Thursday then.

MR. LEONARDELLI: Thank you.

CHAIRPERSON GRAHAM: Thank you.

MEMBER BEAUDET: My second point is page 82 of the submission we have today in front of us talking about tricky operation of a CANDU reactor. And this brings to mind that in the -- the CNSC PMD 1.3, on page 145, where CNSC reviews those consequences for AO's and DBA's, you compare the US EPR and the UK EPR, we have -- we have

agreed that the review without a vendor or a technology chosen would cover all the aspects that would have an environmental effect under a PPE bounding.

When the EC6 was added, we did review extensively what would be the consequences, we did review all the IR's, we asked advise from CNSC in terms of doses or how the PPE was extended. We did get from OPG an update of all the elements that were considered in the PPE and indication as to which elements the PPE was extended because of the addition of EC6.

What I would like to know here is what is your understanding of the PPE envelope? I know in the environmental assessments on page 213, OPG does express that if there is a technology that is chosen that is not covered under the PPE, we -- they would make adjustments, and I believe we have done that exercise thoroughly for the EC6. Now here we compare different EPRs, and I'd –- I'd like to know, how is that going to function after we issue the License to Prepare a Site, which now we were told could be issued before the technology is chosen?

Where is our legal –- or

regulatory, rather, instrument to make sure that all the aspects in details –- I mean, they have to be reviewed –- all the aspects will be checked after we have completed our mandate and that the thorough review that we have done for the EC6 will be done for another technology that is not under review here.

We have four reactor types now. We understand there could be more. There could be differences even in EPRs, et cetera. CNSC, please?

MR. HOWDEN: Barclay Howden speaking.

From a regulatory perspective, the panel, if it were to make positive recommendations on the EA, would be recommending the Follow-up Program, and within the Follow-up Program would be the requirement that the the chosen technology fits within the PPE.

The Follow-up Program is then integrated into the licencing, so, for example, for the License to Prepare a Site, License Condition 10.1, the Follow-up Program would be there, and that’s where it would be found.

So –- and then it would be carried through because the –- to the License to Construct.

Again, the –- the requirements of the Follow-up Program that were to be implemented prior to the issuance of a License to Construct would include that particular condition. But it's being –- the Follow-up Program from the EA to make it into the regulatory program goes into the license, and in particular, the license condition on the Follow-up Program.

MEMBER BEAUDET: I have a further question on this. In the update document that we've received from OPG, which is version 3 for the record, of document number NREP-01200-10000, the panel can assess, for instance, what would be the impacts with Tritium, which exceeded the PPE of the other three technology or waste.

It is a very detailed document in terms of update, but there are certain things, for instance –- I don't know if OPG has the document in front of them at the moment?

(SHORT PAUSE)

MEMBER BEAUDET: It's table 3. It's B8.3, table 3, Site Parameters and Darlington Characteristic Values Composite Table.

Now, this is a document of 128 pages. If we take, for example, on page 83 where

you have “Mass of highly active material”, the limiting factor is EC6.

It says here, “were used not in Environmental Impact Statement or Site Evaluation Studies”.

I’d like to have some comments on that, how used where not applicable.

But I’d like OPG first to comment on a statement like this, because in other instances, it is used in the Environmental Impact Statement. Is it because it doesn’t apply or –- I’d like to have more details on that.

CHAIRPERSON GRAHAM: OPG.

MS. SWAMI: Laurie Swami. Dr. Vecchiarelli will be able to provide a more detailed response.

DR. VECCHIARELLI: Jack Vecchiarelli for the record. The list of parameters in the plant parameter envelope was adopted from similar lists developed in applications in the US, and what we found after obtaining from the vendors all of the various values for each of those parameters, some of them were not actually used, were not necessary to be used in the EA or in the site evaluation work.

The relevant values were determined in the course of those particular studies. Some were taken from the PPE as needed, but some, as it turns out, either we used something more conservative still or it simply did not factor into the Environmental Assessment or the Site Evaluation Studies. And in the US applications, they found the same experience where, what they thought a priori was a parameter that they would need, turns out they did not actually need it.

MEMBER BEAUDET: Thank you. The last topic I'd like to touch –- if you'd give me a moment so I can get rid of some of this –- is on page 86 of the –- the submission where you talk of Smart Grid requires predictable resources.

I'd like you to comment. When you said at page 85, the last paragraph, which goes on on page 86, that there's a considerable historical record of solar and wind power availability, and then on the contrary, a nuclear reactor has a temporary availability profile that is basically unpredictable.

I would think that solar and wind is also unpredictable. I'd like your comments on that, please.

MR. DUGUAY: Well, for the last ten years, I've been working in solar energy, solar photovoltaic systems, and I'll point out to you that even on cloudy days, solar panels would produce electricity, and the weather can be forecasted extremely well an hour ahead of time. That's all a dispatcher need. People who dispatch electricity, they just need to know one hour ahead of time how the wind is blowing or the sun or whatever, and so I claim that both wind and solar are highly predictable because you only need to know one hour ahead of time.

But a nuclear reactor, as you know very well, in one second, something can happen, it will go down. When it goes down, it will be down for days, weeks. In Ontario, it's been down for years before it came back up again. So nuclear reactors from the point of view of a Smart Grid are not very good.

Another thing is that, you know, we have a basic weakness in our electrical system in Quebec. It's the very long lines. It's been recognized by the President of Hydro Quebec. Everybody knows it. And so there is a vulnerability because of the very long lines, and

the nice thing about the Smart Grid ideas, with local power production from solar photovoltaics or wind or biomass or whatever, is that you don't need any more of the long lines.

You have electricity locally. If the network goes down, you just use the electricity that you can produce in your own building from the roof, from parking lots where you have solar photovoltaic panels. So the Smart Grid is going to be also a very reliable grid. And in an economy where more and more you need to have practically instant transfer of information and data processing, it's going to be a very big asset to have this Smart Grid.

It's totally recognized in the US. I don't see why it would not be recognized in Canada.

CHAIRPERSON GRAHAM: Mr. Duguay, when you speak, identify yourself, and that was Mr. Duguay --

MR. DUGUAY: Oh, I'm sorry.

CHAIRPERSON GRAHAM: -- for the transcripts. Just -- no problem, but just they get them on the transcripts.

MR. DUGUAY: They'll notice from

my accent.

MR. EDWARDS: If I could just add a short comment on that. The whole idea of a Smart Grid is really to replace the whole need for what they call base load power. The old grids basically are clunky. You basically need base load power and then you have peaking power and so on, load following facilities.

The whole idea of a Smart Grid is to wean us off that so that you don't need base load power. We've seen in Ontario where we've had to pay people to take off –- to take nuclear electricity because otherwise we'd have to shut down the plant. And it's more expensive to shut down the plant than it is to pay people to take the electricity.

We had to shut down Niagara Falls in order to keep the nuclear power plants running, and even then we had to shut down some of the nuclear power plants.

So the difficulty with nuclear is that it does kind of –- it's not flexible. It doesn't adjust easily to the circumstances.

I'd just like to mention that –- that following the disaster in Japan, virtually all

of the wind production facilities in Japan are functioning fine, including the offshore ones. They survived the tsunami, and they're supplying, in fact, a significant fraction of electricity which people are using for the recovery purposes while they're struggling to deal with these crippled nuclear reactors. It just happens to be the case.

CHAIRPERSON GRAHAM: Madame -- Madame Beaudet?

MEMBER BEAUDET: I -- I think it -- it was in relation to our confidence to predict the weather and, I -- I think, the International Association of Meteorologists are trying to -- to get ways of being more precise in terms of local weather. I mean they -- they can predict over the country, but locally, it's -- it always comes very uncertain what they're -- they're doing, and that was my reaction.

We -- we had many submissions here talking of the smart grid and -- and decentralizing basic power.

MR. DUGUAY: May I reply?

MEMBER BEAUDET: Yes, please.

MR. DUGUAY: Well, have you

noticed that electric cars are coming along -- Michel Duguay, Michael Duguay.

Electric cars are coming along very fast. There's been tremendous progress in batteries. A great invention was made in Quebec not long ago. They have developed a battery based on nanotechnology that can be charged up in four minutes and so when you use solar power, as an example, or wind power, you can count on having electric batteries.

You know, Google is putting billions of dollars in developing solar photovoltaic tanks with batteries to provide power all the time everywhere in an extremely reliable fashion, so I think the technology is -- is there. With batteries, you know, it doesn't matter if the sun is shining or not. You have it stored in batteries, so I -- I think I see a very bright future for this approach.

MR. EDWARD: Perhaps I could just add that the -- the whole future of electricity is really based upon developing better storage systems and so on, and better storage systems automatically favour the renewables rather than nuclear because the big advantage of nuclear is the fact that it’s

-- when it’s operating well, it’s uninterruptable. You know, it just operates full blast supposedly, but once -- once you really make progress in the storage technology, then the -- the balance begins to tilt.

I would, of course, remind you that Germany, which shut down seven reactors in the wake of the Fukushima disaster and which, as I said that they are going to accelerate their phase out of nuclear power, have built 30,000 megawatts of wind power capacity in less than ten years, which is amazing. I mean I don't think you could build 30,000 megawatts of nuclear in ten years.

And also the installed solar photovoltaics in Germany is more than the capacity of the Fukushima six reactors, so it’s -- it’s beginning to make differences. And the question is we’re talking here just as -- just as -- going back decades when nuclear power was first coming on stream and it was a bright gleam of hope, you know, these renewables are really a bright gleam of hope just as the nuclear vision seems to be clouding seriously because of -- I mean, after all, MAPLES?

They can’t get ten megawatt MAPLES running and we expect them to get a thousand

megawatt ACR running. The -- the difficulties at Chalk River, the difficulties with the refurbishment, the cost overruns, the billion-dollar cost overruns, the three years delays in the Point Lepreau refurbishment, all these are testifying to the fact that nuclear power isn't what it used to be.

CHAIRPERSON GRAHAM: Thank you, Mr. Edwards. Madame Beaudet --

MEMBER BEAUDET: Thank you, Mr. Chairman.

CHAIRPERSON GRAHAM: Mr. Pereira?

MEMBER PEREIRA: Thank you, Mr. Chairman. A number of my questions have been answered already, but I do have two points I'd like to follow up on.

One concerns the question in -- in the intervenor's submission on source terms and we have addressed this in previous interactions at the June technical meeting and in other questions that have been raised, but I'd like to get some clarification.

We have in their environmental impact statement and in supporting technical documents a description of the approach used to --

to assess the consequences of beyond design basis accidents and -- and the approach used is to use the limit specified in RD-337.

Now, the environmental impact statement does state that actual source terms and co-damaged frequencies which, I presume refers to so-called core meltdowns -- we're talking of something higher level than that. This information I -- I'm seeking now clarification from the CNSC staff. When will this information be available and how will that information, when it is available, be reconciled with this -- the analysis that forms the basis for the environmental impact assessment consequences of severe -- beyond design basis accidents.

MR. HOWDEN: Barclay Howden speaking. I just want to clear -- you asked a question of when and -- and then a question of how. Okay.

So the when will occur at the licence to prepare -- no, licence to construct because that's the time when the detailed design would be done and the safety analysis and all the various things would be done then.

How it would be done or how it

would be reviewed by the --

MEMBER PEREIRA: How will it be reconciled with the assumed source term that was used as the basis for the environmental impact statement because, from what I understand, what was used in the environmental analysis that supported the environmental impact statement is limits from RD-337, so hypothetical limits rather than real data from the design proposed by the vendor, so just clarity as to how we would validate what was assumed and -- and demonstrate that, in fact, what was assumed in the environmental impact assessment was, in fact, conservative?

MR. HOWDEN: Okay. So I'm going to ask Dave Newland to answer in detail just to -- in the environmental assessment, what the -- what the -- the proponent provided was the -- from the vendors, the design basis accident and the -- the impacts from that. And then they did a stylized approach to approach the -- the beyond design basis to give the potential releases and impacts. When they actually choose a vendor and come in with their safety analysis and their design, Dr. Newland will walk you through what we'll be doing.

DR. NEWLAND: Dave Newland for the

record. I guess this was partly covered off in the technical briefing note that we provided to the panel, a bounding approach to accidents and malfunctions.

But just to expand on what Mr. Howden said, at the time of the licence to construct, we expect -- we're in the process of publishing GD-369, which sets out information requirements for the licence to construct. And as part of those requirements, we expect a preliminary safety analysis report to be provided. Within that report, the applicant must demonstrate that the dose acceptance criteria are met for range of designed basis accidents and that the safety goals in RD-337 will be met for the chosen technology. In the latter case, the applicant or the vendor must use a probabilistic safety analysis in order to make that demonstration.

At that time, at some level, information will be available in a transparent way to intervenors, members of the public in order that that they can see that that demonstration has been done in a reasonable manner.

MEMBER PEREIRA: So when you say it will be made available to the public and -- and

the demonstration is that it -- the analysis presented in support of the environmental impact statement is -- is a bounding, that -- how would that be made available to the public in an open and transparent manner? What -- what's the mechanism for that?

DR. NEWLAND: Dave Newland for the record. At the time when an applicant makes that submission to the CNSC, not all of it, but a portion of that preliminary safety analysis report would be in a public forum and that’s what the public would be able to see. Obviously, the details of commercial in confidence, software, et cetera, would not be made available, but the key methods, the results, at a -- a high level would be available.

MEMBER PEREIRA: Would there be a public hearing that would -- where those issues would be aired?

DR. NEWLAND: David Newland for the record.

Yes. We would go through our usual two-hearing process in which the applicant, in the first instance, first makes the application; B, there is a hearing in which intervenors can then

see what is being put forward in front of the commission.

And then 90 days later, there would be a second commission hearing in which intervenors can intervene based on the information that they have seen either from the documentation or from the first hearing.

MEMBER PEREIRA: Thank you.

I'll turn now to Ontario Power Generation on a different topic.

The intervenor has raised questions concerning the long-term storage of waste onsite or at offsite facilities. And we have covered these topics in some detail prior to the -- this hearing in -- at a technical meeting and then also in the early days of this hearing.

But there's one aspect which this particular intervention raises, and that concerns the long-term storage of resins which capture cabin 14. And if these resins are being stored, say, onsite for a very long period of time, what would be the measures that Ontario Power Generation would have to take to prevent releases due to the breakdown of the resins over a long period of time? How would Ontario Hydro -- Ontario Power Generation

manage that risk?

CHAIRPERSON GRAHAM: OPG?

MR. SWEETNAM: Albert Sweetnam for the record.

These resins at the moment are taken, as we said before, in the transport casks to the Western Waste Management Facility where they're processed and stored.

And in terms of the long-term storage, there's consistent monitoring and shielding in the buildings that we store them in, and that would continue.

And, like we said before, if there's any sort of deterioration of the containers that they're stored in, they would be placed into a secondary container.

MEMBER PEREIRA: But we -- in our previous discussions on these issues, we talked about possibility of having to store waste onsite.

And so would the same -- would there be facilities onsite to do the management that you're talking about?

MR. SWEETNAM: Albert Sweetnam for the record.

If we were unable to transport the

waste from Darlington to Kincardine, we would establish a similar facility to enable us to store the waste complete with the monitoring and the shielding that would be required for that sort of waste.

MEMBER PEREIRA: Thank you.

That's all, Mr. Chairman.

CHAIRPERSON GRAHAM: Thank you, Mr. Pereira.

We will then go to questions from OPG. Do you have any questions for intervenor?

MR. SWEETNAM: Albert Sweetnam.

No questions.

CHAIRPERSON GRAHAM: Questions from CNSC?

MR. HOWDEN: Barclay Howden.

No questions.

I just wanted to expand on a point that Dr. Newland made.

He spoke about a regulatory document GT-369, which is a license application guide for construction which has gone through public review and will be published probably within the next month or two, but just for people to know to watch for that on the website.

CHAIRPERSON GRAHAM: Thank you, Mr. -- we don't need that as an intervention -- as an undertaking? No.

Government agencies, Environment Canada or any other departments?

Okay, thank you.

And intervenors, we don't have any.

And I -- because of the time of day, there's been none registered, so we will now -- before I do, I want to thank Movement Vert and Mr. Edwards for coming today.

And, Mr. Edwards, if it's very short because we're running way behind schedule for the intervenors this afternoon.

MR. EDWARDS: Thank you very much, Mr. Chairman.

Gordon Edwards for the record.

I'm sorry I haven't identified myself previously.

I just want to say that we -- the perception of myself and other people in the environmental community is that there has been a degradation of the environmental assessment process

by lumping it in with the licensing process by having, we believe, inordinate influence by the CNSC on the environmental assessment process.

We don't feel that there's a proper independent objective environmental assessment, and that's a real problem we have.

With the CNSC process, although they do very good work on a technical level; very important work; and produce very good studies and so on; and they also have been very good at making information available through the internet; as far as handling interventions and public hearings, we generally find it woefully inadequate.

And whereas the proponents have unlimited access to the CNSC, they can come back time and time again with additional documents, changes, and so on.

Intervenors are given 10 minutes, and that's it, and they are -- once the hearing is over, they're not allowed to even make any further submissions.

This process is quite inadequate as far as we're concerned.

And we think that moving the details of the environmental assessment over to the

CNSC is taking it out of public accountability.

Thank you.

CHAIRPERSON GRAHAM: While I appreciate your comments and your views, we have made some statements as we went on about participants being able to come back.

MR. EDWARDS: Here, yes.

CHAIRPERSON GRAHAM: And we have done that. And up until right now, I have never refused an intervenor or a question to the intervenor. We've gone over time. We've been fair.

The rules and procedures say we may, and I have always allowed everyone a chance to voice their concerns regardless.

So I thank you very much for coming, sir. I thank you for your participation, both you and Mr. Duguay, and we wish you a safe trip back.

I'm going to declare it now a break for lunch, and we'll come back at 1:45.

MR. EDWARDS: One point of clarification, Mr. Chairman.

I wasn't criticizing this panel at all.

What I was criticizing was the terms of reference, not the panel.

I was criticizing the fact that the details of the design that -- upon which any realistic environmental assessment depend are not available to the panel and, therefore, not available to the intervenors.

Thank you.

CHAIRPERSON GRAHAM: Thank you.

We now will recess until 1:45.

--- Upon recessing at 12:53 p.m.

--- Upon reconvening at 1:46 p.m.

MS. MYLES: Good afternoon, everyone.

My name is Debra Myles. I'm the panel co-manager.

Welcome back to the public hearing for the Darlington new nuclear power plant project joint-review panel.

Secretariat staff are available at the back of the room if you have any questions, if you'd like to -- if you're a speaker this afternoon, please speak to Julie Bouchard. And speak with Julie if you'd like to get permission to put a question to the panel Chair for a presenter

or if you are not previously registered and would like to make a statement.

Opportunities for either questions to a presenter or a brief statement at the end of the session may be provided time permitting.

Please identify yourself each time you speak to make the transcripts as accurate as possible.

And as a courtesy to others in the room, please silence your cell phones and electronic devices.

Thank you.

CHAIRPERSON GRAHAM: Thank you very much, Debra.

And good afternoon, everyone.

We’re trying to catch up or do the last night one.

Then, Mr. Gervan, we’re going to you second, and we appreciate your -- adjusting your time for us.

The first intervention that we’re going to go to this afternoon is an intervention by Nuclear Information and Resource Service, and that’s found in PMD11-P1.189 -- 189.

And my understanding is there’s

the presenter for that.

Oh, yes, I'm sorry that's tele -- it's not on my notes, that's why.

That's a telephone conference presentation.

So are you there?

MS. D'ARRIGO: Yes, I am.

CHAIRPERSON GRAHAM: Thank you very much. You may proceed. Identify yourself, please, and start -- start with your presentation

--- PRESENTATION BY MS. D'ARRIGO:

MS. D'ARRIGO: This is Diane D'Arrigo. I'm the radioactive waste project director at Nuclear Information and Resource Service.

We are a non-profit organization in the Washington, D.C. area that tracks nuclear power waste and radiation issues.

