

Deep Geologic Repository  
Project

Projet de stockage dans des couches  
géologiques profondes

Joint Review Panel  
Public Hearing

Commission d'examen conjoint  
Audience publique

September 16<sup>th</sup>, 2014

Le 16 septembre 2014

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Kincardine, Ontario

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Joint Review Panel

Commission d'examen conjoint

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Kincardine, Ontario / Kincardine (Ontario)

--- Upon commencing on Tuesday, September 16,  
2014 at 9:00 a.m. / L'audience débute le  
mardi 16 septembre 2014 à 9 h 00

**OPENING REMARKS**

**MS MYLES:** Good morning everyone  
and welcome to the Joint Review Panel Public  
Hearing for the Deep Geologic Repository for Low  
and Intermediate Level Radioactive Waste Project.

My name is Debra Myles and I'm  
the Co-Manager to the Panel.

We have simultaneous translation,  
the English is on Channel 1 and French is on  
Channel 2, headsets are at the back of the room.  
Please keep your speech relatively slow for the  
translators.

A written transcript is being  
created for all proceedings and will reflect the  
official language used by each speaker.

Transcripts are posted on the  
Canadian Environmental Assessment Registry  
Internet site on the DGR Project page. To make  
the transcripts as meaningful as possible, please

identify yourself before speaking.

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

The hearing is being webcast live and the webcast, as well as the archived webcasts are available on the homepage -- through the homepage actually, of the Canadian Nuclear Safety Commission at [www.nuclearsafety.gc.ca](http://www.nuclearsafety.gc.ca).

A schedule for the additional hearing days was posted on the Registry on August 26th. Daily agendas that reflect changes made since the 26th are prepared and posted on the Registry each day.

The hearing will begin at approximately 9:00 a.m. and end at approximately 5:00 p.m. each day.

Emergency exits are located at the back of the room and behind the screen to my left. Washrooms are in the lobby of the main entrance and the wheelchair ramp and access are located in the back parking lot.

In the event of a fire alarm, please leave the building immediately.

If you are scheduled to make a

presentation at today's session, please check in with a member of the Panel Secretariat.

If you are a registered participant and want to seek leave of the Chair to propose a question for a presenter, you are asked to speak with a member of the Secretariat as well.

If you are not scheduled to make a presentation today but would like to seek leave of the Chair to make a brief oral statement, the opportunity may be provided subject to the availability of time each day and it must be for the purpose of addressing one or more of the six subjects that are the focus of this hearing.

As I said, opportunities for either a proposed question to a presenter or a brief statement at the end of today's session may be provided on a first-come first-served basis, time permitting.

In accordance with the Panel's hearing procedures, the resumption of this public hearing is solely for the purpose of addressing the six subjects of the Information Requests by the Panel since November, 2013.

Neither presentations nor

questions will be permitted if they do not follow the hearing procedures.

Anyone who wishes to take photos or videos of today's session should speak with the Joint Review Panel's Communications Advisor, Lucille Jamault.

Thank you very much.

Dr. Swanson...?

**THE CHAIRPERSON:** Good morning. On behalf of the Joint Review Panel, welcome everyone here in person or joining us through the webcast.

My name is Stella Swanson, I am the Chair of the Joint Review Panel for the Deep Geologic Repository for Low and Intermediate Level Radioactive Waste Project.

I am going to introduce the other members of the Joint Review Panel. On my right is Dr. Gunter Muecke and on my left is Dr. Jamie Archibald.

We have already heard from Ms Debra Myles, the Co-Manager of the Joint Review Panel, and we also have Mr. Denis Saumure, counsel to the Panel, with us on the podium today.

As noted in the published agenda, the subject for today's session will be expansion plans for the DGR project.

I would like to note that we have a number of government departments on standby in the event that the Panel has any questions for them.

We will now proceed with presentations by OPG, CNSC and Environment Canada pertaining to the subject of expansion plans for the DGR project. The Panel will hear all three presentations before proceeding with its questions.

I would now like to call on OPG to begin their presentation, which is based upon PMD 14-P1.1E.

Ms Swami, the floor is yours.

**PRESENTATION BY / PRÉSENTATION PAR:  
ONTARIO POWER GENERATION**

**MS SWAMI:** Good morning,  
Dr. Swanson and Members of the Panel.

My name is Laurie Swami, I am the Senior Vice President responsible for

Decommissioning and Nuclear Waste Management for OPG.

Today OPG's presentation is on the potential future expansion for the DGR facility. Mr. Jerry Keto will provide our presentation.

Mr. Keto is OPG's Vice President of Nuclear Decommissioning. In this capacity he is accountable for managing OPG's decommissioning liability for all of its nuclear assets, including the upcoming shutdown of the Pickering Nuclear Generating Station.

He is accountable for the execution of the DGR project.

Mr. Keto...?

**MR. KETO:** Good morning. For the record, my name is Jerry Keto, Vice President, Nuclear Decommissioning for Ontario Power Generation.

I'm joined this morning by Dr. Paul Gierszewski, Director of Safety and Licensing with the Nuclear Waste Management Organization.

The purpose of the presentation today is to discuss the potential future



expansion of the low and intermediate level waste deep geologic repository. I will discuss the considerations for an expanded facility that was assessed as part of the design development for the various components and phases of the project.

Dr. Gierszewski will provide an overview of the assumed decommissioning waste characteristics and the impacts of these additional wastes on conventional safety, as well as both the pre- and post-closure safety assessments.

I will then discuss the relative timelines for a business decision to expand the DGR, bounding it by the earliest timelines to accommodate decommissioning waste and the latest being the end of the planned DGR operational period.

As noted in the 2013 hearings, OPG are not requesting a site preparation construction licence for an expanded DGR to accommodate decommissioning waste. Any future expansion of the facility would require a separate and complete regulatory and environmental approval process.

Consistent with the EIS

Guidelines, an expanded DGR for decommissioning waste was considered a foreseeable project and, as such, was considered in the cumulative effects assessment.

However, there are several uncertainties that can influence a future decision to expand the DGR facility. These include the volume of waste to be received, the characterization of the waste and when the waste will be received. These will then influence the design of the facility expansion and support the preparation of the pre- and post-closure safety assessments.

OPG received three Information Requests related to the potential future expansion of the DGR. EIS 12-512 requested OPG to provide a technical assessment and all associated reports for a proposed DGR to dispose of decommissioning waste from the Darlington, Pickering and Bruce nuclear generating stations, as well as the anticipated timing of these expansion activities.

Although such a formal stand-alone technical assessment was not completed as part of the environmental assessment, the

considerations for expansion of the DGR facilities and structures, assumptions of decommissioning waste volumes and characteristics, and planning timelines were provided and will be discussed in this presentation.

EIS 12A-512 requested further clarification of the consideration for conventional safety of occupied underground areas for the extended timelines, short and long-term safety implications and a graphical representation of the relative timelines for the conceptual expansion.

EIS 12B-512 requested the maximum doses for each of the preliminary disruptive scenarios provided in the response to EIS 12A-512.

Slide 5 shows the relative positioning of a conceptual DGR expansion layout at the Bruce nuclear site. North is to the right of the slide. The expansion, optimizing existing infrastructure, repository access and positioning within the Cobourg formation is south of the proposed DGR.

While the surface installation is

contained within the proposed DGR project site, the expanded underground footprint is not close to Lake Huron and is within the boundary of the Bruce nuclear site.

Supported by the detailed characterization activities for the current DGR application, it is expected that the Cobourg formation can accommodate the additional panels to the south of the proposed DGR.

This will need to be verified through future site characterization with additional deep boreholes. It will also incorporate experience gained through the construction and operation phases of the proposed DGR.

As mentioned in the previous slide, an expansion would utilize the existing infrastructure at the site. Consideration in the sizing and configuration of underground services and ventilation have accounted for the potential of future expansion.

The underground openings have been designed for nominal 100-year design life. This was done to accommodate the potential for extended monitoring periods beyond the operations

phase, as well as to provide for repository decommissioning activities.

Geomechanical modelling and ground support have also been considered for these extended periods. A description of proposed ground support methods, as well as monitoring and replacement, were provided in OPG's Information Request response.

The potential safety implications of an expanded repository will be discussed later in this presentation. Ventilation requirements and re-mobilizing for future construction have also been considered in the design. As these are required for the initial construction, they would need to be re-established for expansion development.

After the initial DGR construction, those systems and equipment not required for operations will be dismantled and removed so as to not require ongoing maintenance and management.

Waste emplacement would cease prior to expansion and the emplaced waste would be isolated by closure walls. As such, environmental emissions from the future

development would not be different from that of initial construction. It is assumed that similar construction and development techniques, for example conventional drill and blast, would be employed for the expansion. Therefore, there is no impact on the conclusions of the cumulative effects assessment with respect to underground construction.