And we are affiliated with the World Information Service on Energy, which has offices around the world.

I'd like to dedicate my opposition to the new nuclear power reactors at Darlington to the thousands of people in northeast Japan who many never see their homes and villages again, not

because of the tsunami and the earthquake, but because of the manmade radioactive contamination of their land, communities, air, plants and oceans.

MS. MYLES: Excuse me, Madame. This is Debra Myles, panel manager. We're having a little trouble with your line. There's a lot of interference on it, and we wondered if we might terminate and reconnect and see if that solves the problem? I think it terminated on its own.

One moment, please, ladies and gentlemen, and we'll try to get the presenter back.

(SHORT PAUSE/COURTE PAUSE)

CHAIRPERSON GRAHAM: I believe that's a better connection. You may start. Perhaps you should start over again and introduce yourself.

MS. D'ARRIGO: Hi, this is Diane D'Arrigo. Is it better this time?

CHAIRPERSON GRAHAM: Yes, very good.

MS. D'ARRIGO: Are you hearing me okay, because I'm getting an echo.

CHAIRPERSON GRAHAM: No, it's coming in very good. Please proceed.

MS. D'ARRIGO: Je ne parle pas

français.

Should I proceed?

CHAIRPERSON GRAHAM: You proceed. The translators are translating your -- your message, your English message to French. So just proceed as you were please.

MS. D'ARRIGO: I couldn't hear anything. Were you speaking to me?

CHAIRPERSON GRAHAM: Please proceed.

MS. D'ARRIGO: Okay. So this is working this time?

CHAIRPERSON GRAHAM: Yes, it is.

MS. D'ARRIGO: Thank you.

My name is Diane D'Arrigo. I'm the Radioactive Waste Project Director at Nuclear Information and Resource Service. I have a background in chemistry and environmental studies. Been with this organization for over 25 years tracking the nuclear power waste and radiation issues.

That is the purpose of NIRS, Nuclear Information and Resource Service. We are affiliated internationally with World Information Service on Energy, with offices around the globe.

We'd like to dedicate this statement today in opposition to the Darlington new reactors to the people of Northeast Japan who may be permanently evacuated because of manmade contamination of radioactivity from the Fukushima nuclear reactors.

The contamination of air, water, communities, oceans and land is -- we don't know yet how bad that's going to be because the accident continues. The melting may have stopped, it may not; we have no knowledge of the extent at this point, and it's still a very precarious situation there for three nuclear reactor cores, and seven irradiated fuel pools with billions of curies of radioactivity.

I want to take a moment and ask others to take a moment to imagine the radioactivity releases into Lake Ontario and into this area. It's completely possible. There are many different types of nuclear reactors and all of them have their apparent dangers and potentials of serious meltdown.

There's been a projection just today that 200,000 people within 50 miles of Fukushima could get cancer from the accident. So

with this in mind I will proceed to speak about the opposition that we have to the new reactors at Darlington.

We've been -- our organization has been intervening in the licensing of both AP1000 and EPR reactors which are the designs under consideration at Darlington.

And there are many reasons that nuclear energy is a dangerous mistake for future energy planning. We did submit a presentation by our executive director on the top ten reasons why nuclear power is the wrong choice, and we submitted a briefing paper, Nuclear Energy is Dirty Energy.

The key points apply to the Canadian reactors as well. It is dirty energy. If the toxic radiation emitted daily from every nuclear reactor and commercial nuclear facilities, were the colour and texture of oil or smelled like natural gas or came out as black soot, no one would ever again confuse nuclear power with clean.

Carbon dioxide is not the only pollutant on the planet, and radiation is a toxic, persistent and long-lasting pollutant, which is routinely released from the entire fuel chain to make nuclear electricity.

Tritium releases from nuclear reactors are routine in Canada. There is not as much tritium coming out of the US design reactors, but levels above one million picocuries per litre were measured at nine sites, covering 18 reactors in the US, exceeding safe drinking water standards at 37 sites. And this is according to the Nuclear Regulatory Commission.

Radiation levels have ranged from 20,000 to 15 million picocuries per litre. And this is without a major accident.

Nuclear accidents and security are another concern and issue. Nuclear power holds the potential for a catastrophic accident that's unique among all energy sources. Even the failure of the largest dam would be unlikely to cause the same level of permanent destruction from a nuclear -- that of a nuclear reactor meltdown.

Nuclear power is not carbon free. The entire fuel chain is reliant upon nuclear power. Nuclear power is responsible for about six times the carbon emission of wind power, and two to three times the carbon emissions of various types of solar power technologies.

The nuclear fuel chain is

necessary for nuclear reactors and very polluting, so at every step, from mining, milling, processing, enriching, producing pellets and then trying to manage the long-lasting waste thereafter, carbon is used all along the way.

Enormous amounts of water must be sacrificed and contaminated to cool and operate nuclear power reactors. And if we look at the situation in Japan, I don't know what the estimate is on how much water has been flushed through those melting reactors and those fuel pools, but there will be much more to come.

And that’s one of the problems they’re having right now, is they don’t even know where to put the contaminated water, much of it’s been released into the ocean, but there’s nowhere to put it as they must continue to flush the -- the problem cores and irradiated fuel pools with it.

No assessment has yet been conducted as to the effects on water supplies, especially drinking water supplies at major new nuclear reactor construction programs.

So those are some of the -- the major points overall, general points of concern with nuclear energy. And then specifically with

the two designs that are under consideration, the EPR. The major concern with that is the cost overruns.

The -- and the large -- the high costs in the first place. For single unit in Pennsylvania the proposed cost is 13 to $15 billion at Bell Bend. At Calvert Cliffs in Maryland, the current estimated cost is $10 billion for one unit.

In Finland, where an EPR is under construction and is four years late in its being built, and 80 percent over budget, the projection costs at this point are in the range of $8 billion. And then France, Flamanville, that EPR at Flamanville III is 20 percent over budget.

So as far as economics and the use of scarce energy dollars, putting them toward an EPR is a mistake, so much more energy efficiency and renewables could be provided with even a fraction of that amount of money, and it could well sustain the energy needs.

With the EPR -- I'm sorry, the AP1000 reactors, we recommend that consideration of the AP1000 be stopped immediately based on serious design problems. We submitted to the record the December 2010 nuclear containment failures

ramifications for the AP1000 containment design and the June 2010 PowerPoint by Fairewinds Associates for the AP1000 oversight group regarding the AP1000 chimney effect.

The chimney effect is an unreviewed safety issue. To summarize it briefly, in the event of only a small failure in the containment system of the AP1000, the radioactive gases inside the AP1000 would leak directly into the environment because the gases would be sucked out the top of the AP1000 shield building.

The shield building is a cylindrical building around the reactor with the top opened. It's mainly for shielding against gamma and neutrons and so the reactor, which is inside of this shield building, if there is any problem with a breach of containment, holes, cracks in the containment, the radioactivity could be essentially sucked out in what has been termed the chimney effect.

And Fairewinds Associates in its report provided information that showed that both the NRC and its licensees have ignored some of the specific technical problems that could lead to containment damage, significant coating

degradation, inadequacies in visual inspections of the containment.

There is a high reliance on visual inspections and it's been shown that the visual inspections have missed, in several instances, holes or cracks in the containment.

Significant inadequacies in the inspections of the joint where the containment wall meets the floor. The NRC staff released an information notice identifying unreported containment failures.

The reason I'm mentioning the containment failures is that the AP1000 exacerbates this problem by allowing the radioactivity from a loss of containment to be funnelled out.

To date, three thick containments have experienced complete through-wall failures that remained undetectable by ASME visual inspection techniques until each through-wall crack actually appeared.

The NRC staff and the United States chose to ignore five other key areas of containment failure in its presentation to its Advisory Committee on Reactor Safety on key feature modes, which were ignored by the NRC.

(Inaudible - technical difficulties) pitting on the outside associated with debris; rust associated with corrosive attack on the inside -- inside out as at Salem and now Turkey Point; through-wall cracks in thick containments due to thermal stresses like at Fitzpatrick in the Great Lakes in Hatch 1 and 2; poor coating application and threats against those who to try to apply coatings properly; and the common theme is that the ASME XI inspections missed all of them until through-wall cracking or corrosion holes actually occurred.

The reports on this and any details have been provided and links to further references to follow on that have also been provided in my original submission.

The last thing which I think is very important to me has to do with the radioactive waste that will be generated by the reactors.

There is no guaranteed permanent disposal for radioactive waste from nuclear power because it will last longer than recorded history and we have no technology or location than can hold all of it for the millennia necessary.

It seems evident that Canada is

not satisfied with its current capacity, even without a new build for radioactive waste storage, management and disposal, or it would not be planning to ship 16 radioactive steam generators to Sweden to be melted down and released into the world metal market to contaminate the supply of raw material for consumer goods worldwide.

Those of us downwind of the Western Waste Management radioactive waste incinerator that has been burning Canadian nuclear waste for years have never been consulted or notified that this activity was taking place upwind and upstream.

The issue of radioactive incineration or other pyroprocessing and heat treatment in the US is beginning to undergo scrutiny as the public becomes aware of this growing dangerous practice.

Inhalation of radionuclides, especially with dioxins which form when plastic is burned, is the worst way to be exposed to nuclear waste—that is one of the most effective ways to initiate or accelerate cancer.

Radionuclides can get in with the breath and embed in the lungs and other organs and

continue to expose the body from within.

All of this so-called low-level radioactive waste dumps, for the full range of commercial nucleaer power waste in the U.S., have leaked or are leaking and no new dumps have opened.

So this is an issue that is not -- this is an issue that is a national problem. There is no real way to isolate radioactive waste.

And even so-called low and intermediate level waste (inaudible - technical difficulties) from radioactivity the same as plutonium (inaudible - technical difficulties)and high level wastes need to be (inaudible - technical difficulties) for many ions really, some of it.

Without having a place to fully isolate this material, it’s irresponsible to create it.

So now -- and the now-closed most dangerous radioactive waste disposal sites in the U.S. directly threat the Great Lakes. It’s in Western New York at West Valley.

And it’s been estimated that this disposal site, which operated it’s buried waste from a nuclear power from -- I believe early 1960s, around ’62, ’63, until 1974 and the radioactivity

in those burial grounds will remain radioactive for thousands of years, much longer than that ground is going to be able to hold it.

It's projected that that site is going to erode into the Great Lakes and the cost to exhume and isolate just that portion of that waste site is in the range of five billion dollars.

Much debate is taken place in New York regarding the erosion potential of that site. The upshot is that there is -- even the waste that's been supposedly disposed still -- still threatens us.

I'll just see if there is anything more I wanted to say on that. I mean, there was a concern in the U.S., as well as in -- my page numbers are all mixed up here. Okay, the concern in the U.S. is to what Canada does with its waste.

And we were working to prevent our waste from getting out. We're pushing for removal of that waste, so that it does not threaten the Canadian side of the Great Lakes and we're looking for preventing new radioactive waste being generated on the Canadian side of the Great Lakes.

The waste that would be generated there, if it doesn't stay there would be shipped to

Western Waste Management Facility or to the incinerators and then after incineration would blow back across the Great Lakes again, so it's a back and forth shell game with no real way of fully isolating the waste.

Let's see, so, yes, the conclusion would be that we've got incomplete and evolving design plans, which are inadequate and expensive for nuclear reactors. That there is no way to manage and isolate the waste and that the danger of a serious accident, meltdown is quite possible and where -- we're seeing that right now before our eyes.

I could speak more on the health effects, but I know that that has been covered. I'll just put in that there is not a safe level. I know that that was discussed yesterday and I do have new additional information on -- if it would be of help that any amount of radioactivity that's added to the environment from the nuclear fuel chain is in addition to naturally occurring. And that even naturally occurring according to the National Academy of Sciences was asked yesterday.

Yes, naturally occurring radioactivity does have its health effects. There

are a certain number of cancers that are projected from the existing background and there's not really much we can do about that except in the case of radon when there are measures taken to remove that from buildings so people are not exposed.

But for, you know, that which is already out there naturally occurring and which has already been added to the environment, we can't do too much but we can practise prevention and not add additional radioactivity to the environment.

And prevention is the way to go with cancer, birth defects, ischemic heart disease and other health effects from radioactivity and that the low slow continuous doses can do more damage than one big exposure (inaudible - technical difficulties).

So with that, I will conclude and, you know, repeat that we will see (inaudible - technical difficulties).

CHAIRPERSON GRAHAM: Is that the end of your presentation, Ms. D'Arrigo?

MS. D'ARRIGO: Yes. Yes, that's it.

CHAIRPERSON GRAHAM: Thank you very much.

Then we'll go then to intervenors' questions -- or panel members' questions. And I'll go with Mr. Pereira first.

--- QUESTIONS BY THE PANEL:

MEMBER PEREIRA: Thank you, Mr. Chairman.

The intervenors raised some concerns about the management of low and intermediate level waste and in particular the environmental impacts of incineration of waste.

Could OPG comment on its practices? Does OPG continue with incineration as an option for managing some of its waste?

MR. SWEETNAM: Albert Sweetnam, for the record.

Our present facilities at the waste management site in Kincardine, there we do waste reduction activities. These include both separation/incineration and compaction.

For the incineration part of it, all of the emissions meet the regulatory requirements of Ontario.

MEMBER PEREIRA: Thank you.

The CNSC, do you have any comments on releases that arise from incineration of

radioactive waste from Canadian reactors?

MR. HOWDEN: Barclay Howden speaking.

I'll just give a quick introduction and ask Doctor Thompson to comment on the effluents from that.

From the standpoint, most of the waste goes up to the Bruce site, low and intermediate level waste, and some of it is, as Mr. Sweetnam described, handled in different ways.

In terms of incineration, Doctor Thompson can speak to that.

One thing had been raised last week that there was a mention that ion exchange resins were incinerated but they are not incinerated, but I'll let Doctor Thompson speak to the effluents.

DR. THOMPSON: Patsy Thompson, for the record.

When the OPG incinerator, it's a new incinerator, was designed, built and the process for the certificate of approval, CNSC staff were involved in reviewing the documentation produced by OPG to ensure that the incinerator would also meet CNSC requirements.

And at the time the incinerator was being designed and built, the new Canada-wide standards came into force and the new incinerator does meet the Canada-wide standards that are relevant for incinerators.

In terms of the levels of radionuclides or radioactivity in the environment on the Bruce site, the combination of the operations of reactors, the operation of Waste Management -- Western Waste Management Facility, including the incineration, result in very small releases to the environment and the doses to members of the public as a result of all these combined operations are in the level of a few microsieverts per year for all releases from the site.

MEMBER PEREIRA: Thank you.

And besides radioactive releases, how about the releases arising from burning other like plastics and so on?

DR. THOMPSON: Patsy Thompson, for the record.

I don’t have the details of the contaminants with me. But the certificate of approval from the province sets limits for these

contaminants. And all the contaminants that are listed in the Canada-wide standards are being respected.

MEMBER PEREIRA: Thank you.

I'd like to go to the intervenor now and ask for comments on where the process is in the United States and their view of the designs of some of the reactors that you spoke about? Are there any active applications under consideration and is there any progress towards construction of new reactors?

CHAIRPERSON GRAHAM: Ms. D'Arrigo?

Did you get the question from Mr. Pereira, Ms. D'Arrigo?

(SHORT PAUSE/COURTE PAUSE)

CHAIRPERSON GRAHAM: For the public's information, we are trying to connect.

MS. D'ARRIGO: To make a correction that the AP1000 was actually -- the design itself (inaudible - technical difficulties) three years ago but it is still undergoing changes. It is now in revision. I believe it's on revision 17. So the design is continually changing for the AP1000.

The EPR has not been certified.

The design itself has not been certified by the U.S. Nuclear Regulatory Commission and its certification is I believe expected in -- let's see -- it's in a couple of years. I would need to check on the exact date. It's escaping me at this moment. But it's -- it has not yet been certified, the EPR design.

And there are several -- 63 applications for EPR in the U.S. which are being challenged and there are AP1000 proposals and applications which are not -- seemed to be delayed and others are (inaudible - technical difficulties).

MEMBER PEREIRA: So just to summarize, are there any approvals for construction of new reactors in the United States, approvals from the U.S. Nuclear Regulatory Commission?

MS. D'ARRIGO: No new reactors have been approved in the United States. There are applications for -- I believe the current number is 26 but some of those have been withdrawn or are considering being withdrawn.

None have been approved at this point. We are in the licensing process.

MEMBER PEREIRA: Thank you very

much.

Thank you, Mr. Chairman.

CHAIRPERSON GRAHAM: Thank you, Mr. Pereira.

Madame Beaudet?

MEMBER BEAUDET: Thank you, Mr. Chairman.

I have a question to CNSC regarding the submission on page 5, last paragraph, about the West Valley, New York -- the West Valley site directly threatening Canada.

And I'd like to know if the CNSC or whatever Canadian department is involved in identification evaluation of activities or past activities that would cause trans-boundary threats?

MS. D'ARRIGO: Excuse me. Is this going to be a question for me because I can’t hear what's being said and I need to go on to my webcast (inaudible - technical difficulties)? I did not mean to interrupt.

MEMBER BEAUDET: No, it's addressed to the CNSC, Canadian Nuclear Safety Commission that we have here with us and I'll repeat the question. So maybe you have comments to add.

What I am asking is in reference to the West Valley burial ground in New York that you refer to on page 5, last paragraph of your written submission.

And I want to know if it's CNSC or other federal department that is involved in the identification evaluation of activities or past activities that would cause trans-boundary threats to Canada and if there's -- who does the inspection, cleanup protocols or decisions to keep the status quo?

CHAIRPERSON GRAHAM: Dr. Thompson, do we have staff to respond?

DR. THOMPSON: Patsy Thompson for the record. No, we don’t have any information on this site. I don't know if Environment Canada does. We could endeavour to find the information. There was at one time a joint Canada-U.S. program for areas of concern in the Great Lakes and I don't know if that site was captured in that program. I’m not familiar at all with that site,

MEMBER BEAUDET: Well, there could be other sites or other activities and is it CNSC who is responsible -- accountable for -- if this is such a problem and is brought up?

DR. THOMPSON: Patsy Thompson for the record. No, the CNSC is responsible for facilities in Canada.

MEMBER BEAUDET: Then who would be responsible to evaluate if somebody brings up such an issue in Canada?

DR. THOMPSON: Patsy Thompson for the record. In the past when situations like this have been identified, the CNSC is requested to provide expertise in terms of our ability to assess, but it's usually been in support to the Department of Foreign Affairs, for example, or Environment Canada.

MEMBER BEAUDET: Thank you. Thank you, Mr. Chairman.

CHAIRPERSON GRAHAM: Madam Beaudet, are you -- do you want that put in an undertaking? I mean, do you feel it's necessary to have that information or not?

MEMBER BEAUDET: Well, I think we should have some background as -- because it seems that -- the submission we have here, they seem to have groups that look into that and I was trying to find if there was anything of equivalent in Canada.

CHAIRPERSON GRAHAM: Dr. Thompson

or Mr. Howden, can -- is there some information you could obtain for the panel with regard to these questions of Madam Beaudet's, either in the technical form or in the form of just information?

MR. HOWDEN: Barclay Howden speaking. We will seek to endeavour to find that information, but I'd like to add a little supplemental. You twigged something. In terms of in Canada, in terms of sites that have been either legacy mine sites or sites potentially contaminated by radiation from the past, I just want to make you aware that when the *Nuclear Safety Control Act* came into being in 2000, the CNSC set up a program called the Contaminated Lands Evaluation and Assessment Network Program or the CLEAN Program. And that assessed all potential legacy or contaminated sites, contaminated with radioactive materials across Canada at the time, and in 2004 reported to the Commission the status of all those sites and indicated which sites needed further remediation and the regulatory process to bring them under regulatory control because one of the issues is when the new Act came in, a lot of these sites that had been exempted under the *Atomic Energy Control Act* were now needed to come under

regulatory control, and that program was put into place with all the sites being brought in.