Future surface impacts are limited to the OPG project site and planned facilities and structures. The only noticeable change is the increased size of the waste rock management pile. As described in the IR response, the waste rock pile would increase in size from 9 to 11 hectares and the height of the pile would increase from 15 to 35 metres.

The sizing of the stormwater management pond will be further assessed by OPG and the CNSC as agreed in the 2013 hearings. However, the ultimate sizing of the pond is not expected to be impacted by the expansion development.

All other facilities and structures as proposed can accommodate future construction activities. As mentioned in the

previous slide, this will include re-establishing equipment. For example, re-installing hoisting equipment at the ventilation shaft and associated waste rock handling systems.

Emissions associated with surface activities will be consistent with those of the planned construction activities as it is assumed that similar equipment would be used during the expansion. As most of the facilities will already exist, there would be less surface disturbance during expansion than initial construction. Therefore, there is no impact on the conclusions of the cumulative effects assessment with respect to construction of service facilities.

There are very limited changes in operational activities in an expanded repository. Prior to the initiation of construction, the Western Waste Management Facility would need to have sufficient capacity to store waste during expansion construction. Also, the emplacement rooms underground that are filled with waste would need to be isolated through the establishment of closure walls. All waste emplacement activities will cease.

Following construction, operations would resume with no material changes in the pre-closure safety considerations from that of the proposed DGR. This is further discussed in slide 11. There is no impact on the conclusions of the cumulative effects assessment with respect to operations.

I would now ask Dr. Gierszewski to discuss the nature of the decommissioning waste and the considerations of an expanded DGR on both the pre-closure and post-closure safety case.

**DR. GIERSZEWSKI:** Dr. Paul Gierszewski, for the record.

We do not have detailed information at this time on the volume and characteristics of the low and intermediate level waste from decommissioning. This characterization will be determined many years from now, closer to the period when the waste will be generated as part of decommissioning of the stations.

However, we know the general nature of the waste and have made preliminary estimates to support planning. The waste types



are expected to be similar to waste currently received from operations and refurbishment. The amounts of the various waste types will be different and the total radionuclide inventory will be higher. It is estimated that there will be approximately 135,000 cubic metres of as-packaged waste without consideration for volume reduction. About 10 to 20 percent of the total packaged volume will be intermediate level wastes. These account for the bulk of the radioactivity.

Assuming that all reactors initiate decommissioning 30 years following shutdown, the total radionuclide inventory is estimated to be 390,000 terabecquerels. This information, although preliminary, has been used to provide a safety assessment in response to this Information Request.

The preliminary estimate for decommissioning wastes assumed that most metal wastes would be simply disposed as-is. This estimate results in a large amount of low level waste metal. This in turn would result in large amounts of hydrogen gas generation within the repository over long times.

Since this is mostly surface contaminated metal, there is opportunity to reduce the metal content of the wastes. Importantly, the net result would be the same for radionuclide inventory, but a smaller amount of metal to be accommodated within the repository. This would be considered as part of future updates to the estimates for waste from decommissioning.

The conventional safety considerations for an expanded DGR are very similar to those of the planned DGR. Although the expansion would extend the operating life of the facility, relevant underground structures have been designed for a nominal 100-year life. Furthermore, the repository design takes into consideration the inherent requirements for long-term stability.

The DGR planned geotechnical activities will monitor the effectiveness of ground stability over time. Where required, ground support would be augmented or replaced. We note that there are examples of facilities operating over these periods of time in similar geologic settings, such as the Norton Mine in

Ohio, which has been open since the 1940s. The photo shows the Barberton Mine in the U.S. which is at similar depth to the DGR and was operated for over 40 years.

During operations the radiological impact for the assumed decommissioning inventory would be similar to those for operation and refurbishment waste. This is because the waste package off-gassing of volatile radionuclides such as tritium and carbon-14 would be similar.

For workers who could be exposed to gamma radiation, such as from cobalt-60, the OPG radiation protection requirements would ensure that the worker doses would remain within the OPG dose targets. Therefore, there is no impact on the conclusions of the cumulative effects assessment.

As per the Information Request, post-closure dose impacts for waste from decommissioning were estimated, however, these impacts are based on very preliminary calculations and would require detailed waste characterization and a revised safety case with detailed analyses.

This slide summarizes the potential impacts of including decommissioning waste within the DGR. It shows the maximum calculated dose rate for three normal evolution scenario cases and for disruptive scenario cases. These results generally show an increase in the maximum dose due to the increased inventories of key radionuclides in the expanded repository.