The last two sites that are just in the process of being licenced, are the Gunner and Laredo legacy mine sites in Northern Saskatchewan. And they have submitted -- the province of Saskatchewan has submitted the licence applications for those. But all the other sites have been brought under regulatory control and have undergone remediation where necessary. So that was very much a Canadian program. To the best of our knowledge there wasn't any that would be threatening the United States, but we will find the information in terms of how the two countries worked together to make sure that sites from one side could impact the other. We'll find that information for you.

MEMBER BEAUDET: Thank you.

CHAIRPERSON GRAHAM: Thank you. I have a question to Dr. Thompson. You referred to Canada-wide standards being adopted. Those Canada-wide standards are they similar to what standards are set in the U.S. or are they stricter or more lenient. You've analyzed other standards, crossed other jurisdictions, could you address whether our

standards, first of all, do they meet the IAEA governing, but also are they stricter or not than what the intervenor's referring to in the U.S.?

DR. THOMPSON: Patsy Thompson for the record. The Canada-wide standards that would apply to incinerators are contaminants like fine and ultra fine particulates, mercury, dioxins, furans, PCBs, a lot of conventional contaminants. The Canada-wide standards are -- were revised and put in place following a process of obtaining scientific literature. There were technical working groups and if I recall correctly, the standards that Canada was putting in place at that time, which was around 2005 and 2006, were quite consistent what was being done through -- by OECD countries for example.

CHAIRPERSON GRAHAM: Thank you. A question for Mr. Howden at CNSC. With regard to the regulatory process and licencing, licence -- in this we are licencing to prepare a site, but licence to construct and licence to operate and so on, I'm quite aware of our process where licencees for class one nuclear facilities have to come back and come before the Commission for a full-scale application, generally, in most cases, every five

years with a one-year review process within the annual reports and so on.

My question is, is that similar to the United -- the American process in which do they come every five years or when there's a licence issued is it for a longer term?

MR. HOWDEN: Barclay Howden speaking. The system in the United States is very different. They issue their licences for up to 40-year periods. And --

CHAIRPERSON GRAHAM: Is that 40; did you say?

MR. HOWDEN: Yes, I did. And those can be renewed at that time. Obviously, during that period of time, the U.S. then are seized doing their full compliance program and doing disclosures of issues that may occur. I'm not exactly sure if they have a yearly or five yearly type approach, but the licence periods are much longer in the United States.

CHAIRPERSON GRAHAM: Thank you very much. We'll now go to questions from the floor. The first question -- the first I'll go to is OPG. Do you have any questions of the intervenor?

MR. SWEETNAM: Albert Sweetnam, no questions.

CHAIRPERSON GRAHAM: CNSC, do you have any questions?

MR. HOWDEN: Barclay Howden, no questions, thank you.

CHAIRPERSON GRAHAM: Government agencies, Environment Canada or others? No. Okay, thank you. Intervenors, do we have any intervenors? We have two and we'll close the record with that now. And we'll have Mr. Peter White of the Society of Professional Engineers and Associates. Mr. White?

--- QUESTIONS BY THE INTERVENORS:

MR. WHITE: Can you hear me fine? Thanks. I have a question for the intervenor. I was just wondering she mentioned the steam generators from Bruce Power that were being recycled. I was just wondering if she knew how much radioactive material we're talking about in those steam generators?

CHAIRPERSON GRAHAM: Ms. Diego?

MS. DIEGO: Yes.

CHAIRPERSON GRAHAM: Did you hear the question?

MS. DIEGO: Yes. He wanted to know how much radioactivity is in the steam generators. And I have that information, but not off the top of my head right now. I do know that a percent of that is plutonium.

CHAIRPERSON GRAHAM: I'm wondering if you could repeat that. We did have -- the transmission didn't come in very clear. Just standby for a second and I'll give you the go ahead to repeat that. Do you read me now or can you hear us now?

MS. DIEGO: I can hear you. Should I respond? Hello?

CHAIRPERSON GRAHAM: Yes, go ahead.

MS. DIEGO: I actually do not know the amount of radioactive in the --

CHAIRPERSON GRAHAM: I'm sorry, we're not getting the transmission clearly. The question cannot be answered at this time and I'm not sure -- procedure, how we do this -- or getting answers.

MR. WHITE: If it would please the panel, I can answer the question. It's my understanding that both steam generators are being

sent to Sweden to recycle the steam generators because only a very small fraction, approximately about 64 grams of the materials --

CHAIRPERSON GRAHAM: Sir, I just want to remind you that I haven't allowed questions on the steam generators because it is before the courts --

MR. WHITE: I see

CHAIRPERSON GRAHAM: -- and we are not at liberty to discuss that in any way that it may prejudice the hearings that are before the courts and it is out of our jurisdiction. So I thank you for your question, but I can't take the -- I can't do an undertaking to get you an answer because it's out of our jurisdiction.

MR. WHITE: Right.

CHAIRPERSON GRAHAM: Mr. Kalevar?

MR. WHITE: I understand that. It's just that I think it is relevant information for the panel to have, but we can submit that if you want.

CHAIRPERSON GRAHAM: Thank you. Thank you, Mr. Kalevar?

MR. KALEVAR: Thank you, Mr. Chair.

My question is -- but if I cannot communicate with her, what is the point of asking the question? I mean --

CHAIRPERSON GRAHAM: You don't communicate with her, you ask me the question. You realize that.

MR. KALEVAR: Oh, yeah, yeah, but through you to her. If you can't get through to her, I mean, it will stick -- stay with you.

CHAIRPERSON GRAHAM: Put your question, Mr. Kalevar, and we will get on with the process.

MR. KALEVAR: I see. My question is, I would like to know what is the evacuation around Fukushima right now, and what precautions are being taken in terms of evacuating or getting the population around other nuclear stations ready for evacuation? And what is the scope of evacuation they are thinking of? 10 kilometres, 20 kilometres, what is it? 30 kilometres?

CHAIRPERSON GRAHAM: Did you get that question, ma'am? If not, what we will do is we will undertake to see if that is relevant information that is accessible to the intervener or to the panel, and we will try and get you the

answer.

That's the best we can do, sir.

MR. KALEVAR: Thank you very much.

CHAIRPERSON GRAHAM: Thank you very much. We will now go to undertaking number 57. I just want to -- okay, I will.

Just I'm going to -- undertaking number 57. Madame Beaudet, do you want CNSC to get that information or get what they can?

So CNSC, are you clear with Madame Beaudet's question and with regard to the US and give us an undertaking and maybe give me a time?

MR. HOWDEN: Barclay Howden speaking. We will endeavour to get back to you on Wednesday morning, and at that time we will know whether we can deliver it then or whether we have to adjust the time because we will have to talk to DFAIT and Environment Canada.

Thank you.

CHAIRPERSON GRAHAM: Thank you. That's so noted.

One other intervener has a question, Dr. Michael Ivanco. Sir, the floor is yours.

DR. IVANCO: Yeah, it's Dr.

Michael Ivanco, I'm here from the Society of Professional Engineers and Associates.

One of the comments made by the intervener was that the lifecycle greenhouse gas emissions from nuclear power were substantially higher than they are from alternatives such as wind or solar power. Most studies I'm aware of show the exact opposite.

So the question was, what source -- what was the source of the information for that statement?

CHAIRPERSON GRAHAM: What we will do is we will give that an undertaking, the same as Mr. Kalevar's, to see if we can get that information from the intervener and get back and address that tomorrow morning to the meeting. So I will give that undertaking number 58 for both those questions and see if we can get a response back from the intervener for both Mr. Kalevar's question and Mr. Ivanco's question.

So that's number 58.

CHAIRPERSON GRAHAM: Now, am I understanding that that is all that we have, the questions from the intervener? So there's nobody else for interveners? No.

Thank you very much. If you can hear us on the web, thank you very much for your presentation.

And we will now proceed to the next item on the agenda, which is Mr. Gervan, who has a ten-minute oral presentation I believe.

Mr. Gervan, the floor is yours.

--- PRESENTATION BY MR. GERVAN:

MR. GERVAN: Thank you very much, Mr. Chairman, and I welcome the opportunity to make my views known on this issue. Thanks to the panel, and I must also say thank you to the many interveners who have made their time and skills available to us for this intervention.

I must say that arriving today I was somewhat surprised by the scale and complexity of these hearings and also I must say somewhat sobered by the cost to the public as I look around at all of these experts and PHDs and so on.

And all -- I must say that I feel it is to no avail, and that as I will demonstrate to you, I feel that the chances of the Darlington expansion proceeding are really very, very slim in light of the environmental and geo-political situation from Japan, but more importantly from

strictly economic considerations.

It would be foolish in the extreme to proceed with nuclear expansion when the economics every day seem to indicate that nuclear is getting more and more prohibitively expensive, prohibitive to regulate and to safely secure, whereas the alternatives with -- are becoming much more affordable and more amenable to our needs, our direct needs.

Before I proceed I would like to -- I took the opportunity this morning to ask a question of OPG regarding the -- whether or not there was manmade -- there was mandatory drug testing for operators and critical staff at our existing nuclear facilities, and I must say I was very surprised and alarmed that this is not the case.

I’m not personally a big fan of mandatory drug testing, but it makes me nervous to think that how would we explain to our children that someone at Pickering or Darlington or Bruce or wherever on staff, and I would say that the odds, if we’re talking about statistical odds, there is a very high potential risk of someone in those control rooms right this very minute being high on

drugs, alcohol or being mentally sort of unstable. This seems in itself to be a cause of major concern.

However, I will proceed with my brief comments here.

As an intervener in these hearings, I feel obliged to register the following procedural objections. I know some of these have been raised before and by others, but I feel I would like to first of all note that in view of the ever worsening situation at the Fukushima nuclear reactors, it would seem the height of hubris to proceed with the planning for new nuclear here in Ontario.

We do not yet know the full repercussions of this tragedy. How can we know how we will feel about the nuclear risk until the plutonium dust has settled in Japan?

My second objection is, is it possible to critique the Darlington expansion without knowing which reactors are proposed? The Canadian nuclear industry has boasted of the superior safety of the CANDU heavy water design. Does the Ontario government then contemplate substituting a less safe, light water alternative

in the not unlikely event of the demise of AECL and its CANDU technology?

Thirdly, I draw your attention to yesterday's *Toronto Star* report called "The power paradox why we have plenty."

It seems Ontario's electrical demand in the past five years has declined about 10 percent, rather than the 5 percent growth predicted by OPA. In fact, we find ourselves with a safety margin of nearly 33 percent. We do not urgently need to commit 30 billion dollars to nuclear expansion that may prove to be both undesirable and unnecessary.

We have lots of options for replacing our aging nuclear fleet. We have large surpluses of water power available to us from Ontario -- from Hydro Quebec, from Manitoba Hydro and from the new facility proposed in Labrador.

We have lots of cheap natural gas for efficient and cheap combined heat and power. Wind is now cheaper and faster to implement than new nuclear. There is no need to rush to nuclear. Why then do we proceed with these investigations?

Fourthly, the very limited scope of this panel's investigation does not do justice

to the complexity of the nuclear dilemma, nor the enormous environmental, social, and economic consequences. This process needs to be replaced with a comprehensive and independent examination of Ontario and, in fact, Canada's nuclear future. Something in the line of the Royal Commission that was proposed by Dr. Edwards this morning seems to me would clear a lot of this up.

And, lastly, I'm old enough to remember the extensive deliberations, I believe it was three years, of the Porter Commission into Ontario's nuclear future circa 1978. The commission concluded, amongst other things, that Ontario should not contemplate further expansion between –- beyond the four original reactors at Darlington until such time as safe and secure method had been demonstrated for the storage of spent fuel.

This has not been done. We are no closer to a solution than we were 30 years from now –- 30 years ago. Therefore, this process and Ontario's reckless nuclear expansion must be suspended.

As to the detailed technical criticism of the proposed nuclear expansion, I

won't further burden the panel with information and arguments that have been well and thoroughly dealt with in this morning's submission by the Sierra Club.

So these are my procedural –- procedural objections. Please allow me to say a bit about where I'm coming from and give you a taste of an alternative future energy scenario which will better serve the interests of the people of Ontario and future generations.

As I said, I'm a retired engineer and business person from rural eastern Ontario. In fact, I live on the back street in the rear of Leeds and Thousands Islands Township a mile north of Seeley's Bay. The reason for this geographical orientation is the following:

I live a long way east of here. Electricity from Darlington suffers significant line losses and requires extensive transmission infrastructure to arrive at my drive. We sometimes feel like we're at the end of the line. In fact, even my cellphone only gets one bar on a good day.

Of late, however, there has been an energy shift on the back street. As a direct result of the *Ontario Green Energy Act,* we are

producing electricity for the grid where it is needed and producing no pollution.

We’re doing it with our own money, with no government financing or loan guarantees, with no waste storage problems and decommissioning conundrums, and rather than promising to produce electricity in perhaps ten years, as a nuclear plant might. And for an indeterminate cost, me and my neighbours are producing clean, green electricity at contracted cost, and we’re producing it right now.

My dairy farm neighbour Ben Green has a 500 kilowatt biodigester unit in operation. My wife and I have installed a 10 kilowatt solar photovoltaic array. In fact, today, in a reasonably mixed sunny and cloudy environment, we’re producing somewhere in the neighbourhood of 60 kilowatt hours, which is not a lot in the grand scheme of things, but it’s enough for my family and for three or four of my neighbours.

My electrician neighbour Brent Bolten has a five kilowatt photovoltaic array, as well as a small wind turbine. In fact, Brent, inspired by his success, has started up a small solar installation business.

Speaking of business, Quantum Solar Enterprises out of Kingston this past summer had two crews of bright, young, enthusiastic, clean energy warriors building my solar installation. The *Green Energy Act* has provided a welcome stimulus to our rural eastern Ontario economy and a refreshing sense of renewal and self-reliance.

There is an alternative vision to the mindless centralized power grid expansion that Darlington exemplifies. A more secure and reliable decentralized Smart Grid of sustainable, renewable, and efficient energy systems is necessary, it's possible, in fact, it's already beginning to happen in my area.

At this time, I would quote briefly from a comment made by Dr. David Suzuki, our esteemed environmental sage, just this past week. He said that, If the money proposed to refurbish aging facilities and build new ones were put toward renewable energy from wind, solar, and geothermal, the impact would be immediate; it would get us moving towards a truly sustainable energy future.

Nuclear energy's time has passed. I know it might surprise some of you folks in the

industry who look to the industry for your livelihood, but I thoroughly believe that that is the case. Nuclear energy's time has passed. Unfortunately, we are leaving a shameful legacy of nuclear waste and financial indebtedness. Our children and grandchildren will curse us for it.

CHAIRPERSON GRAHAM: Thank you very much, Mr. Gervan, for your oral presentation. I just want to comment just briefly with regard –- you had some questions or –- or comments. Drug testing, that's a constitutional issue. Ruling on proceed –- whether we should proceed or not was done on the first day.

Types of reactors, whether we should go through that and –- when we don't even know the type of reactor, this panel had asked information requests in excess of 300 information requests went in on various issues, including design type and so on.

And we –- we have –- the options of whether nuclear power is needed and so on has been –- there's been many, many questions asked on that in the last few days, but we still appreciate everyone's intervention, everyone's presentations, and I thank you very much for yours today, and it

will be –- it’s all part of the record, it’s all part of before we make a decision. There’s been no decision made yet, and it will be some time yet, and thank you very much for your presentation.

(SHORT PAUSE)

CHAIRPERSON GRAHAM: I’ll call on Madame –- or on Madame Myles to make a couple of comments. There’s some information with regard to the –- with regard to the website and what we’re doing.

MS. MYLES: Thank you, Mr. Graham. Debra Myles. The website –- the webcast had been down, but I’ve just been informed by our technicians that it is back –- back up and proceeding.

I also wanted to let everyone know that the last presenter, Ms. D’Arrigo, did hear the questions that were put to her, and she –- we will either contact her again by phone tomorrow or she will send the answers to those questions for the panel’s consideration.

The –- apparently the problems were with the phone lines that have been coming in, so future presenters shouldn’t hesitate to use the dial-in system. Hopefully we won’t have these

problems again. Thank you, Mr. Graham.

CHAIRPERSON GRAHAM: Thank you very much, Ms. Myles. Perhaps if we could get more or less a short written answer responses under my Undertaking 58, and we'll read those into the record tomorrow and that –- we'll do it that way just in case we get into another technical problem. It might be more –- it might be easier for Ms. D'Arrigo to do that.

We'll now proceed to the next item on the agenda, which is the United Church of Canada as indicated in their submission PMD 11-P1.67. I don't have a name somewhere, but anyway, welcome and identify yourself.

REV. OBEDKOFF: It's Vicki Obedkoff.

CHAIRPERSON GRAHAM: I'm sorry.

REV. OBEDKOFF: Hi. My name is Vicki Obedkoff.

CHAIRPERSON GRAHAM: Welcome, and please proceed.

--- PRESENTATION BY REVEREND OBEDKOFF:

REV. OBEDKOFF: Thank you. The United Church of Canada has been deeply involved with nuclear issues for 30 years. We made a

substantial submission in 2004 to the National Waste Management Organization, and we –- I know you've read our submission already. At the back, we have 12 ethical principles. I'd like to direct their attention to two of them, and I'll repeat them.

"Human societies must bear a responsibility toward the earth in its wholeness."

And, secondly, "The rights of future generations must be protected."

And so the right to protect the very seed of our bodies that create the new generations and life itself must be protected is a primary moral obligation.

And along with that, we also bear responsibility for the fate of the earth.

In 2008, we released a resource called Always Changing, Forever Yours: Nuclear Fuel Waste.

And essentially we have come to the conclusion that nuclear waste cannot be safely contained nor guaranteed indefinitely.

We have been expressing concerns for over 30 years about the entire nuclear fuel cycle.

I would like to summarize then our position which is, we have been calling for a Royal Commission, a national public inquiry, on the whole nuclear fuel cycle, from uranium mining, through milling, through new builds, through refurbishings, through the use of depleted uranium, et cetera.

Our calls so far have not been met, but we are very pleased to see a renewed call from a number of organizations.

You've heard that today from Dr. Edwards and Duguay about the call for a Royal Commission.

And as some of you have already pointed out, that would expand the conversation we're having. It would allow for all kinds of testimonies and really letting the public be deeply involved in the full spectrum of this discussion.

In the meantime, until we have the Royal Commission, we ask for a moratorium on any new builds, on any refurbishings, on any uranium mining, in fact, on the whole nuclear fuel cycle.

We've been calling for this for over ten years.

You've already heard much expert testimony around some of our concerns, but I'd like

to highlight several.

As you know, the United States have given up on Yucca Mountain. They've spent lots of money and lots of time. They have not found a solution to permanently guarantee the safe disposal of radioactive nuclear waste.

Michel Duguay referred this morning to the sarcophagus and Chernobyl. That sarcophagus, as you know, a whole lot of cement that got dumped over, is cracking. It's disintegrating, and more radioactive materials are coming out of it to add to the load already there.

I know Dr. Thompson referred to a study put out, I believe, in 2005 by the International Atomic Energy Agency. And that study said somewhere in -- I think your figure was 37. I have 55. It doesn't really matter. The study said somewhere under 60 workers were killed, that's all.

But, in fact, that very agency, the International Atomic Energy Agency, signed a commitment back in the 1950s not to receive data from the World Health Organization -- or, rather, to veto anything that the World Health Organization might have to say about the health hazards of low-level radiation.

I can give you my sources. I'm happy to do that.

So we've had to rely, because there's been, if you like, a blackout of data collected by the United Nations -- finally the reports are coming out from the Russian scientists and the Russian doctors. The books are now being published. The studies have been done.

One anecdote, my background is Russian. When Chernobyl happened, my relatives brought some of the children with thyroid cancer out to our home area in British Columbia to give them a rest, perhaps to give them the strength to fight for their remaining life, perhaps just to taste that there is a bit of life possible.

And I'll read you now some of the statistics from the Russian scientists and doctors now that they're available.

I'm not comparing our situations, but I'm saying that we need to broaden the scope of the expert data that we recognize.

We now know that between conservatively 5,000 to 10,000 liquidators have died prematurely of cancers.

And the medical studies are in.

In Belarus near Chernobyl between 1986 and 2001, 8,358 cases of thyroid cancer occurred, 716 in children, 342 in adolescents, 7,300 in adults.

Now, childhood thyroid cancer is extremely rare, so to have this high incidents in a relative geographic area is a deep cause of concern.

But it’s not over. The effects of that accident is not over because 50 percent of the fallout went across Northern Europe.

The Swedish studies are now coming in. You may have heard about this in previous submissions.

The children have been damaged. There is no doubt about it.

I mention this to say that the double jeopardy, if you like, of the original accident site continuing -- or not being able to adequately contain contamination into generations plus the effect of the fallout is a continuing disaster.

We don’t know yet what’s going to come out of Fukushima.

But when I heard there was plutonium in reactor 3 -- and, as we all know,

plutonium -- every time they're releasing the steam -- they're trying to, you know, cool the -- cool the reactor core, but every time the steam comes out, there's more plutonium.

Our contacts in Japan through United Church of Canada personnel are just despairing. They're not even using the word "plutonium" with the public.

We simply can't guarantee there won't be an accident.

We heard this morning -- I was very impressed by Mr. Bertrand's submission, as we all are.

We simply can't predict there will never be an accident despite our best precautions.

For example, we're told we don't live in an earthquake zone, that's fine, but neither did Arkansas think it lived in an earthquake zone until they started fracking.

Fracking, as you know, uses copious amounts of fresh water to get natural gas deep down.

Suddenly they're getting very deep tremors that are causing concern to the Geological Society.

We don’t know in the years to come what new kinds of intensive mining, what new kinds of rush to exploit resources in the earth is going to do.

We heard about software issues.

We simply are not God, and on -- with the repercussions being so grave and continuing for so many generations, we simply can’t risk one more accident because it adds to all the radiologic -- radiogenic load already released.

We could go on with some statistics.

You may have heard in other submissions that in 1997, the US National Cancer Institute estimated that as many as 212,000 Americans had developed or would develop thyroid cancer from the radioactive iodine released from the ‘50s and ‘60s above-ground nuclear tests.

That’s just one example of nuclear load where the studies have now been done. The list goes on.

I was really alarmed personally to hear somebody from the nuclear industry in the early days of the Fukushima accident saying, well, no one’s died yet.

And that goes back to an invalid way now of assessing risk.

As we know, we can't assess internal risk of radiation that we ingest, from a little bit on my fish and chips that could have landed on my lunch this afternoon. Once I take that into my system, it has a very different latent effect than if a nuclear bomb dropped or I got a sudden external dose or even a small dose from an x-ray.

And, yes, perhaps there were no immediate deaths from what happened in Fukushima, but the latent effects -- the latent effects of the most tiny bits of radiogenic materials take from 5 to 20 years to develop, unless, of course, it's something like radioactive iodine 137. It comes up sooner.

But most things take from five to 20 years to develop. Studies have now been done in Germany. They've had the best studies which show that children living within 15 or 20 kilometres of a well-functioning nuclear plant have much higher incidences of leukemia. Those studies have been peer-reviewed, they've been broadly supported and the evidence is considered conclusive.

I could say many things, but I'll say one thing. I've been working as a minister for 30 years. I've conducted a lot of funerals. I've visited a lot of sick people. There's an epidemic of cancers right now. I've been looking for the pieces of the puzzle, and you have to wonder when you start hearing some of the stories of the people involved. But I do know that growing up five hours of the nuclear installation at Hanford, we were affected in ways that we weren't told about.

To be fair, people didn't know the effects at that time, but now we know. And once we know that there is no safe level of iodizing radiation, once we know this we have a moral responsibility not to continue the tragedy. So that is why we support the call for a Royal Commission to broaden the kind of expert testimony, witness to broaden the range of studies that have been done, to get away from the vested interests of the International Atomic Energy Agency and its mandate to promote nuclear energy.

Even if done innocently, the time is past. The time is past for nuclear power. There is a new world being born. We already know that wind and sun and geothermal can meet most of

our needs. It may not be immediate. I know there's concerns about base-load to industry, but the new things are coming online faster than we could have ever hoped for. They're less expensive, and I think instead of spending 38 billion, whatever it's going to be, 33 to 36 billion on the old way of doing things, the big centralized nuclear plants, it's possible to meet our needs. Not our short-term greed and not needs that are inflated, but the needs we need to carry on as a society without doing damage to the very seed that is present in our children and grandchildren. And it's the most precious thing that we've been entrusted with.

I have 30 minutes, but I would like to be open for some questions. We took note also of the fact that the Canadian Nuclear Safety Commission also had some concerns about the safety of CANDU reactors. That is part of our call for a moratorium. In fact, we have extended the call for a moratorium on sales of CANDU reactors.

One of our ethical principles is that God or the Devine or however we name that of ultimate concern, asks us to love our global neighbours, to treat our global citizens as

neighbours. And why would we unload technology that we have justified concerns about on peoples perhaps somewhere far away. In fact, we might be unloading them on us, because it's still a mystery what kind of technology will be used at Darlington, and so it's really hard to know that.

I could go on about the lists of dead people in my high school reunion. I come from an area of British Columbia. Of course it has a high natural radon background, but there is no doubt that the extra load from follow-out and from the plutonium dust that came from all the radioactive materials lying around in the General Electric sites has added to that load.

I'll tell you a hopeful story. The doctors were so concerned about the cancer clusters they were seeing in my home area that Bob Willard, who just retired as the head of family practice medicine at UBC was involved with a team of physicians and commissioned a study of the whole nuclear fuel cycle, not only just in my area, but the whole cycle. The study was adopted by the BC Medical Commission. It's still online, and it played a major role in the BC government, over 30 years ago now, 1980, putting a moratorium that's

turned out to be permanent on uranium mining, never mind nuclear reactors.

It was a happy timing of events. There was public pressure to have a Royal Commission. The BC Medical Association Report came at the right time. And then politics played a role. It turned out that the premier -- there was high incidents of breast cancer in the premier's family, and these are the human factors that intervene. Even a rather right-wing provincial government a few years ago, under a great deal of pressure to make a lot of money from opening up uranium mining, said no. Turned out that Barry Penner, the Environment Minister was from the old days, one of Bob Willard's colleagues, and he knew that this stuff is poison. So our BC government back home has resisted the call to make a lot of money, and has protected public health.

You've heard the testimony from Lorraine Rekmans, I believe, from Serpent River, and the people from Blind River. These were some of the people in Ontario who have suffered health consequences from the old mines at Elliot from the contamination at Serpent River. So I won't burden you with more. You've already heard that

testimony, but it's -- it's quite frightening.

I'd like to draw attention, again, to the hopeful stories coming forward. I enjoyed learning about the smart grid. Why would we want to build the old style of centralized electricity production. As someone once said, "It's a hell of a way to boil water," and a hell of an expensive way to boil water, but it's also very expensive to build long lines that sometimes break down under ice storms. We can start to be generating the power we need in a decentralized way, and a way that won't contaminate sperm, ovum, the very transmission of life through the generations. And I would argue our most sacred trust.

I'm going to pause and see if you have some questions so we can dialogue for a bit.

CHAIRPERSON GRAHAM: Thank you very much, Reverend Obedkoff, for your presentation. And I think Lorraine Rekmans did not appear.

REV. OBEDKOFF: Oh.

CHAIRPERSON GRAHAM: She did not appear yet. She was scheduled, but didn't show up. So I just pass that along for information. The process goes now that I go to panel members for

questions. Madam Beaudet.

--- QUESTIONS BY THE PANEL:

MEMBER BEAUDET: Thank you, Mr. Chairman. I'd like to refer to your written submission on page 3, the first paragraph where you say the United Church has asked for a review of existing regulations to correct lack of ethical consideration for non-human life. And I don't know if that has to do with mining of uranium, but maybe a philosophical point, but I'd like to understand a bit more what you mean here.

REV. OBEDKOFF: Thank you for the question. I'm not sure I'll have the complete answer. I didn't write the policy, and so I may not have the answer in depth at this point, but I could -- you know, we could do an undertaking to -- to find that out.

But I think the second sentence is the context. There is no regulation specifically to control exposure of non-human life to ionizing radiation. So there's been protocol set, we can argue with the protocols that are set to determine what's a permissible dose for humans. I mean, the Bear Committee in the United States has now said there is no safe dose, and even the ICRP has

acknowledged there is no safe dose. Permissible dose for humans, as you know, is only permitted by law, it doesn't mean it's safe, but there's been no consideration of what the burden, the radiogenic burden would be for the non-human chain of animals, plant life, that I'm aware of, anyway. I'm not aware of the regulations.

Are there some? This is something I don't quite -- I'm not aware of myself. Perhaps you might know on the CN -- Canadian Nuclear Safety Commission.

CHAIRPERSON GRAHAM: I think where the questions go from here, so I'll go to Madam Beaudet.

REV. OBEDKOFF: Okay.

MEMBER BEAUDET: No, I wanted to have a definition what you consider here non-human, but then because --

REV. OBEDKOFF: Yeah.

MEMBER BEAUDET: -- for the First Nation group, everybody -- everything has a life, so I wasn't sure if it was more a philosophical question then not?

REV. OBEDKOFF: Thank you. I respect the First Nation's viewpoint. I think for

sure we could say plants and animal forms and there may be other -- but, yes, everything does have a life.

MEMBER BEAUDET: Thank you. My other point was you refer to different -- this is the page before last, different figures coming from Ontario Power Authority in terms of, for instance, you can reduce your electricity usage at a cost of under four cents or nuclear power in Ontario works out to 21 cents per kilowatt hour. I would like to know what is -- what are the documents or the source of this information?

REV. OBEDKOFF: Sure, let me turn to that.

MEMBER BEAUDET: Not media articles. Do you have -- Ontario Power Authority, do you have a specific document, a report or the mixed plan they have? I would like to have more precisions on that, please?

REV. OBEDKOFF: Sure. Sure, and I want to be clear, those paragraphs are my personal comments.

In the policy -- the policy of the United Church of Canada is the text written in italics. And the text written in the bolder font

that's highlighted are my own comments and so I've been taking my information largely from the environmental community, but somewhat from the business pages of the Toronto Star.

And, you know, there's things published like this every day and the rates change. The percentage of whatever, the -- I guess what I'm saying is the overall point is that it's cheaper right now to buy electricity from some sources than what's being proposed from nuclear.

That seems to be more consistent over the last five years as the new technologies are coming on-stream. I can hardly keep up with it myself, it's changing so fast, so the things that got added is my personal comments was being gleaned from probably 20 articles on the web, in the Environmental Movement, in the media at the time, but, no, I haven't reviewed the official Ontario documents.

MEMBER BEAUDET: I would like to turn to OPG and ask, what is the cost per kilowatt hour for production of nuclear?

MR. SWEETNAM: Albert Sweetnam for the record. As previously said by the Deputy -- sorry, by the Assistant Deputy Minister when he

appeared here, for Ontario Power Generation is about five and half cents per kilowatt hour for nuclear.

And for our colleagues at Bruce, it's a little higher. I forgot exactly the number he quoted. I think it was six and half cents per kilowatt hour, but that's on the transit of the day that the Assistant Deputy Minister appeared.

MEMBER BEAUDET: That figure, would be the LUEC? I mean, as you explained yesterday, it covers all the cost?

MR. SWEETNAM: Yes.

MEMBER BEAUDET: LUEC?

MR. SWEETNAM: Yeah.

MEMBER BEAUDET: I don't know how you pronounce it in English?

MR. SWEETNAM: Yeah, Albert Sweetnam for the record. That would be the LUEC, the levelized unit cost of electricity rate.

MEMBER BEAUDET: Thank you. Thank you, Mr. Chairman.

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

MEMBER PEREIRA: Thank you, Mr. Chairman. I have got a question for CNSC staff.

The intervenor comments on the impact of chronic low doses of radiation and also asserts that the ICRP calculation of acceptable doses based on external doses. And the conclusions drawn there cannot be considered to be applicable to eternal doses, so could you comment on those two points?

DR. THOMPSON: Patsy Thompson for the record. The ICRP recommendations are based on both internal and external dose exposures. The risk factors take that into consideration. The risk factor takes into consideration both cancer and hereditary effects. Even though hereditary effects have not been observed in humans, the risk factor is based on the studies on the animal populations.

MEMBER PEREIRA: And the second point is the health impacts of chronic low-doses?

DR. THOMPSON: Patsy Thompson for the record. The -- all the epidemiological evidence, and that is based on both exposures from external sources of radiation, but also internal sources of radiation, indicate that there is an increased risk of cancer at moderate to high doses of radiation and that relationship is linear.

None of those studies have shown

increases in the risk of cancer at doses below about 100 millisievert, but for regulatory purposes to be precautionary, the CNSC uses the linear no-threshold relationship that assumes that a risk exists down to a zero dose.

CHAIRPERSON GRAHAM: Thank you. Now, we'll go to questions from the floor with regard to participants. And the first one is to OPG. Do you have any questions?

MR. SWEETNAM: Albert Sweetnam for the record. I don't have a question, Mr. Chair, but I would request your indulgence to make a comment. The reason for that is that the intervenor has said that the CANDU technology is unsafe, and given the fact that OPG presently owns 20 nuclear reactors of the CANDU technology and operates ten of them, I think it would be appropriate for us to go on the record with regards to the safety of these reactors, if you would allow?

So can I ask Dr. Jack Vecchiarelli to address the safety of CANDU reactors?

DR. VECCHIARELLI: Jack Vecchiarelli for the record. I would like to shed on some light on the aspects of CANDU safety and I

would also like to follow that up with a little bit more of a personal perspective on nuclear safety in general.

With respect to CANDU safety, there are many issues, which we have ongoing work on to investigate in more detail. There are with the CNSC what are called generic action items.

These are issues, which the CNSC puts forward as not necessarily suggesting that the safety of the reactors are in question, but they would like more evidence to support -- to confirm that position and so there's lots of money that is spent internally within OPG and with our counterparts within the CANDU industry through R&D to look into these issues, interfacing with the CNSC staff in meetings to follow up on viability of these issues, whether they need to be resolved with some sort of design changes in some cases. That is what is an outcome.

And other cases it's to improve analysis methodologies. So and there also what are known as various categories of CANDU safety issues. Again, this is something raised by the CNSC. They tend to relate to some generic action items, but they are also some other related issues.

And, again, they're not calling into question the safety case, but they're particular aspects, which require further confirmation and we work closely within the industry and with the CNSC to confirm that the margins are acceptable. And that their continued safe operation is assured. Margins are the key.

REV. OBEDKOFF: Is that a --

CHAIRPERSON GRAHAM: Yes, I'll have you now --

REV. OBEDKOFF: I respect your comments. I would like to say we had a lot of expert testimony that went into the making of our policy and it's not lightly that we called for a moratorium on CANDU sales.

When I hear acceptable, that doesn't mean totally safe. I think you've just used word within the -- that whatever the design fault are within an acceptable range.

Can you address the fact --

DR. VECCHIARELLI: Sorry, may I continue? May I continue?

REV. OBEDKOFF: Oh, could I --

CHAIRPERSON GRAHAM: Madam Reverend, yes.

REV. OBEDKOFF: I would just like to finish as well --

CHAIRPERSON GRAHAM: No, the floor -- he was presenting and when he's done, I will let you --

REV. OBEDKOFF: How long -- sure, I just don't want to use all my time on this interaction. I still have a question here too.

DR. VECCHIARELLI: A couple of minutes.

CHAIRPERSON GRAHAM: You will be given the appropriate time. Would you continue OPG?

DR. VECCHIARELLI: So Jack Vecchiarelli for the record. There are limits, there are lower limits, which are sufficient, but not necessary conditions that we aim to meet and we meet those with margins. And this is demonstrated daily through our operations and through ongoing safety analysis activities.

What I would like to -- since the time is limited, there have been a number of passionate statements made from a number of intervenors about the risks of accidents, et cetera. I'd like to say that we are equally

passionate within OPG and within the nuclear industry, about safety.

As Dr. Newland mentioned on day one, accidents can happen and they do happen. That is a reality. But we take it very seriously. Anybody that's ever worked with me will appreciate that I scrutinize everything to the nth degree. I know -- I wish you could witness some of the heated discussions we have within the industry and with our counterparts in the regulator over matters which would seem to be incredibly esoteric, but we drill down; we challenge everything; we foster what's known as a questioning attitude. This is part of a very healthy, safety culture and this is alive and well within the nuclear industry. We have children as well. We care. We want to ensure the safety of reactors and we go to great lengths to see to that.

I just want to add one other point that the -- the requirements -- the safety requirements for the new designs are even more stringent than the current designs and so I think that is something that also has to be taken into consideration when you consider events such as Fukushima.

CHAIRPERSON GRAHAM: Thank you, OPG. Now, I'll refer to you, Reverend.

REV.OBEDKOFF: Thank you. I don't doubt your passion and commitment and professionalism at all -- not at all. None of us know for sure, because we are talking about something so grave and so serious that just one accident, one unpredictable thing unleashes hell. And it's simply beyond any of us, if you like, to say, play God with this because we just don't know.

I have met some folks who work in the nuclear industry in Vermont. In fact, I met the operator of a nuclear plant near Putney, Vermont. And this was all off the record and it's so close to human error sometimes, it's --

CHAIRPERSON GRAHAM: Reverend Obedkoff --

REV. OBEDKOFF: Oh, I'm sorry.

CHAIRPERSON GRAHAM: Would you talk to the chair and --

REV. OBEDKOFF: I understand.

CHAIRPERSON GRAHAM: -- direct to the chair in this procedure.

REV. OBEDKOFF: I understand.

CHAIRPERSON GRAHAM: As a --

someone that is used to speaking to the public, I would appreciate if you would do the same.

REV. OBEDKOFF: Thank you. Thank you. I did want to respond to the -- and this is not to imply that you're not doing your job passionately as well, but I do know that for years the ICRP based its whole risk assessment on the effects of the external radiation that came from the A-bombs dropped on Japan. And that was status quo for a long time.

And to be fair, it wasn't a plot, it's simply that the studies weren't done and the experts in the more biological effects of radiogenic health, hadn't weighed in yet or weren't allowed to weigh in yet. And so it took a while to catch up to the reality that internally digested radiogenics behave in a different way. They're latent rather than just the immediate risks from external doses.

And it was with some resistance that the ICRP finally acknowledged that there is no safe dose. They came to this conclusion long after other, for example, the National Academy of Scientists, that their people in the United States did.

So our call for a Royal Commission is to be open to other studies, other groups and to widen expert testimonies from parts of the world that perhaps we haven't heard of, and to go beyond the debates that are more closely controlled by the nuclear -- let's just put it this way, by those who advocate nuclear energy.

CHAIRPERSON GRAHAM: Thank you for addressing the chair. I am sitting up here and I appreciate your comments. OPG, do you have any comments? OPG, I'm sorry, CNSC -- OPG is finished. CNSC?

DR. THOMPSON: Patsy Thompson. If I could I don't have a question, but I would have a couple of comments. There's been, in this interventions and other interventions, statements about a secret agreement between the WHO, the World Health Organization and the International Atomic Energy Agency to keep data from health studies secret. Actually, there's a working agreement which is WHA12.40 which was signed between the WHO and IAEA in 1959, and that agreement is for mutual collaboration and exchange of information.

What I would add is that the basic safety standard which is the IAEA radiation safety

standards, are being -- have been updated and they are being finalized and that basic safety standard is being endorsed by the WHO, the United Nations Environmental Program, UNEP, as well as the International Labour Organizations. All of these organizations have had representatives working with the IAEA and the radiation safety standards committee to review and revise the basic safety standards. So there's a lot of involvement; there's no secrecy.