However, doses would remain orders of magnitude below the dose criterion for normal evolution scenarios and within the risk criterion for disruptive scenarios. Therefore, there is no impact on the conclusions of the cumulative effects assessment.

**MR. KETO:** Jerry Keto, for the record.

The following slides illustrate two planning scenarios for a decision on expanding the DGR to accommodate decommissioning waste. The early and late scenarios show the range in timelines from which a decision could be made.

In both scenarios it is assumed that additional DGR site characterization would be required to support a decision to proceed and

an additional four years would be required to prepare for and obtain regulatory approval for expansion.

As much of the site infrastructure to support development will be in place, construction is assumed to be approximately four years. In both cases, a decision to expand the DGR would be made in several decades.

The early scenario aligns with the earliest possible dates that low and intermediate level waste from decommissioning could be available. This assumes that decommissioning starts approximately 30 years following the safe storage period. As such, a decision to expand the facility would be required by approximately 2035, preceded by site characterization activities to have the facility available to receive waste by approximately 2044.

This timing also coincides with the filling of panel 2 and allows for the initial closure walls to be installed. Following construction of the expanded repository, the operations would resume and continue for approximately 50 years, extending the life of the

DGR by approximately 30 years to 2095.

The start of decommissioning for both Darlington and Bruce nuclear stations also assume that decommissioning occurs 30 years following shutdown.

The late scenario is driven by the end of the planned DGR operations in the early 2060s. A decision would be required to expand the DGR facility for decommissioning waste or close and decommission. Decommissioning waste from Pickering would need to be placed in interim storage pending a decision to expand. Should the decision be to expand the DGR, Darlington and Bruce nuclear station decommissioning activities would occur following the expansion and could be received directly.

The operations phase to emplace decommissioning waste is reduced in this scenario and, as with the early scenario, emplacement activities are complete in 2095.

In conclusion, OPG is not seeking approval for the expansion of the DGR for decommissioning waste. The placement of decommissioning waste in the DGR is a planning assumption. There are many uncertainties that

would influence the scope and timing of such an expansion. However, the expansion has been considered as part of the design in the EIS through the cumulative effects assessment and its considered to be both technically feasible and not likely to result in significant adverse environmental effects.

**THE CHAIRPERSON:** Thank you very much.

We will now continue by proceeding directly to the presentation by the Canadian Nuclear Safety Commission which is PMD 14-P1.2E.

Dr. Thompson, please proceed.

**PRESENTATION BY / PRÉSENTATION PAR  
CANADIAN NUCLEAR SAFETY COMMISSION**

**DR. THOMPSON:** Good morning, Madam Chair and Members of the Panel.

My name is Patsy Thompson. I'm the Director General of the Directorate of Environmental and Radiation Protection and Assessment with the Canadian Nuclear Safety Commission.

With me today are Ms Kay Klassen, Senior Project Officer for Licensing of Waste Management Facilities; Ms Kiza Francis, the Environmental Assessments Specialist on this project and Dr. Son Nguyen, Geoscience Technical Specialist, who are available to answer questions.

CNSC staff's presentation will focus on the effects -- the information provided by OPG had on the cumulative effects assessment.

CNSC staff did review the information to determine the impact the information had on the current licence application. Should OPG apply to expand the facility sometime in the future, CNSC staff would initiate the regulatory process at that time and this would include an environmental assessment and a review of the licence application.

I will now ask Ms Klassen to continue with the presentation.

**MS KLASSEN:** Good morning. My name is Kay Klassen.

EIS 12-512 concerns the possible expansion of the DGR project for additional low and intermediate level radioactive waste



resulting from future decommissioning of OPG-owned reactors in the context of cumulative effects assessment from the EIS Guidelines.

The presentation will provide related background information, a summary of the JRP's information request to OPG, the main points of OPG's response, the basis on which CNSC staff assessed the response and the results of our review.

CNSC staff's assessment of the impact of this additional information on our 2013 EIS and licensing PMDs to the Panel will also be discussed.

To provide some background information, OPG's project description was submitted to the CNSC in late 2005 to initiate the environmental assessment process under the *Canadian Environmental Assessment Act*. The project description was for a geologic repository for the long term management of low and intermediate level radioactive waste from OPG-owned or operated nuclear power reactors in Ontario.

The size of the repository was identified as approximately 200,000 cubic metres

emplaced volume of waste. The description also acknowledged that if the DGR was permitted to be deconstructed and then allowed to operate that sometime in the future OPG may want to develop a project to expand the repository for about an additional 200,000 cubic metres emplaced volume of low and intermediate level waste from decommissioning activities for OPG-owned and nuclear power reactors.