The other point I would like to make is the statement about there are no standards to protect non-human life. What I would like to say is that this was a traditional position of the International Commission on Radiation Protection. The Atomic Energy Control Board, the predecessor of this CNSC, actually started their own ecological risk assessments for radiation in the mid-nineties. We were the first regulators to do it internationally. And others have developed standards and approaches and the Darlington new build EIS has sections where we have made sure that the impacts on non-human species are taken into consideration and the risks have been found to be very low.

CHAIRPERSON GRAHAM: Thank you very much. We'll now go to interventions or questions to the intervenor from the floor and I have three. One of them is a non-registered participant, but in the lenience that I'm trying to show to everyone to give them a chance, I'll also allow that one, which makes three. The first one is Doris who is with the Registered Nurses Association. Ms. Grimson?

--- QUESTIONS BY THE INTERVENORS:

MS. GRIMSON: Thank you very much. Doris Grimson for the record. We heard from Dr. Thompson that current radioactive emissions from nuclear reactors made the ICRP guidelines and if I understood correctly, I also heard that there is no correlation -- linear correlation between the levels of a chronic radioactive emission and cancer in humans.

I want to be assured here, on behalf of the nurses of this province, that we can look at every child's health and say that there is no link -- and by that I mean, no link, between chronic low levels radioactive emissions from nuclear reactors and cancer in children.

CHAIRPERSON GRAHAM: Dr. Thompson.

DR. THOMPSON: Patsy Thompson for the record. The information that is available from decades of epidemiological studies do show a linear relationship between radiation exposure and cancer incidence. That relationship and the undertaking that we submitted yesterday, has at the end of it, a representation of the data and the linear relationship as well as other models. So there is a linear relationship at doses between 200 and higher in terms of millisieverts. To be safe and to regulate safely, the CNSC considers -- and other regulators consider, that that relationship extends down to zero essentially. So we go a linear from zero to high doses and we extrapolate the rest down to zero. That is the model used for regulatory purposes.

The public dose limit that the CNSC uses is one millisievert per year. It is a small -- it is within the variability of natural background and the doses around nuclear reactors in Canada are a few micosieverts, so a few tens of thousands of the public dose limit. The public dose limit is a thousand microsieverts; the doses are less than ten microsieverts usually, every nuclear facility -- nuclear power plants. And so

at those levels people having different lifestyles and living in different parts of the country will have more variability in their doses than people -- than the added microseiverts from living near a nuclear facility, and this would not add to the risk that people have of developing cancer because they live around nuclear facilities.

CHAIRPERSON GRAHAM: Thank you very much. The next questioner is, as I said -- was a non-registered participant, but I'm going to permit a question, and it’s from Cheryl [sic] Farlinger -- Farlinger.

MS. FARLINGER: Thank you very much for your consideration. It’s Shirley Farlinger.

For 30 years, the United Church of Canada has opposed nuclear weapons and yet these have continued to spread to many more countries. This is not a coincidence. One feeds on the other. The nuclear industry promotes things that will make it some money; irradiated food, fluoride in water and, particularly, money they can make from supplying the material for depleted uranium-coated weapons that was brought up -- but perhaps I should explain what that is.

The use of these weapons in the battlefield produces radioactive ceramic-like pellets that can be breathed into the lung and then irradiate the body for the rest of the person's life. This is going on right now in Iraq and Afghanistan. So nothing concerning nuclear power can possibly be outside your mandate. Thank you.

CHAIRPERSON GRAHAM: Thank you. I will take that as -- as an observation and not a question because I didn't get a question to direct to anyone, but I take that as your observation.

Mr. Kalevar, do you have a question?

MR. KALEVAR: Thank you, Mr. Chairman, through you.

Yesterday Mr. Pereira observed when International Institute of Public Health -- concern for public health was presenting that there is no safe dose of radiation. I think that point has been made so many times in the many representations I have heard that can this commission make a ruling on that issue because that's the key issue. If you can make a ruling saying that there is no safe dose for radiation, then the matter is closed as far as I am concerned.

And so my question is for the commission. If you are going to make a ruling on that and when will you do that?

CHAIRPERSON GRAHAM: Mr. Kalevar, we are going to make our decision on many of the issues based on many of the issues that are presented to us and that -- that decision will be out when we get all the information that we require, write our report, refer it to the -- to the minister in Ottawa, cabinet makes a decision and that decision will be announced.

We’re way behind schedule, but I'll let you have as a -- as someone speaking from the cloth, I know you want the last word, so you can have a very short one.

REV. OBEDKOFF: It'll be short.

With due respect about the IAEA, Dr. Michael Fairney (ph), formerly on the faculty of the University of Brazil said that, in fact, the IAEA had blocked a World Health Organization study of Chernobyl, and it’s really a pity that -- that studies weren't allowed to go ahead. They are going ahead anyway. I mean the Russian scientists and doctors have been collecting lots of data, but there isn’t a process right now that, I understand,

allows all that data to come into informing exactly what we're talking about and that's the effects over a longer period of time of the latent -- latent effects of small doses of radiation.

CHAIRPERSON GRAHAM: That question is to the Chair, I hope?

REV. OBEDKOFF: Oh, I'm sorry, to the Chair, yes.

CHAIRPERSON GRAHAM: Thank you.

REV. OBEDKOFF: Thank you.

CHAIRPERSON GRAHAM: That question has been addressed by our staff at least three times, I believe, in the last eight or 10 days that we've been here. I don't know if Dr. Thompson addressed it this afternoon. I don't know if you have anything else to add, but if you do, please do it and please be precise if you can because of time.

DR. THOMPSON: Patsy Thompson for the record. I will add that the United Nations scientific committee on the effects of atomic radiation is a committee of experts from 21 countries and this committee has been active and will continue to review all the data coming out from Chernobyl. And there are many Russian

scientists and medical doctors that are on the UNSCEAR committee reviewing this information. The next report of UNSCEAR on Chernobyl was -- is -- was published in -- a few weeks ago in -- in 2011, so this year.

CHAIRPERSON GRAHAM: Thank you very much. Thank you very much, Rev. Obedkoff, for coming today and presenting your views. I'm now going to declare a 15-minute break and the Chair will resume at 3:50.

--- Upon recessing at 3:34 p.m.

--- Upon resuming at 3:52 p.m.

CHAIRPERSON GRAHAM: Would everyone please take their seats for the -- so we can continue the agenda?

The next intervenor on the agenda is the Ontario Nuclear New Build Council and it’s under PMD 11P-1.142, and, Mr. Mutton or Mutton --

MR. MUTTON: Mutton.

CHAIRPERSON GRAHAM: -- Mutton, the floor is yours.

--- PRESENTATION BY MR. MUTTON:

MR. MUTTON: Thank you very much, Mr. Chairman, and good afternoon to the members of the panel. I'm joined here today with the vice-

chair of the Ontario Nuclear New Build Council, Terry Dorgan, from the International Brotherhood of Electrical Workers Union and from the Ontario Nuclear New Build Council, Garth Cochrane from the United Association of Plumbers, Steamfitters, Welders, Journeymen and Apprentices.

My name is John Mutton and I am the chair of the Ontario Nuclear New Build Council. I'm also the former mayor of the municipality of Clarington and I served in public office for approximately a decade. I'm the former chair of the Canadian Association of Nuclear Host Communities and I work very closely with the Nuclear Waste Management office on the adaptive phase management project for long-term storage of radioactive waste. I'm -- also worked on the low-level radioactive waste host community agreement with Port Granby and Port Hope, so I've had extensive experience in the nuclear industry.

The Ontario Nuclear New Build Council is a coalition of businesses, trade unions and community leaders from -- from across Ontario. We have supporters in the local board of trade, the city of Oshawa, members of council from Durham lakeshore municipalities, and these two gentlemen

also represent the Central Ontario Building Trades as well.

Our mandate is to advance the development of new nuclear units at the Darlington site in order to encourage Ontario's economic revitalization, sustain economic prosperity and develop environmentally safe responsible electricity generation for Ontario.

Regarding economic prosperity, with the decommissioning of Pickering nuclear generating station, highly skilled labour that live in the area will be able to work at Darlington B with zero disruption to their current lives, with Pickering nuclear generating station being about 15 minutes down the road.

New nuclear construction will create opportunities for the next generation of skilled workers, providing transferrable skills. In fact, the -- the diversification of Durham region's economy has relied on this with the creation of the Durham strategic energy alliance. New nuclear will also enhance the nucleus for nuclear training in Durham region at Durham College with courses and programs and the University of Ontario Institute of Technology, which -- which has

a school of nuclear.

Why nuclear new build? Our -- our council believed that the likely baseload gap is going to be 6,000 megawatts of coal closing in -- in 2014 in Nanticoke; three to 4,000 megawatts closing in Pickering in 2020 or earlier; 900 megawatts at a time per unit starting in 2016 regarding the Darlington rehab. And of the 6,300 megawatts at the Bruce, at least one unit or 800 megawatts will normally be undergoing rehab. And we also believe that Ontario requires non-CO_2 emitting baseload power for the future.

We -- we sourced a -- a study which was a trend analysis of electricity demand during the last two recessions and we've enclosed it -- and we've attached it in our written submission. Recessions tend to cause a dip in electricity demand. Post-recession, these dips have been followed by a return to pre-recession forecast levels or higher. Post-recession growth trend makes it appear as though the recession has never occurred. And then in our attachment, we have the 1980s recession and electricity demand and 1990’s recession and electricity demand.

We've taken a look at alternatives

to new nuclear. Regarding gas, we know that there is definitely problems with nimby, or not in my backyard, and also with nimto, nimto. We believe that there's -- shale gas is not commercialized and shale deposits in Ontario are meagre at best.

We're likely to see higher prices post recession and gas is not the ideal candidate for base load.

Regarding renewables, hydro is tapped out mostly. Wind, solar and bio-gas are intermittent and extremely costly with transmission issues. They both have the same "not in my backyard" and "not in my term of office" type issues around their communities.

The benefits of nuclear new build as we see it are to stimulate economic activity today on the local, regional, provincial and national bases. To ensure Ontario has cost effective, reliable and non CO2 producing base load power for the future.

In fact, a study was done at the Canadian Nuclear Association, and it has shown that Clarington and Durham region have the highest approval and support levels for nuclear in Canada, recognizing that nuclear energy equals clean air.

We have the highest safety standards. Without question, the workers at Canadian nuclear facilities are the highest trained in the world and the safest reactors, being CANDU.

For example, during my time representing Canada at the G8 negotiations for ITER Canada Fusion Project in Moscow, St. Petersburg and Leon, we were widely accepted as the best handlers of Tritium in the world.

New nuclear will also provide sustainable economic development for the long term. So when we take a look at the possibility of two new units at Darlington, for example, it will provide 12,000 new highly skilled jobs for Ontarians, 1.2 billion dollars in annual GDP, increased research and development in nuclear energy and spinoffs and gained experience in new nuclear technology.

New nuclear energy is cost effective and reliable. With electricity rates going up, new nuclear will counter-balance rates by providing low cost base load power six cents or less versus over 20 cents, and green. The only new source of emission free base load production, the only alternative to CO2 emitting natural gas is

nuclear.

For example, one 1,100 megawatt CANDU reactor would displace about 23,100 tonnes of CO2 emissions, equivalent to taking 4,620 cars off the road.

Nuclear construction and ongoing nuclear operation has the highest safety standards. There is -- under construction, highly skilled workers will be building these facilities. In fact, we are very lucky in this area. Within 20 minutes of the plant we are proud to call home -- the United Association of Steam Fitters and Welders, the International Brotherhood of Electrical Workers Union, the Carpenters' Union and the Labourers' International Union locals are all within 20 minutes of Darlington.

Maintenance of the plant. The past performance excellence in maintaining the nuclear facility in Ontario, as well as being recognized through the five-year licensing process by the Canadian Nuclear Safety Commission says a lot for new nuclear and the state of the safety of the workforce around nuclear.

Workers are currently trained and updated in industry best practices consistently.

And regarding community safety, years of adhering to CNDC safety regulations, testing and reporting.

We believe that there's going to be a significant stable economic development from the two new reactors at Darlington in creating over 13,000 direct and indirect jobs. It will stabilize electricity rates to ensure that our competitive manufacturing sector stays in Ontario, and create a solid base for exports into a nuclear energy hungry global market.

It will take advantage of a willing host community, and a community that is technically and socioeconomically ready for new build. And I might add, this site, when the international communities took part in the ITER Fusion project, there was a process that it went through called the joint assessment of specific sites at the G8. This site, where Darlington B is proposed to be expanded was ranked as the number one site in the world technically and socioeconomically, and it outranked -- it scored the highest on each level for each and every one of those -- each and every one of those criteria, so we believe what makes this the best site in the world for a fusion reactor, makes this the best

site socioeconomically and technically in the world for another fission reactor.

So in conclusion, as a grassroots group, the Ontario Nuclear New Build Council wants to say that we are ready, we are willing and we are able to implement new nuclear at Darlington as soon as possible.

Thank you very much, Mr. Chairman.

CHAIRPERSON GRAHAM: Thank you very much, Mr. Mutton.

The -- we will go directly to questions from panel members. Mr. Pereira?

--- QUESTIONS BY THE PANEL:

MEMBER PEREIRA: Thank you, Mr. Chairman.

I'll start off with one of the points you made in your presentation. You said that gas in not ideal for base load. Could you elaborate on that?

And the reason I ask is that because many of the intervenors who have talked about alternative sources of power, have talked about solar and windmills and hydro, and gas is an essential part of that mix. Go ahead?

MR. MUTTON: We thought the

volatility of prices with gas is going to make it an -- from our -- obviously this is from feedback from our entire council, would -- is going to make is very volatile for future base load.

CHAIRPERSON GRAHAM: Mr. Mutton, when you speak would you just identify yourself?

MR. MUTTON: Oh, sorry.

CHAIRPERSON GRAHAM: For the transcripts, they need that.

MR. MUTTON: Yes, thank you.

CHAIRPERSON GRAHAM: Thank you.

MEMBER PEREIRA: A question on the same line, some of the intervenors as well considered the concept of base load as being something that’s not necessarily essential, that it’s smart grids and matrix of supply, that there’s no need for a base load source of generation. Have you got any thoughts on that?

MR. MUTTON: For the record, actually, regarding smart grid, I’ve -- for the record, John Mutton.

Regarding smart grid, I’ve actually worked quite a bit in the private sector and with the National Smart Grid Committee and Dr. Richard Marceau, the Provost at the University of

Ontario, Institute of Technology.

Smart grid isn't even close to being -- it doesn't even have a definition yet nationally. It's not even close to being implemented. Sure, there are a lot of companies, and there's a lot of political sexy talk about smart grid, but we're not there yet.

MEMBER PEREIRA: Thank you. My final question concerns protection of the environment, and clearly we are engaged in -- this panel is engaged in an environmental assessment.

What is -- what are the views of your group on the impact of this project on the environment in this area?

MR. MUTTON: Well, what I can say is that from the experience, and I know with the three members that are sitting here at this panel, in our experiences with obviously Darlington A or Darlington Nuclear, that OPG and Darlington Nuclear have been wonderful ambassadors to the environment.

I used to be the chair of the Ganaraska Conservation Authority, representing a large chunk of this area. I know that the vice chair and Mr. Cochrane are both big supporters of the Friends of the Second Marsh, which would be

abutting the new build as well.

I -- we don't see anything but positive effects from the location of a new nuclear facility in our community.

MEMBER PEREIRA: Thank you, Mr. Chairman.

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

MEMBER BEAUDET: Thank you, Mr. Chair.

I'd like to go on a similar line of questioning from my colleague. When you said that smart grid is a long time from here, we had several presentations that were discussing this concept.

Do you mean for industry? Because if you are in a rural area, I mean, we had submissions, like, from the Farmers' Union, et cetera, and we had people with experience in developing in remote areas their own power system, so when you have that comment you mean for heavy industry?

MR. MUTTON: I'm meaning implementing it on a level not only for industry, but for the public. I have worked with several

private sector companies, as well as speaking with -- actually, I married one of the companies to the University of Ontario, Institute of Technology, in order to derive a definition for smart grid and to move some of the ideas regarding smart grid ahead.

And speaking with members of the National Smart Grid Committee, it's -- obviously I think it's something we all want to see happen regarding smart grid, but it is a long way away. I would liken it to the discussions that we were having ten years ago regarding hydrogen fuel cells, and that ten years later they were going to be the future, and I think that's the exact type of rhetoric or well wishes that we're seeing now regarding smart grid.

Sure, I hope that we get there, and I know that the committee hopes that we get there, but we don't see it happening. And based on expert opinion from the National Smart Grid members, that's where I see it going.

MEMBER BEAUDET: Thank you.

My other point is when you talk of emission of CO2 -- we had the Deputy Minister the other day with the -- from the Ministry of Energy, and we felt that from the interventions -- and it's

a question we ask him -- that the Ontarians don't seem to understand what the province is trying to do with the long-term plan of the next 20 years.

One -- probably one of the cause of that is that people see all kinds of figures, and you can never compare them or check them, or even ask to get official figures, we seem to have a hard time.

And I refer, for instance, the creation of -- in direct new jobs, we did ask OPG to try to get us exactly what is happening and the percentage they feel is going to come from the local area of the Region of Durham.

And with your figure here, if you say that you -- a 11,000 megawatt CANDU reactor displaces 23,000 tonnes of CO2 in reference to what? It -- by replacing what -- replacing coal, replacing gas; what do you mean exactly?

MR. MUTTON: It would be -- it would be replacing a percentage of each thereof.

And we sourced that information through the Canadian Nuclear Association, and it was information that was backed up from Atomic Energy of Canada Limited. So that actually -- information regarding that has been around, I

believe, since about 2004 when Murray Elston was the Chair of the Canadian Nuclear Association that they -- they did that survey and developed that data.

MEMBER BEAUDET: Thank you.

Thank you, Mr. Chairman.

CHAIRPERSON GRAHAM: Thank you, Madame Beaudet.

I have one question, and it's been -- you stated it at the -- starting out in your presentation, and it's been stated several other times by various intervenors, that the CANDU is the safest reactor technology in the world.

I guess my question is to CNSC. Is that a proven fact that it is the safest, or is it just the safest in certain parts of the technology?

And perhaps I'd like to know how the -- how that statement is -- comes forward. And that's not the first time I've heard it, and I'd just like to know what the position is of CNSC with regard to the technology of CANDU.

MR. HOWDEN: Barclay Howden speaking.

We're not involved in any of the

studies that are done to be able to make that sort of comparison.

We just look at it from a regulatory standpoint in terms of not posing unreasonable risks in Canada.

CHAIRPERSON GRAHAM: Could OPG comment?

MR. SWEETNAM: Albert Sweetnam.

I'll ask Jack Vecchiarelli to address the safety of the CANDU reactors.

DR. VECCHIARELLI: Jack Vecchiarelli for the record.

Safety actually starts with accident prevention. You look at the use of maintenance procedures. You look at adhering to high standards in the design, safe operation, taking conservative decisions in the face of uncertainty, the training of staff. So that's at the forefront, the very primary fundamental level.

And from there, we heard in earlier presentations in the first week about the defence in depth in the CANDU designs starting from the fuel sheaths that can -- the fuel itself that retains over 99 percent of all the fission products; the surrounding cladding; the pressure

tubes; the calandria tubes; the moderator; the shield tank around the moderator, which, in essence, is like a core catcher; the robust containment designs; and finally the exclusion zone boundary to disperse any potential radioactivity releases.

These are all part and parcel of a very strong defence in depth part of the process in the design of CANDU which makes it very robust and safe.

CHAIRPERSON GRAHAM: Thank you.

MR. MUTTON: Mr. Chairman, may I add one point to that?

CHAIRPERSON GRAHAM: Yes, Mr. Mutton.

MR. MUTTON: John Mutton for the record.

I have had the opportunity to visit several nuclear installations in the world, in Moscow, St. Petersburg, Lyon, Spain, and China.

And in November of 2005, I went with Premier McGuinty on a -- on the trade mission to China. And I visited Qinsham where the latest CANDU 6 was built.

One of the things that I heard

from the Chinese government was -- as you know, that most other places in the world run on a PWR, pressurized water reactor, system.