In 2011 an EIS and licence application to prepare a site and construct a DGR project was submitted. About half of the waste already in storage at OPG's Western Waste Management Facility at the Bruce site is at the Bruce site and the remainder is expected to be generated over the remaining period of planned operation and refurbishment of OPG's own owned reactors.

The expansion of the DGR is not part of the current proposed DGR project and is not included in the licence application being considered to construct the DGR project. Expansion of the DGR facility in approximately 2055 for additional waste has been assessed in the EIS under cumulative effects as a reasonably

foreseeable project, one identified in OPG's agreement with the Municipality of Kincardine.

In OPG's 2012 business plan the Pickering commercial operations were identified as ending in approximately 2020 with the expected transition to storage and surveillance phases from 2001 to 2051 and then the decommissioning phase from around 2051 to 2064. The operational plans for the shutdown and transition to storage and surveillance at Pickering are still in development.

Following the JRP hearings in the fall of 2013 the Joint Review Panel issued a series of related information requests, EIS 12-512 plus part "a" and part "b" asking for further information on the possible expansion of the DGR and the information request included the layout of the expanded facility and changes to the DGR project surface and subsurface layout, the facilities and structures, the decommissioning waste description and the timeline for a possible project; also, the implications to pre- and post-closure safety, sequencing and mitigation measures and the identification of the radionuclides important in the assessment of

post-closure disruptive scenarios for an expanded facility.

OPG's response was that the expanded DGR project would include two more underground panels located in parallel to the currently planned ones for an additional 200,000 cubic metres or so of emplaced waste.

The surface area for the expansion concept would remain within the proposed DGR project fenceline and would use the existing DGR project surface and underground systems and facilities to construct -- for construction of the expansion and then operation of the expanded facility. OPG also expects to apply proven and applicable mitigations from the DGR project to the expansion construction and operational activities.

OPG also provided information that described the low and intermediate level radioactive waste that would be generated from decommissioning activities. The waste material includes expected low-level gloves, Tyvec covers and other materials associated with workers at nuclear power plants, plus concrete pressure tubes, calandria tubes and end-fittings. That

waste is similar in its general description from waste from operation but with more concrete and metal content. It also does not include ion-exchange resin waste as they are associated with operations and are dealt with as operational waste.

OPG described the different early and late timelines for the receipt of waste arising from decommissioning activities, identifying construction could commence as early as 2040 or as late as 2068 and last approximately four years.

OPG also described the possible sequencing of waste panel use, identifying that if construction occurred early it was possible that waste from both operational and decommissioning activities could be stored together in the early scenario. The placement of operational waste would be ceased during construction of the extra panels.

OPG's response included the information requested regarding the implications of an expanded DGR on both pre- and post-closure safety. OPG discussed the effects of changes in timeline, the characteristics in inventory of the

waste from decommissioning activities, possible mitigations such as decontamination and recycling of low-level metal, additional decay time and additional shielding.

The application of experience from the DGR project, possible mitigations of containers to meet the radiation protection requirements and further sampling and testing of bedrock as needed near the area of the expansion.

I will now pass the presentation to Ms Kiza Francis to discuss CNSC's staff's review of OPG's response.

**MS FRANCIS:** Thank you.

For the record, my name is Kiza Francis. I'm the Environmental Assessment Specialist on this file.

The information provided by OPG in response to this information request was used by CNSC staff to confirm the cumulative effects assessment review. As per the *Canadian Environmental Assessment Act*, a cumulative effects assessment is completed by first considering the predictive residual effects of the proposed project, then examining the overlap in time, space and type of effect of past and

existing projects, planned projects and reasonably-foreseeable future projects with the predicted residual effects of the currently proposed project.

The assessment takes the predicted residual effects and looks at the overlap, then identifies if in areas of overlap there are any cumulative adverse impacts. If any cumulative adverse impacts are identified a determination of their significance is completed.

Using that approach, CNSC staff's review of OPG's response considered whether the responses identified material changes in the reasonably foreseeable expansion from what was originally described and assessed in the EIS.

The review also considered whether the identified changes resulted in differences in the overlap of time, space, and type of effect with the predicted DGR project residual effects.

Finally, if the differences affected the cumulative effects assessment in the EIS and CNSC staff's assessment of it, as presented in PMD 13-1.3.

CNSC staff's review of OPG's

responses found that the response provided further details and clarifications on the possible DGR expansion relative to what was described and assessed in the EIS.