And regarding safety and regarding looking at waste, the idea is -- is that a spent fuel bundle that comes from a pressurized water reactor in the future with new technology, which is -- which is evolving, is going to take some slight tweaks, and it's going to be tomorrow's fuel.

So the idea -- and what they were very encouraged about is that if we have a CANDU reactor in our country -- sure, we have all the PWR reactors, which -- obviously they're using some of them for their -- to advance nuclear weapons programs.

Okay. But if they have a CANDU reactor, they can take the spent fuel bundle out of a pressurized water reactor. There can be some minor tweaks to it, and it can be used as future fuel with a CANDU reactor.

So it was one of the things that was really encouraging to hear in all those different countries about how great and safe Canadian technology was. And I heard it loud and clear in every one of those countries, Mr.

Chairman.

CHAIRPERSON GRAHAM: Thank you.

I will now go to OPG. Do you have any questions for this intervenor?

MR. SWEETNAM: Albert Sweetnam.

No questions.

CHAIRPERSON GRAHAM: CNSC, do you have any questions for this intervenor?

MR. HOWDEN: Barclay Howden speaking.

No questions.

CHAIRPERSON GRAHAM: Government agencies, like federal or provincial government departments, do you have any questions?

If not -- I see none.

I understand we have one intervenor so far. It’s Michael Ivanco.

And I would presume Mr. Kalevar has also got a question.

So, Mr. Ivanco, your first question, please.

--- QUESTIONS BY THE INTERVENORS:

MR. IVANCO: This is more of a comment about your calculations of greenhouse gas emissions avoided.

Just for the record, the emissions for coal fire generation are about 1 kilogram of carbon dioxide per kilowatt hour.

An 11,000-megawatt CANDU unit running all year would produce about 9.6 terawatt hours of electricity.

If you do the arithmetic, it works out to 9.6 million tonnes of carbon dioxide, which is roughly 2 million cars.

And if it's -- if it's gas instead of coal, then it's roughly 5 million tonnes of CO2, which is equal to about 1 million cars' emissions annually.

CHAIRPERSON GRAHAM: Is that a question, sir?

MR. IVANCO: No.

CHAIRPERSON GRAHAM: Do you -- Mr. Mutton, do you want to respond?

Mr. Kalevar?

MR. KALEVAR: Thank you, Mr. Chairman.

Through you to whoever on that table --

CHAIRPERSON GRAHAM: For your information, Mr. Kalevar, this is the Ontario

Nuclear New Build Council.

MR. KALEVAR: Yeah. I just don't know the names of the people there, that's why.

CHAIRPERSON GRAHAM: Mr. Mutton was the presenter.

MR. KALEVAR: Okay, to him then.

Since the CANDU reactor is so well appreciated throughout the world, as you say it, could you please tell me why there is no taker for the sale of AECL, which is the mother of CANDU reactors?

CHAIRPERSON GRAHAM: Mr. Kalevar, I think that your question -- I appreciate your question, but you're asking someone for -- it's the Federal Government that has AECL for sale, not the new build council. So I don't think that that type of question is relevant to today's hearing.

MR. KALEVAR: No.

CHAIRPERSON GRAHAM: I don't think it's relevant.

MR. KALEVAR: They might have knowledge about --

CHAIRPERSON GRAHAM: And I would appreciate that you put questions that are relevant, and we'll accept them every time.

But I don't accept that, and I'm not going to put this group on the spot for a question like that.

Thank you.

With that, I don't think there's any other questions.

Mr. Mutton, thank you very much for your counsel. Thank you very much for coming today, and we appreciate your observations.

The next question -- the next intervenor is the Registered Nurses Association of Ontario, which is outlined in PMD11-P1.201.

And, Ms. Grinspun, you're the presenter today. The floor is yours, ma'am. And you have someone with you and maybe you'll introduce them also. Thank you very much.

--- PRESENTATION BY MS. GRINSPUN:

MS. GRINSPUN: Yes, absolutely.

Thank you very much.

With me is Rob Milling, the director for health policy at the RNAO.

Thank you so much.

The Registered Nurses Association of Ontario is the professional organization representing registered nurses in this province.

It is the strong, credible voice leading the nursing profession to influence and promote healthy public policy.

We appreciate the opportunity to make a submission to the Joint Review Panel on the proposal by Ontario Power Generation for the site preparation, construction, operation, the commissioning and abandonment of up to four new nuclear reactors at existing Darlington nuclear site near here on the north shore of Lake Ontario.

Last January, we presented the Premier of Ontario and all the other party leaders, as well as all MVPs with a copy of Creating Vibrant Communities, RNAO's challenge to Ontario's political parties, which is how our comprehensive platform for the upcoming 2011 provincial elections.

This fully costed platform outlines practical and concrete recommendations in six key areas; strengthening social determinacies of health that allow us to create healthy and equitable communities, building sustainable green communities, strengthening Medicare and our not-for-profit health care system, improving access to nursing services, and strengthening our public

services. We have copies with us for those of you who wish to have one.

When we talk in our platform about building sustainable green communities, we recognize that the connection between the environment and health is well-established. According the World Health Organization, environmental factors account for 24 percent of the world's burden of disease and 23 percent of all deaths.

Creating Vibrant Communities means healthier environments through cleaner air and water, good green jobs on a base of equity and environmental sustainability, getting serious about climate change, and reducing toxic substances and other pollutants in the environment and in our food and water.

Registered nurses are particularly concerned about our climate change because of the serious environmental and health implications. Confronting impacts of climate change calls for renewed commitment. That's why RNAO is advocating to immediately and urgently phase out qualifier power generation and not delay until the scheduled 2014.

In our platform, we talk about wind and solar power and the need to be much more aggressive in reducing energy –- energy use by public education, setting targets for conservation, and production of green renewable energy.

We are clear on one other thing. The RNAO has been consistent in saying there is no place for new nuclear power in Ontario’s long-term energy future.

To quote our platform, Creating Vibrant Communities, RNAO is convinced that one alternative, an expansion of nuclear power, is not the answer. Nuclear power plants are prohibitly expensive, take years to build, present radiation risks, and produce large amounts of radioactive waste that must be stored in perpetuity, and no solution for such –- such storage has been found yet.

Ontario relies on expensive, risky nuclear power for half of its electrical power, and it is time to put those resources into clean air energy.

I start with the extensive background so that the panel understands that the renewal does not come lightly or opportunistically

to the issue of whether Ontario Power Generation should be authorized to build four new –- four new nuclear reactors.

Nuclear power comprises, as I said, 50 percent of Ontario's power supply. Yes, it employs thousands, including the family and friends of many registered nurses in communities such as the one we're here today.

Yet the RNAO nurses from the Darlington area with whom I have spoken directly, some of which who are here with us today, have become increasingly concerned about the staggering health, environmental and economic cost of nuclear power, particularly as safer and more affordable green alternatives are available.

Setting in motion a process that would result in up to four nuclear power reactors at Darlington would be a serious mistake that could have serious health consequences for the people of Ontario now and well into the future.

In reaching this conclusion, the RNAO takes the precautionary principle to protecting human health and the environment. I will come back to the precautionary principle shortly.

First, we must acknowledge the terrible events of this past weeks that hang like a ball over these hearings. Like all Canadians and people around the world, our hearts go out to the people of Japan who are dealing with unthinkable tragedy. We admire their courage and resilience, even as the full extent of the disaster continues to take shape.

We know that the best and brightest of the world's nuclear technologists and engineers are working around the clock at great risk to their own health to prevent further catastrophe, and we wish them all the best.

The air force (ph) on the other side of the globe inspires us with hope. Our government and the nuclear industry here at home assures us it could never happen here and we have nothing to be worried about. Let us not be smug. No doubt the nuclear experts and government leaders in Japan were confident that the sheer magnitude of the disaster could never happen there, but of course it could, and it did.

Here in southern Ontario on the shores of a Great Lake, it will not be a tsunami and earthquake striking in tandem. That does not

mean there is no risk of harm to health. Nuclear power is an unforgiving technology. Japan reminds us that all nuclear reactors are vulnerable to the potentially deadly combination of human error, design failure, and natural disaster.

Other countries get it. Germany and Switzerland head a growing list of countries that watched the instability of Fukushima reactors over the past several weeks and recognized that this is not the time to be take –- to be talking about plans to expand nuclear facilities. One might ask what those countries know that we apparently don't know here at home. The better question is, what do we all not know.

That's why we must not recklessly push forward with the construction of four new nuclear reactors in a heavily populated area of our province.

This brings us to the precautionary principle. I know many others have referred to the precautionary principle in these hearings, and more will do so. I want to talk about how central the precautionary principle is to how nurses view their responsibility to advocate for social equity, health, and environmental

sustainability.

The precautionary principle, a tenant of Canadian law, requires that when faced with the potential for irreversible harm, it is incumbent on decision makers to examine not merely the mitigation of such effect but minimizing them. In the context of this review, that would require an examination of non-nuclear alternatives for producing electricity.

However, such an examination has been excluded from this review, and no such public review has been undertaken by our provincial government.

A commonly accepted statement of the precautionary principle is when an activity raises threat of harm to human health or the environment, precautionary measures should be taken, even if some cause and effect relationships are not fully established scientifically.

It is important that the process of applying the precautionary principle be open, informed democratic and include potentially affected parties. The proponents of an activity rather than the public should bear the burden of the proof. This process must also involve an

examination of the full range of alternatives, including no action.

There is an argument to be made that the greater burden should apply to policy decisions concerning an application for new nuclear reactors. Where radiation threats are concerned, not only must people be safe, but they must also feel safe. We speak in our written submission about the need to engage the public about radiation and its safety in a non-condescending manner. People do not change their perceptions of radiation by being told they're wrong, their questions are inappropriate, education must play a role. That's the fact of robust credible analysis. No action must be considered viable, and in the case of nuclear radiation, a preferred option and the public safety is assured, both in fact and in perception.

Dr. Kathy Backill (ph) and colleagues, in an article cited in our written submission, referred to a long list of hazardous products that were once considered safe such as cigarettes, DDT, thalidomide and various food additives, and suggest that the precautionary principle should dictate that radiation be added to

the list until such time as a safe does of radiation exposure can be demonstrated.

Indeed, the government and in the case of these hearings, Ontario Power Generation have not yet demonstrated that nuclear power is safe. Henceway I had the question before to our experts. While the government counts nuclear power as being part of the more than 80 percent of power generation resulting from emissions free sources in 2009, this is misleading.

During production of electricity, nuclear power may not emit pollutants as defined by Environment Canada, but nuclear energy certainly produces more than its share of climate change causing greenhouse gas emissions during nuclear power plant construction, uranium mining and refining, transportation and fuel fabrication.

Talk of new nuclear generation stations being built in Ontario has steered a great deal of interest in uranium -- in uranium prospecting and mining providing more reasons to be concerned about the impact of this proposal on environmental and human health. Uranium mining has been called potentially the most contaminating stage of nuclear power generation thanks to the

large amount of radioactive dust and tailings and random gas that is produced.

In over 50 years of nuclear power generation in Ontario a permanent solution has yet to be found for the disposal of nuclear waste. At the Pickering Nuclear Power Station alone, 20,000 tonnes of highly radioactive waste has already been produced and is being stored at site with no foreseeable solution. Most alarming a recent study concludes that there is no safe levels of radioactive exposure. In fact, any amount of exposure to ionizing radiation is too much and is harmful.

Further, the health risk associated with radiation arrives at all stages of the nuclear fuel chain, from uranium mining and refining to the fission process in nuclear reactors, and radioactive releases into the air and water, to the legacy of radioactive waste that will live for our grandchildren and future generations. What a present we leave them.

Studies have linked human produced radiation with cancers, genetic damage, birth defects, mental disability due to in utero exposure, immune system dysfunction and diabetes.

There is the fear of a large scale accident or meltdown that has made Three-Mile Island, Chernobyl, and now Fukushima, part of the common lexicon, but the real danger of radiation may well prove to be the chronic low-level exposure, the effects of which are fully understood, particularly in children.

If for no other reason this cries out of obligation of the precautionary principle. As Dr. Backill (ph) concludes, providing the least radioactive in the environment, water and food, seems the most prudent advice.

While there are relatively few Canadian studies on the deleterious effects of low levels of radiation on health, there is evidence linking increased prevalence of leukemia in children that are living near nuclear facilities. Higher rates of congenital abnormalities have also been documented. A 2008 German study showed us that statistically significant relationship between risk of leukemia and living within ten kilometres of a nuclear plant with consistent results across all 16 nuclear power plants in Germany. No wonder people went to the streets. Maybe that’s what we need to do here too.

While there is no definite evidence in Canada linking nuclear reactors and harm to human health because of small sample sizes, three studies conducted by the Atomic Energy Control Board in Ontario provide reason for concern. Two of the studies in 1989 and 1991 examine childhood leukemia within a 25-kilometre radius of nuclear facilities in Ontario, including the Chalk River Research Centre, the Port Hope Uranium Processing Plant, Elliot Lake Uranium Mining, and Pickering and Bruce Electricity Generation.

The third study looked at childhood leukemia and paternal -- paternal radiation exposure. In initial studies, most cases of childhood leukemia were consistently found at each location, except Chalk River, though the overall numbers were small.

Though the authors conclude that the findings justify further investigation, a large case control study has not yet been done in Canada. Proponents of nuclear power should not take heart from the inconclusive findings of these Ontario-based studies. Rather, the point to the clear need to apply the precautionary principle and put the

burden of proof where it belongs, on the agencies seeking to construct new nuclear reactors.

Further study of the health effects of nuclear facilities in close proximity to heavily populated areas must be conducted before decisions are taken to expose those areas further to risk of nuclear radiation. Before leaving the topic of potential harm to human health. I want to talk briefly about tritium.

While we do not yet know what technology is being projected for the new Darlington reactors, Canadians are being asked to write Ontario Power Generation a blank cheque. Canada’s CANDU nuclear reactors use heavily -- heavy water as a coolant to avoid the building of excessive heat. Deuterium easily converts to tritium by absorbing a neutron. Canadian reactors release and leak much greater amounts of tritium than reactors that use light water. Nurses and other health professionals are concerned about the levels of protection that Ontario's drinking water quality standards provide against tritium, a radioactive isotope of hydrogen with a half-life of 12.3 years.

This persistent toxic substance

moves quickly through the environment once it is released, and it is not readily removed from drinking water. So reducing or stopping releases is the most practical way to control tritium exposure.

The Canadian Nuclear Safety Commission recognizes tritium as a risk to human health when it is ingested in drinking water or food or when it is inhaled or absorbed through the skin. Like other radionuclides, tritium emits ionizing radiation when in the body and this radiation has been shown to be a teratogen, mutagen and carcinogen.

Intentional releases of tritium from the Chalk River Nuclear Facility have been documented where tritium levels in the Ottawa River did not exceed allegedly safe limits. Even small amounts of a carcinogen, mutagenic and teratogenic substances such as tritium could still be concluded to represent an unacceptable risk when released into the water supply. And I ask myself why would the government of a country like ours do this on purpose?

The isotope tritium occurs naturally but it is also known to have been

released into the environment in large quantities by Ontario's nuclear reactors. By one estimate, major Canadian nuclear facilities were releasing amounts of tritium equating about 10 percent of natural production of tritium in the northern hemisphere. The majority of the releases come from Ontario reactors and their impact is greatest near nuclear facilities.

A 1991 study looked at birth defects within 25 kilometers of the Pickering Nuclear Station from 1971 to 1988 and compared them with airborne and waterborne tritium discharges over that period. While the study found a statistically significant increase in babies with Down Syndrome born near Pickering and a correlation with tritium discharges, the later relationship fell short of being statistically significant.

Nevertheless, the higher rates of Down Syndrome are reminiscent of similar findings within Chernobyl survivors and suggest that more study is needed before massive increasing tritium-releasing CANDU reactors are here at Darlington.

CHAIRPERSON GRAHAM: Madam Grinspun, just a comment. You've only got about five minutes left. You are reading from your

entire text. We have read it.

Maybe you might want to give that five minutes into some points, so I don't have to -- because I don't think you'll be able to get finished within the five minutes for all of your reading.

MS. GRINSPUN: I will for the sake of the people from the public and the nurses.

Thank you very much.

CHAIRPERSON GRAHAM: Thank you.

MS. GRINSPUN: The full impact of human health of a substance like tritium is complex and not fully understood. There are multiple health end points. Exposed population is diverse with many who are vulnerable due to compromised immune system or due to the stage of development, such as young children to which I have referred before. The interaction of chemicals and radioactive nuclide alters health effects. The mechanisms of health impact are complex and multiple forms of tritium enter the body and are organically found in tritium.

It is essential that there be rigorous studies of the health impacts of tritium exposure immediately before steps are taken to

build new nuclear reactors in this area.

I will move now to speak about other reasons that are important for nurses about this blank cheque that we are providing. The blank cheque will have all of us on the hook for the cost overruns and increased debt for many years to come. Nuclear power is prohibitively expensive. While the government itself is budgeting 33 billion for its nuclear plants, and this was before the disaster in Fukushima, that bill probably will increase now that all the safety valves need to increase, which alone would elbow out other more cost-effective and environmentally sound investments. The track record of nuclear plants is not impressive; every project has gone considerably over budget, in fact, by at least two and a half times.

So if we are concerned about hydro bills for the huge cost of overruns from these reactors, then this is the place where we can save as well.

As the government manages a fragile economy, it is understandable that the prospect of jobs in the nuclear industry and losing some of those jobs would deter pulling the plug of

new nuclear plants. In fact, replacing aging nuclear power plants with green energy means additional well paying jobs. Renewable is doable and there are reports that show about this, that additional 27,000 jobs could be created over 10 years. I will now strongly suggest that every alternative to nuclear plants must be explored at the earliest opportunity before making new ill-advised investments in new nuclear plants.

There is a lot that has been said in the last week and a half here about renewables and I want to finalize by referring to comments that were in the previous submission, "To NIMB", Not in my backyard; and "To NIMTO", Not in my term of office, nurses would say "TATA", there are thousands of alternatives.

So we say the Ontario Power Generation application to build four new nuclear reactors at Darlington on the basis that the need for 4,800 megawatts in additional nuclear energy is not a justification, has not been justified. Details of the vendors and technology are unavailable or not made transparent. The potential risk to human health and the environment is too great and the economic cost is unsustainable with

nuclear power.

Instead invest in more cost-effective and safe alternatives such as energy reduction. We need to educate the public and the industry and all of us that use energy that reducing energy utilization is the way to go. We are one of the most per capita energy consumption people that exists on this planet here in Canada and here at home. Invest in energy conservation, energy efficiency and renewable energy sources. Wind, solar, water are just three of the "TATA" possibilities that nurses encourage the government to use.

Thank you.

CHAIRPERSON GRAHAM: Thank you very much. We will now go into question from Panel Members and first I will go to Madame Beaudet.

--- QUESTIONS BY THE PANEL:

MEMBER BEAUDET: Thank you Mr. Chairman.

I have a question for CNSC on this presentation and the comment that with the Canadian studies, the authors concluded that the findings justified further investigation and a large control study has not yet been done in Canada.

I would like to know -- I believe you had mentioned that these were ecological studies and there was no relationship established and in such a case, then who would give the green light or the go ahead for further studies?

DR. THOMPSON: Patsy Thompson for the record.

The studies that the intervenor mentions were actually followed up. They were descriptive studies and the recommendation was that these studies be followed up by case control studies. They were actually followed up by case control studies and we have provided those studies in the undertaking number 30 and we also have described these studies in fairly extensive details in two reports that are on the CNSC website and that we have referenced in two undertakings we've provided over the last few days.

And so those studies were followed up in Canada with Canadian case control studies and the ACB and then the CNSC, also we're involved in cohort studies of workers, so there's been descriptive studies.

Those that were mentioned by the intervenors, they were followed up by Canadian case

control studies and there have been also cohort studies on workers.

Perhaps if I could add, the Durham Regional Health Committee and the representative was here earlier when the Durham region representatives were here, published a study of the region about three years ago, which updated -- and the findings were that there was no difference in the health status of the population living in Darlington, Pickering relative to the rest of Ontario.

MEMBER BEAUDET: So you have to achieve first if there is a relationship and then you'll have to do studies to see if there is -- what is the cause, cause and effect? That's my first question.

My second one, CNSC does epidemiological cause studies as well or what would be the next step in order to understand more and evaluate the concerns of a lot of the intervenors in this hearing?

DR. THOMPSON: Patsy Thompson for the record. I will provide some information and then my colleague, Rachel Lane, will respond to your more technical questions, as I wouldn't be

able to answer.

Essentially the ACB and CNSC have been involved in studies in terms of -- through our research and support program and we have worked with research scientists that have done the work on behalf of the CNSC and other organizations.

We have also -- because of the concerns that have been expressed by many people over the years about tritium and the fact that there are gaps in knowledge in tritium, we extended a considerable amount of work on tritium. And there were some recommendations made to the Commission last June on the -- we presented the findings of the tritium work. And we made some recommendations.

Some recommendations were to -- to continue. Some experimental work, research to better understand the mechanisms associated with the cellular effects at low levels. And we also made recommendations to do an international tritium epidemiological study so that the numbers would be sufficient to have statistical robustness. And because of the low doses involved, but I'll ask Ms. Lane to reply to your first, more technical question.

DR. LANE: Rachel Lane for the record. I'm the acting director for the Radiation Health Sciences Division and I'm am epidemiologist.

There are different types of studies and the ecological or descriptive studies, basically what they do is they look at the distribution of disease, so distribution by person, place or time.

They're a good sort of first step at looking at the overall distribution of the disease and the problems with these studies is that they are population-based, so you'll look at a community and compare it with a -- a standard, larger community.

So, for instance, in Durham, you'd compared Durham region with all of Ontario or Durham -- or Port Hope with all of Ontario. And the problem with that is that you don't have information on individuals, so even though you might see rates of disease that are unusual because you don't understand the individual risk factors of the individuals within that community, it doesn't say anything, other than that you have some sort of a cluster or what have you.

So then the next level is

basically a case control study and actually case control and cohort studies have pros and cons and you use them in different situations, but basically with the case control study you have cases of newly diagnosed disease, so in the case of leukemia where they found the higher rates of leukemia in the descriptive study, what we then did is we took cases of childhood leukemia in Canada and we looked at them and we had controls that did not have the disease and then they were compared on various risk factors, so the age of the children, the sex of the children, where they lived and various issues about a whole list of risk factors.

And one of the main risk factors we were interested in was whether their parents had preconception, radiation exposure, so the cases and the controls could have these parents that had this.

The finding was there was no relationship between those children with the disease and their parents' preconception exposure compared to the controls and their parents, okay, so that basically said that there wasn't a relationship, okay? So that's a case control study.

So the difference between that and the first one is that you have individual information on risk factors of both the cases and the controls, which makes it far more relevant.

And the final study is the cohort study. In cohort studies, you basically take a healthy population, so usually it's like a worker population or what have you. And they are free of disease at the beginning, but what you can do is you can collect very detailed information on their risk factors over time.

So, for instance, I've done a lot of work with uranium miners and we can have information on their exposures over the duration of their employment and you have information on other risk factors as well, so not only radon, but we're looking at gamma, we can look at their age and sex and all kinds of bits and pieces of information.

Then we follow them through time through the course of their life actually and we can link them to mortality and cancer incidence records that we have in Canada. And from that we can assess whether or not their exposure was related to their death or their cancer.

We look at all causes of death and

we can look at great detail at different cancers. We can look at it by -- by dose categories and so on to get an understanding of the relationship.

Now, those are just individual studies. There is something called Hill's Criteria for Causation and this is based on nine criteria to determine whether a risk factor A causes disease B.

One of the most important criteria is a temporal relationship. The risk factor occurred before the disease basically. And there are all other nine criteria such as a dose -- a dose response relationship.

The strength of the association, whether you see it in biological situations as well, so there is like a biological rationale for it, et cetera, et cetera, so if you see that, that's great.

Now, we have the United Nations Scientific Committee on the effects of atomic radiation. For radiation, this has been in place for about 57 years now and each year people from 21 countries, the top experts in the world on radiation, and they are not political, they are the scientists, meet in Vienna and do literature reviews on radiation, sources and effects.

And they look in great detail and

in great debate on epidemiology, health, physics, radiation, biology, blah, blah, blah related to radiation and basically come up with what we consider radiation Bibles on what we understand today on the best information on the sources and the effects of radiation, so that is what the CNSC bases its radiation risks on, and that is what we base the way in which we regulate and provide radiation protection.

Thank you.

CHAIRPERSON GRAHAM: Thank you. Madam Beaudet?

MEMBER BEAUDET: Thank you, Mr. Chairman.

CHAIRPERSON GRAHAM: Mr. Pereira?

MEMBER PEREIRA: Thank you. I will just follow up on that line of questioning, and thank you for that explanation on the different methods of conducting epidemiological assessments.

But going beyond that, it seems to me like we have interventions here of one set of intervenors convinced that radiation from the nuclear industry is causing cancers in Canada, and then the science being presented by the CNSC and others saying there isn’t enough evidence to link

radiation from the nuclear industry with cancers.

Now, I'm wondering whether there might be another way this panel could get some advice in looking at data that might be available, that might be available from Health Canada on the incidence of cancer in Canada, unrelated to the nuclear industry, but just the incidence of cancer right across Canada and then their assessment of, based on epidemiological studies, what are the causes of those cancers? And then once could perhaps relate those assessments with the location of impacts by the nuclear industry.

I don't know if that already exists, perhaps it does because I would expect Health Canada does studies of health impacts on Canadians in general, not just -- not necessarily with a preoccupation of focusing on the nuclear industry.

This might be a more sort of objective way of looking at it, as a general disease condition across Canada, and then from that we might be able to draw some inferences with respect to whether the nuclear industry is a factor, perhaps a synergistic factor or a single factor, as the theory seems to be among some of the

intervenors, that it is the sole factor for some types of cancers.

I don't know whether that is helpful, but if it is, then I'd like your opinion whether that would help?

CHAIRPERSON GRAHAM: I guess what Mr. Pereira is asking is, are such studies or is such information available, and if it is, we will do an undertaking to go to Health Canada to get that.

Either Dr. Lane or Dr. Thompson, do you have information if that information is at Health Canada?

DR. THOMPSON: Patsy Thompson, for the record.

Well, there have been studies done of cancer distribution in Canada and -- by risk factors, and one of those studies indicates that when you look at tobacco, diet, occupation, family history, alcohol and other risk factors associated with cancer, that radiation actually accounts for about 3 percent of the causes of cancer that's in Canada.

There are also annually cancer statistics that are produced by Health Canada that

talk about, you know, mortality and incidence of cancer in different age groups in Canada. Whether that information is regularly put together with risk factors, I'm not sure if that information exists on an ongoing basis, but there have been -- I'm being told it does, so I will let Rachel continue.

DR. LANE: I'll be shorter this time. Rachel Lane, for the record.

Yes, the Canadian Cancer Statistics puts out an annual book that looks at cancer mortality and cancer incidence in Canada, and it tends to also have special sections, so there might be a special section on childhood cancer and the main risk factors for it and so on.

We can easily get -- and also Health Canada and the Public Health Agency of Canada have been doing fact sheets and so on, on what are the causes of cancer in Canada for eons, and they are available on their web site. So that is readily available and we could easily put an undertaking together for you.

MEMBER PEREIRA: So that would try to cross-relate that with --

DR. LANE: Other causes.

MEMBER PEREIRA: -- nuclear --

DR. LANE: Yes, yes.

MEMBER PEREIRA: well, causes due to nuclear radiation, obviously related to where the nuclear industry has activity?

DR. LANE: Yes.

DR. THOMPSON: Patsy Thompson, for the record.

So we will, if that is acceptable to the Chair, take the lead on the undertaking and work with Health Canada as needed to provide something that would be useful for the panel.

CHAIRPERSON GRAHAM: Yes, if you would. It will be undertaking number 59, and I believe it's both Health Canada and I think Dr. Lane said --

DR. THOMPSON: The Public Health Agency of Canada.

CHAIRPERSON GRAHAM: -- the Public Health Agency of Canada. And I thought maybe you mentioned Cancer Society too, but -- so whatever documents that we can get to draw the parallels that Mr. Pereira was asking, we appreciate that.

We will put that on the agenda for, say, next Wednesday -- or next Tuesday, and if

you can't get them by then, you can give us a time when you think you can get that information.

DR. THOMPSON: Patsy Thompson. We will come back next week, next Tuesday, with a timeline if we don't have the information by then.

MEMBER PEREIRA: Thank you, Mr. Chairman. I have one more question to Ms. Grinspun.

Thank you for your presentation. You cover some very good points and some good observations.

Did your organization engage in the consultations that the Ministry of Energy in Ontario undertook in developing their energy plans, the long-term energy plan? Do you provide input to them and what was your reaction to their, you know, consideration of the inputs from various intervenors?

MS. GRINSPUN: Yes, we did, and we have been involved in all the stages of the process and express similar views as today on all the aspects of energy. Also in the platform that we released 18 months ago in advance to the elections and our views are there as well. Some have been -- received very good uptake, and others, like this

one, a less favourable one.

It is -- it is sad for us as nurses to see that a government that was showing very bold leadership in relationship to renewable energies. I mean, relationship to many other aspects that impact on greener, healthier, cleaner communities, such as pesticides and other aspects, right, not just energy, that all of a sudden is taking a turn in the wrong direction in our view.

It is sad because although we fully understand the economic realities that this government finds itself in, we also fully understand that you can have as many jobs, and perhaps even more so, if the government had chosen to put those 33 billion dollars, which probably will never be that much. It will be, if we open them, will be way more than that. We will never open them though, at least not all of them, so that will not be the case.

But if we were to put the same energy as a political will and the same energy in terms of funding into renewable energies, this province could become the example, not only for North America, but for many other places, so it is sad.

And it is sad that this is happening, and I hear you speak in relationship to the fact that there isn't enough evidence to show correlations. Well, there isn't enough evidence to show otherwise.

So for a government that was extremely attentive, rightfully so, to children, and continues to be in so many areas, such as education, et cetera, that all of a sudden we are abandoning children and putting the burden of the proof on children, longitudinally or not, rather than putting the burden of proof on the government itself and on OPG.

I say that with sadness because I have a lot of admiration on many other aspects for what the government is doing, and not on this one at all.

CHAIRPERSON GRAHAM: Thank you very much.

Mr. Pereira?

MS. GRINSPUN: And I -- on behalf of nurses. This is not just a personal comment. My colleagues are here, and many others are waiting to hear what is the outcome of this panel.

MEMBER PEREIRA: Thank you very

much. Thank you, Mr. Chairman.

CHAIRPERSON GRAHAM: Thank you, Mr. Pereira.

Now we will move to the other aspects of this presentation. And I will go first to OPG. Do you have any questions to the intervenor?

MR. SWEETNAM: Albert Sweetnam. No questions.

CHAIRPERSON GRAHAM: CNSC, do you have any questions to the intervenor?

MR. HOWDEN: Barclay Howden. No questions.

CHAIRPERSON GRAHAM: Any other government departments? The only one here is Environment Canada and I see there they have none.

Now, I'll go to intervenors. Pardon me, questions from other registered participants, and I have here Mr. Michael Ivanco. He wants to ask a question. I might remind you, Mr. Ivanco, that the last two times you went up to the microphone you've made statements and not asked questions. You are the next presenter, I believe, so if it's a statement, maybe you could keep it for your presentation, but if you have a question, the

Chair would gladly entertain it.

--- QUESTIONS BY THE INTERVENORS:

MR. IVANCO: I do have a question. It's a bit long-winded, but not too long-winded, so I beg your pardon for that. I wanted to point out that most of the cobalt 60 in the world that's used in radiation treatment for cancer is actually made in the core of CANDU reactors. Most of the medical isotopes that are used in diagnostics of heart disease and cancers are made in Ontario. And collectively these save hundreds of thousands of lives around the world.

How do rationalize, you know, promoting the precautionary principle towards nuclear power in the knowledge that if nuclear power didn't exist neither these technologies nor these materials that save hundreds of thousands of lives a year would be available.

CHAIRPERSON GRAHAM: I'll direct that question to you, Ms. Grinspun.

MS. GRINSPUN: Yes. Thank you for the question. Of course, that nuclear power that is being used for diagnostics is very different than nuclear power that is generated to keep the lights in our house, so with all due respect, I

don’t put them on the same -- on same book even, let alone the same arena.

We are saying there is no need for new nuclear power to keep our society going, the lights in our house, our cars, et cetera, et cetera, the insatiable need -- that we need to use energy in our country and province. So we are using 50 percent of the energy comes from nuclear power, what’s the percent that -- that we use of that for diagnostics. Let’s put that in context. We’re talking about the bigger picture here. Thank you.

CHAIRPERSON GRAHAM: With that, thank you very much. Mr. Kalevar, do you have a question? You’re not registered, but generally you do. Do you have a question?

MR. KALEVAR: (Off Mic)

CHAIRPERSON GRAHAM: Well, I’m not prompting you, but you generally come up when we’re finished, so I just presumed you had a question.

MR. KALEVAR: Thank you very much for waking me up.

CHAIRPERSON GRAHAM: That was about an hour ago.

MR. KALEVAR: Well, I will ask --

MS. GRINSPUN: Did I put you to sleep?

MR. KALEVAR: I beg your pardon?

MS. GRINSPUN: Did I put you to sleep?

MR. KALEVAR: No, that was an hour ago, he said, not -- but anyway, I think the question I would ask is, since you are so sure that nuclear radiation -- any kind of nuclear radiation causes cancer, and the gentleman before me has said that you need radio isotopes to cure some of the cancers. Do you see the difference between the research reactor that makes radio isotopes and the nuclear reactor that produces power, and how would you go about justifying the one without the other.

CHAIRPERSON GRAHAM: Ms. Grinspun, just a short answer please.

MS. GRINSPUN: (Off mic) ourselves for saying that there is reasonable doubt that nuclear power does not cause cancer in children at the very least, that’s why we are saying more controlled studies that are longitudinal are required before we proceed with opening new nuclear plants. And we are saying also that the burden of proof should be on those that want to open the new

nuclear plants, the Ontario Power Generation and also the government, and not ignore studies like the German KIKK that did show and will stand by government, did show very compelling evidence of a positive relationship. If not correlation, a positive relationship, and we should not be putting our kids at risk when we are not sure that there is no more than that even.

CHAIRPERSON GRAHAM: With that, thank you very much for your presentation. Thank you for coming today and safe travels back to your -- to your home.

We have one more presenter for today, and that is the Society of Professional Engineers and Associates. And that can be found under PMD 11-P1.167 and PMD 11-P1.167A. And my understanding is that Mr. Ivanco, you are the presenter, and you have some overheads to go with that, which have been filed with the panel, so we will proceed with Mr. Ivanco.

--- PRESENTATION BY MR. IVANCO:

MR. IVANCO: Thank you. We have a presentation. I don't know if that shows up on the screen or not. Okay. I'll start it then. I'll first introduce us. We're the Society of

Professional Engineers and Associates. We represent, I would say, the largest concentration of nuclear design and safety expertise in the country. Our approximately 1,200 members consist of every discipline of engineering, every discipline of natural science, and many disciplines of technology. Our members are -- live in the community, we are parents, we have grandchildren, some of us, and we do care about the future of the planet and the future of Ontario. We also support nuclear power.

With me is Peter White, the president of the society. Peter is an engineering physicist by training, and he's a safety expert. Also with me is Thomas Marshall, who is a young technologist. He's in robotics and process control.

This is the outline of our presentation, and I'll go through it fairly quickly if I can. I already said that. The economic benefits to Ontario, I believe, are relevant to part of this assessment. There will be about 1,100 permanent hi-tech jobs for the next 60 years. That's what will be created at Darlington by a two-unit station. I'm not really talking about a four-

unit station. And for this two-unit station there'd be as many as 3,000 construction jobs during the peak.

Thirty thousand Ontarians in the CANDU supply chain provide precision manufacturing, maintenance and engineering services. That's the current CANDU industry. Recent CANDU construction in China, I give as an example, used 80 percent nuclear components made in Canada. This is relevant because there are very few industries where we ship manufactured goods to China, this is one of the few, and it's one of the last major Canadian technology exports.

We believe that they provide value for ratepayers. CANDU reactors have historically been amongst the best performers in the world. According to the WANO statistics current to September 31st of 2010, four of the top five performing reactors in the world out of about 440 were CANDU reactors. I think one of them -- one or two of them was Bruce, the other one might have been Darlington, and two of them were CANDU 6s, which we built and designed.

The components for CANDU reactors are built locally, most of them in Ontario, and

both the proposed designs that we have for Darlington VEC6 and ACR are modular in design which reduces construction risk. A lot of people have complained about cost overruns in the past.

I also want to point out nuclear power's historically cost competitive with coal. Cradle to grave, I don't mention coal because it's a good thing, but coal is generally acknowledged to be cheap. And certainly in jurisdictions where they're building a lot of electricity generation like China and India, they're building a lot of coal plants, and they're building a lot of nuclear plants, and mostly because they perceive those to be the cheapest.

We've been providing nuclear power in Canada now for effectively -- well, 57 years. Actually the reactors go back more that, the research reactors. Power reactors go back to about 1962, and they make -- last year was about 52 percent of Ontario's electricity. Not supply mix, it actually only accounts for about 33 percent of Ontario's generating capacity.

I mentioned China and India are pursuing nuclear due to its proven economics and environmental benefits. And also for those people

who have talked about cost overruns, we have historically focused on building reactors overseas, and our last seven projects came in on budget or on or ahead of schedule, and that’s in countries like China, Korea and Romania. The historic cost overruns most recently at Darlington was not a project which -- which we built.

We want to point out that there have been a lot of design improvements in new reactors. There is a new regulatory document. I'm sure the CNSC can tell you about RD-337, which embodies many of these new tight emission requirements and both of our designs that we propose that our members have designed will meet these.

We don’t believe there are any adverse health impacts from existing designs that we have seen. And we do believe that the improved designs will reduce the already low emissions even further.

We’re not experts on health effects of -- of radiation, but we have read the epidemiological studies and they seem to consistently demonstrate that there's no connection between the very low levels of radiation released

by nuclear plants on human health. I think you've heard numbers like 10 microsieverts per year in the vicinity of nuclear facilities compared to a thousand microsieverts as natural background.

I do want to point out there are places in the world where the natural background is hundreds of thousands of microsieverts a year and even in those places, in India, for example, they don’t see increased incidences of cancer that I'm aware of, and I refer to the Durham study which already has been referred to by other people.

I also want to point out the nuclear workers -- and many of our members are nuclear workers. They work at plant sites. They do refurbishment. They're exposed to much more radiation than the general public and certainly I do reference a report where our health is as good as or better than the general Canadian population.

Ionizing radiation is generated in the reactor core, given off by used fuel. I do want to point out that our fuel is safely contained in many redundant barriers. And it’s also worthwhile pointing out that natural gas and coal plants also have emissions. They don’t contain them or sequester them the way we do. They just

blow them up in the sky. And it’s a fact that residents near coal plants are exposed to more ionizing radiation than residents in nuclear facilities because coal has a certain ingrained uranium concentration that is released into the atmosphere.

It’s about 99.9 percent of exposure to the public is from potassium-40, typically found in most food; radon gas; radium from decay of natural uranium -- I think you're aware of this; and medical diagnostics such as CT scans, x-rays, nuclear medicine, and I add that cells can't really distinguish if the gamma ray that’s causing ionization is coming from potassium-40 or from x-rays.

I'll just add an anecdote of my own personal experience. I used to work at Chalk River laboratories, which is a nuclear site. I once had a nuclear medicine test in 1989 and five weeks after that test, on the way into work, I set off the radiation detectors. So I was too radioactive to work in a nuclear facility five weeks after I had the test, which was a lifesaving test.

I looked at alternatives. I think

it's important as any -- part of any environmental assessment is to look at alternatives. And understand that Ontario has a variety of energy sources; hydroelectric power, coal, natural gas, nuclear, wind and solar. One thing that's generally not appreciated by most people in this province is we have one of the lowest greenhouse gas footprints of any electricity-generating system in the world. It's about 200 grams of carbon dioxide per kilowatt hour. And nuclear provides 50 percent of that electricity with exceptionally low greenhouse gas emissions.

In 2009, CANDU reactors produced 85 terawatt hours of electricity in Ontario, which is why I made the statement earlier. Understand that if this electricity had been generated by natural gas instead of nuclear, it would have contributed 42 million extra tonnes of greenhouse gas emissions to the environment, which is the equivalent of about eight more -- eight million more cars on the road -- annual emissions from eight million cars.

We recognize that nuclear power is not completely greenhouse gas emission free if the entire life cycle of a nuclear plant is considered,

and other people have made this point. And this is because fossil fuels are used in mining and construction, but understand that these emissions are miniscule. They're in the range of four to 16 grams per kilowatt hour compared to a thousand grams for -- for coal or 500 grams for gas. And these low life cycle emissions are even acknowledged by the antinuclear group Pembina, who pegged that number at about four grams per kilowatt hour. And this is a comparative graph showing the greenhouse gas emissions from different sources using life cycle studies.

We want to talk about natural gas because it’s an important part of Ontario’s electricity-generating system. However, we want to point out that an electricity-generating system with a high reliance on natural gas is not sustainable. Natural gas is used for home heating, one of its most efficient uses, and it’s also used as a feedstock for materials such as plastic, fertilizer, antifreeze, fabrics, and even for hydrogen production.

And on average, 50 percent of the energy generated by burning natural gas is actually converted to electricity when you do that. The

rest is waste heat. That's actually good compared to most thermal sources, but it's bad compared to using natural gas, for example, for heating your home where the efficiency is close to a hundred percent.

Uranium by contrast is a non-renewable resource. There are very few uses for uranium other than electricity production so, unlike natural gas, using uranium to generate electricity will not create a resource deficit in a more useful area.

Nuclear reactors also have the unique ability to breed new fuel while using uranium. In fact, much has been made about plutonium. Plutonium is in every single nuclear reactor. About half of the electricity in Ontario is generated by nuclear power and about half of that is made by plutonium. It's in the core of the reactors. Plutonium is used to generate electricity. It's -- it's a good thing because it's used up. And there are proven existing technologies that can actually breed more fuel than they use and the point we want to make is that using breeder technology of the nuclear fuel resource is virtually limitless.

A few points to make are the CANDU reactors are the preferred thermal reactor design for utilization of thorium as an alternative nuclear fuel. It’s one of the things I work on. It’s three to four times as abundant as uranium in the earth’s crust and currently exploitation of this is underway with ourselves and with the Chinese. And I want to make the point that when we run out of coal, natural gas, all of these fossil fuels, we will still have an abundance of fissile material to use in nuclear reactors to make electricity.

This is one thing -- I don't know if it’s been touched on by anyone else, but we are touching upon it. There is new technology coming on the horizon and it will have an impact on baseload electricity requirements. And understand, our definition of baseload is -- is the electricity that you need at two o'clock in the morning in the middle of winter and the middle of summer. It’s the electricity demand below which the demand never falls. And understand currently 85 terawatt hours of nuclear power -- it can be replaced by a combination of renewable source -- it can't be replaced by a combination of renewable sources and

-- and conservation efforts. It's a lot of energy and it's extremely difficult for us to imagine how you could do so.

We can see a -- a use for renewable energy, intermittent renewables in conjunction with other things, but understand that those countries where they have the largest penetration of renewable resources -- those are Germany, Denmark and Spain -- they rely extremely highly on fossil fuels to generate their electricity and that's not a coincidence because intermittent renewables and fossil fuels go hand in glove.

This is what I meant to talk about, new technology and future baseload electricity requirements.

One thing that is coming because peak oil is either here or almost here is the electrification of the transportation system. The price of gas has already gone up to the point where using electric cars as a second vehicle are almost economically feasible and we believe that when this happens, it can happen quickly and it can have a profound impact on baseload requirements.

The analogy I would use is 15

years ago nobody had a DVD player in their house. They all had VCRs. Right now, nobody has a VCR in their house; they all have DVD players and it can happen that fast.

A compact electric car, a very compact one, would need about a kilowatt hour of electricity to travel five kilometres. And if you work your way through the arithmetic, if you actually converted all the vehicles in Ontario to compact electric vehicles, you would need 10,000 megawatts of extra baseload and that's a very, very conservative extrapolation. It assumes that you only charge your cars in the middle of the night. It assumes that you only slow charge them over an eight-hour period, not fast charge them. Once you start introducing flexibility like that, your -- your generation requirements actually go up. And the question I ask is where is this electricity going to come from? If you're going to burn fossil fuels to make electricity to drive electric cars, it just makes no sense.

So in summary, building a new CANDU reactor at Darlington, we believe, will benefit our present CANDU fleet. The work to design and build a new reactor will help preserve

Ontario's highly skilled workforce. The challenges of this work attract a talented workforce. I think we have a very talented workforce. And we also believe that selecting a CANDU reactor is an investment in maintaining engineering, scientific and technical expertise. And we really believe that CANDU technology will help substantially release -- reduce our greenhouse gas emissions as a society.

We don't believe that Ontarians should be concerned with the safety of nuclear installations. Those who are should understand that, you know, we who design these reactors, we live in this community. We have a vested interest in ensuring that our products that we supply are safe and a good choice for the environment and we feel very strongly that we are. And we thank Ontario Power Generation for the extensive environmental assessment they've undertaken and feel confident as technical experts and Ontarians that the public industry has been thoroughly satisfied.

Now, I want to make the point that when we put this presentation together, it was about one day before the Fukushima accident. And

we didn't know it was going to happen at the time, but we asked for an extension until Monday and they said, “Sure”.

So we put in these two slides not knowing what the result would be or if we would be sold in the meantime.

But the two things tie together, the accident and AECL restructuring, which we believe, you know, will have an impact on things going forward.

I didn’t know what to put in these slides, so this is where they were.

And I want to make these concluding remarks to our presentation.

We’d like to discuss the future role of Atomic Energy of Canada in light of the events in Japan and the Conservative Government’s imminent privatization of AECL and how this may impact the future safety of Canadian nuclear plants, such as Darlington.

As you know, the Conservative Government has been trying to sell the commercial side of AECL for almost two years.

The Federal Government is on record as stating the sale will be a 100 percent

privatization of AECL.

As stated earlier, we're the designers of CANDU technology, and we provide a critical role in supporting the ongoing safe operation of CANDU reactors in Canada.

What can we learn from the events in Japan?

We're not going to smug or arrogant and tell you that our reactors are perfectly safe and nothing will ever happen to them.

We know that there will be lessons to be learned from the events in Japan.

The Japanese operator of the damaged nuclear power plants is the utility TEPCO analogous to our own Ontario Power Generation or Bruce Power.

During the crisis, however, TEPCO turned to the original designers of their reactor, General Electric, to help them manage the crisis because they know the boiling water reactor designed the best -- it's General Electric's design.

Similarly, our members know Canada's CANDU designed the best.

The 40-year-old power plant in Fukushima is roughly the same age as some Canadian CANDU units.

The fact that the designer, General Electric, still maintains a team of scientists and engineers who were able to respond to this crisis is important for our government to understand and a significant point for our regulator, the CNSC, to note.

A sale could easily result in AECL being carved up in pieces which would put at risk the design, engineering, and safety team that can be called upon in the event of an emergency.

Our members believe that we design the safest reactors in the world.

Indeed, we believe that based on the limited detail available about the sequence of events at the Fukushima plant, the same problems would likely not have occurred at a CANDU plant.

CANDUs, for example, have a secondary heat transport system that can be used for passive cooling without pumps in the event of a power outage.

In addition, CANDUs have a huge inventory of water inside reactor containment

compared to other designs and less fuel, hence less decay heat.

It's the decay heat of that fuel and the inability to deliver enough water into the reactor core that's causing the ongoing problems at that plant.

Still, we know that there are likely to be lessons learned from those events, not just for boiling water reactors, but for other designs as well.

The lessons may be changes in operating procedures. The lessons may be design changes for future plants or retrofits to -- or retrofitting new designs to existing plants.

Our members were the CANDU designers, and we will play a crucial role in implementing any lessons learned; that is, if we're still around to analyze, assess, and implement any lessons learned.

Our information is that while the events in Japan continue to unfold, AECL is on the brink of 100 percent privatization. This is a very bad idea, and events in Japan underline why it's such a bad idea.

The sale of AECL will almost

certainly lead to the breakup of the CANDU Design Authority and a loss of expertise needed to ensure plants run safely and effectively decades into the future.

This is an obligation that our Federal Government has to both Canadian citizens and those in other countries to whom we've sold reactors.

These obligations cannot be privatized.

Indeed, maintaining the critical mass of CANDU reactor design knowledge to keep our plants safe is not a private sector mandate. It's the mandate of the Government of Canada which answers to the Canadian people.

The Federal Government executes this mandate through the CNSC and through AECL.

The safety of Canadians is paramount.

It's not in the public interest to allow a sale of AECL if there is a risk that the design authority is weakened or broken apart.

The CNSC website indicates that there are 11 safety areas, among them is design and safety.

According to the site, it relates to the activities that impact on the ability of systems in a facility to continually meet their design intent given new information arising from operating experience, safety analysis, or the review of safety issues.

This is exactly why the CNSC is right in making this a condition of a license.

The continuing changes that affect a nuclear plant require the requisite skill set be available.

We know from publically-available information that the potential buyer, SNS-Lavalin, does not appear to have an interest in all aspects of our company, which will likely result in a breaking up of our design team.

We have been very vocal in expressing our objection to an outright sale of AECL, and yet, as we speak, the Federal Government appears intent on concluding the final steps of the sale.

Indeed, expert consultants hired by the Federal Government have told us that they see no difference between the cell phone industry and the nuclear industry.

Let me be clear, there's a big difference.

And a company such as SNS cannot nor should they be expected to execute a public mandate.

In a mad dash to sell AECL cannot possibly lead to a decision that's good for Canadians or for CANDU owners abroad.

The Federal Government must ensure that when it is time to implement the lessons learned from the Fukushima-Daiichi nuclear power plant, there are people still working at AECL or its successor who are qualified and competent to implement any design improvements.

This is in the best interest of a sale -- of Canadians, not a fire sale coupled with an avocation of the government's responsibilities.

The CNSC has been mandated to set regulatory policy direction on matters relating to health, safety, security, and environmental issues affecting the Canadian nuclear sector.

We call on the CNSC to report back to the Federal Government that the 100 percent privatization of AECL is an unacceptable risk to the industry and Canadians.

Officially, OPG is considered the design authority for CANDU plants that they operate.

While OPG carries the license and the burden to show compliance, this could become extremely difficult, if not impossible, given the level of safety required if the expertise at AECL is lost.

The old Ontario Hydro once had a comprehensive team of design and safety experts and could design reactors as well as we could.

However, that expertise was lost through the 1990s, the final blow coming with the breakup of Ontario Hydro.

Although OPG has an exceptional technical staff, they don’t have the same skill set that we do. It’s just different.

Just as CANDU 6 operators in New Brunswick, Quebec, and around the world call on us to disposition difficult technical issues from the CNSC, so, too, from time to time, does OPG.

Yet people like myself, Peter, Thomas, and 1,200 others who represent the existing CANDU design knowledge may not be working in this field a year from now.

Before any permission is given to move forward with new nuclear construction, the CNSC must call on the Federal Government to secure the long-term viability and continuity of the design authority for the CANDU reactors in Canada.

Thank you.

CHAIRPERSON GRAHAM: Thank you very much, Mr. Ivanco, for those remarks and your presentation.

I will now go to panel members.

Mr. Pereira?

--- QUESTIONS BY THE PANEL:

MEMBER PEREIRA: Thank you, Mr. Chairman.

Thank you for your very interesting presentation. You talk about the engineering aspects and socioeconomic issues.

As you know, as part of our mandate as a joint-review panel, we're looking at the environmental assessment.

And in that part of the decision -- part of the assessment is looking at the sustainability of the proposed project.

And in important consideration there is the long-term legacy of waste that comes

from nuclear generation and how that will be handled in a manner which will not burden future generations.

Have you any comments on how that challenge should be addressed?

MR. IVANCO: Sure. I can comment on it. I'm not an expert in nuclear waste disposal, but I certainly know a lot about nuclear power.

Understand that -- for example, it was mentioned that 20,000 tonnes of waste exist at the Pickering site. That site is 40 years old, and it's been generating electricity for a long, long time. And people don't realize just how small of volume 20,000 tonnes of uranium dioxide is. It would probably fit in half this room -- would be my guess. It's -- and that's generated electricity for millions of people for 40 years.

I think the amount of nuclear waste each household is responsible for in an average year is about the size of a double A battery.

And of that material, only 2 percent is actually waste. The rest of it is uranium that's the same as the stuff that came out

of the ground.

Different countries deal with it in different ways.

In France, they reprocess their fuel. They take out the 2 percent that's waste, and they put it in glass, and they dispose of it.

Some people plan to bury everything.

And I've heard statements saying that you can't guarantee that you can bury nuclear waste forever.

I just want to point out that the most rich uranium deposit in the world is in place in Saskatchewan called Cigar Lake. It's 24 percent rich uranium, or it's so radioactive you can't mine it with people. You have to use robots. And that deposit has been there for over 1 billion years longer than the Rocky Mountains. So it's older than the Rocky Mountains. And they've had no leakage from that site in a billion years.

MEMBER PEREIRA: Thank you.

No more questions, Mr. Chairman.

CHAIRPERSON GRAHAM: Madam Beaudet?

MEMBER BEAUDET: I have one

question in the same line of thought as my colleague here.

MEMBER BEAUDET: We had numerous submissions, whether written or oral, on tritium, and ways to try to reduce, and how low, and in the drinking water, et cetera, and when you look at EC6 the emission for tritium is even higher than the other technologies that we have to study, to review.

I was wondering, your society, you probably have subcommittees, do you have a subcommittee or a committee that would review, research, or new developments and evaluate effects on the environment because our scope of study is to try to determine if there is a significant effect with the project, and if there is, we need remedial measures and follow-up programs. I'd like to know if your society, you sort of look into these things, especially when you want to develop, or build rather, CANDUs?

MR. IVANCO: I can answer that. We don't, as a society, look into it. We have members who do work in that area, who work for Atomic Energy of Canada.

I just want to point out that when

it comes to tritium you're talking about something which exists in small quantities, and I know that Ontario Power Generation has developed technology to remove it from the reactors.

You have to understand, in this industry one person's waste is another person's fuel. And in this case tritium is also perceived by many people in the world as fusion fuel for the future. And I know that a lot of the tritium that's taken out of the Darlington reactors goes to places like Japan and France where they do fusion research with it, so, I mean, there are methods to extract it. I personally, as a scientist, I don't see it as waste, I see it as fuel.

MEMBER BEAUDET: Thank you.

My other question would be to OPG, and it is just cross-checking some figures we received on March 30th, volume 9 of the transcript, page 252. And you gave us -- we had here one of the slides of the presentation regards greenhouse gas emissions, and Mr. Sweetnam, you had given us figures for CO2 emissions for nuclear, wind, et cetera, and you first said that it was lifecycle. Did you mean lifecycle from cradle to grave? That's my -- first part of my question.

And did you mean lifecycle not just for nuclear, but also for wind, solar, I mean natural gas especially?

CHAIRPERSON GRAHAM: Madam Beaudet, maybe you -- I don't think OPG got the page of the transcript.

MR. SWEETNAM: It's okay.

CHAIRPERSON GRAHAM: Did you get that?

MR. SWEETNAM: Yes.

CHAIRPERSON GRAHAM: Okay. Could you give that again perhaps?

MEMBER BEAUDET: Page 252. Sorry about that.

CHAIRPERSON GRAHAM: And that's the March 30th transcript.

MR. SWEETNAM: Albert Sweetnam, for the record.

Yes to both of your questions.

MEMBER BEAUDET: Thank you.

Thank you, Mr. Chairman.

CHAIRPERSON GRAHAM: Thank you, Madam Beaudet.

One question I have for OPG. Following the statement of Mr. Ivanco with regard

to the privatization of AECL, is -- is that a concern of OPG if a CANDU technology is chosen, to have the backup and the -- the backup from private companies versus AECL? Is that a concern that you have going forward?

MR. SWEETNAM: Albert Sweetnam, for the record.

As the operator of most of the CANDU units in the world, OPG has a very long relationship with AECL. I don't know if many people know that the actual Darlington station was actually not done by AECL, but was done by Ontario Hydro, who actually did the design in conjunction with staff from AECL.

OPG has a licensing agreement with AECL that provides us access to the intellectual property associated with our designs. We are allowed to utilize these -- this intellectual property for the maintenance of our reactors.

If AECL does not exist anymore in its present form and we are not able to enter into an arrangement with the new owner of AECL, that agreement allows us to proceed to third-party vendors with that IP, provided we utilize it only for the maintenance of our reactors and not to

build a new reactor.

So we are not concerned. As the low cost producer of electricity in Ontario, we are quite forward thinking in terms of the risk associated to our industry. We have addressed this risk quite a while back and we have been dealing with this situation for over a year.

We have plans in place at the moment to deal with that eventuality if it does happen. If AECL does not exist anymore we have plans in place to deal with how would we maintain our units, how do we refurbish our units, and how do we utilize intellectual property associated with those units.

In terms of the new build, if for whatever reason AECL does not exist, then there would obviously not be a CANDU product offered by a vendor, and then we would deal with the other technologies.

Our understanding of the federal restructuring process of AECL is that some -- they will be discussing with a new owner of AECL, and our expectation is that this new owner would offer a CANDU technology.

And as I stated on the record

before, the position of the Ontario Government is to negotiate first with the new owner of AECL.

CHAIRPERSON GRAHAM: Madam Beaudet, do you have anything further?

Thank you very much, Mr. Sweetnam.

Now we go to the floor. Do you have any questions to the Society?

MR. SWEETNAM: Albert Sweetnam. No questions.

CHAIRPERSON GRAHAM: CNSC?

MR. HOWDEN: No questions.

CHAIRPERSON GRAHAM: Government organizations?

Intervenors and Mr. Kalevar?

--- QUESTIONS BY THE INTERVENORS:

MR. KALEVAR: Thank you, Mr. Chair.

I am a graduate engineer from Waterloo and an MBA from McMaster, but if anywhere I have even a slight medical problem, and if there is an engineer and there is a nurse before me, I will take the advice from the nurse any day. I just wanted to make that clear. So when it comes to medical effects that the nurses have brought to your attention and the claims from --

CHAIRPERSON GRAHAM: Your question, Mr. Kalevar, please?

MR. KALEVAR: The question now to the engineers, as an ex-engineer and an MBA, is since you say that CANDU is so safe and all that, how come you are not able to get any insurance from the insurance industry? Why do you have to depend on the tax dollars for your insurance?

CHAIRPERSON GRAHAM: I think the insurance issue has been answered several times, but if you would care to comment?

MR. THOMAS: Well, I was going to say, I mean, obviously that is a policy issue that is dictated by the government and by the legislative process that we use.

The insurance companies are out there to work in a policy environment, so we can't comment on how they conduct their business activities in that policy environment.

CHAIRPERSON GRAHAM: Thank you. With that, that concludes our agenda for today I believe.

I want to thank everyone for participating today. Tomorrow, being Saturday, we will reconvene and we will do that tomorrow morning

at 9 a.m., same place, same station. We will be here at 9 o'clock tomorrow morning to reconvene with further intervenors.

Thank you very much, everyone, for your participation today. Mr. Ivanco and your team, thank you very much for coming and thank you for your presentation and your expression of concerns.

Adjourned.

--- Upon adjourning at 3:45 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

1