Having said that, there were no changes in the general physical description of the expansion concept relative to what was included in the cumulative effects assessment of the EIS. The use of existing surface and underground facilities, the expanded waste rock area would increase in surface area and would be higher but remains within the existing fence line and there are no expected changes to the size of the surface water management pond.

There are no changes in the general construction activity of the expansion concept from that already considered in the cumulative effects assessment of the EIS, including the controls and mitigations necessary to address process water, worker safety and environmental protection. Environmental protection should be much like those in use during underground development of the proposed DGR project. The expansion will benefit from the mitigations and monitor performance of the DGR



project during its construction and implement best practices.

No changes in the general operational activities before the expansion concept from that already considered in the cumulative effects assessment of the EIS.

Waste received following expansion will be required to meet the existing waste acceptance criteria. Radiation dose within the facility and at the fenceline will be required to conform to the existing radiation protection requirements and operational releases from the facility are not expected to change.

It is important to identify that all projects are staged developments. The level of detail associated with a possible future project would also be less and more conceptualized at this time, the more distant the future project is.

Other information reviewed by CNSC staff related to the timeline of the expansion and sequencing of panel use. The expansion could commence as early as 2040 or as late as 2068. Expansion activities remain similarly overlapped with other planned and

foreseeable projects in the cumulative effects assessment regardless of the early or late development of the expansion.

If the expansion occurred earlier, the sequencing of the use of waste panels could change and it is possible that waste from operational activities and decommissioning activities could be placed in waste panels together. The nature of the waste emplacement activities is not expected to change, but it is important to ensure that the length of time that rooms remain open is minimized. The effect of opening the space for additional wastes early means increased inspections during operation to assess the ground support safety and implement any associated maintenance.

Therefore, CNSC staff would expect planning of the sequencing to take this into consideration. The waste panels would still be closed once they are full to reduce the possibility of any radioactive releases and to protect workers. The timing of the decommissioning and closure of the DGR facility will remain unchanged and would still occur in approximately 2100.

The timing and sequencing does not result in real changes to what was considered in the EIS.

The response by OPG provided clarifications on possible effects of the expansion on pre-closure safety. The additional information covered topics such as the waste characteristics on inventory, radiation protection requirements and packaged shielding. OPG has identified that pre-closure safety would need to include consideration of the reactor history and the decay period that would affect the level of radioactivity in the waste from decommissioning activities. It could impact radiation protection requirements for worker safety including the need for overpacking and shielding to address waste acceptance criteria for emplacement in the DGR.

With the required application of the radiation protection requirements and waste acceptance criteria, worker dose would remain controlled and CNSC regulatory requirements would continue to be met. Operation of an expanded facility would also have benefitted from the operational experience or OPEX of the DGR.

The responses by OPG also provided clarification on possible effects on post-closure safety of the expanded repository concept. As the waste that would be added to the repository are expected to contain more metals, more gas could be generated by anaerobic metal corrosion and possibly impact the long term safety case. As a large quantity of metal is surface contaminated low-level waste, metal may be minimized by decontamination and recycling and by a reduction in the use of metal containers in favour of concrete ones.

Therefore, these concerns at the time of a licence application for expansion construction are expected to be managed by control of the waste and by having additional information on the geosphere from further testing and research over the operation of the DGR project.

Information from detailed decommissioning planning for the reactors would include radiological surveys to support decommissioning activities. This information would be used to develop the radiological and chemical inventory necessary to conduct the

safety assessment for expanded repository performance.

In the long term the expansion would add to the total inventory in the repository, resulting in an approximate doubling of the calculated peak dose which remains 5 orders of magnitude, well below the dose criterion of 0.3 milliSieverts.

The cumulative effects assessment for the construction of a possible expansion indicates no change to the proposed construction activities. Noise and dust effects will be reduced by established mitigations. Furthermore, the activities on the Bruce site would be similar at any of the proposed timings of the expansion.

Therefore, CNSC staff has concluded that there has been no changes associated with assessing construction of the expansion with the DGR project in the cumulative effects assessment.

Similarly with operations, there are no appreciable changes projected as there continues to be similar activities and similar effects. The mitigations to address waste and sequencing differences are understood so that

activities remain within regulatory requirements.

For post-closure safety the safety case will be better defined by the reduction of uncertainties over the operational period of the DGR project and projected issues with gas generation can be addressed by waste management practices.

In the current safety case gas generation was conservatively assessed. An expanded DGR is expected to remain within the bounding safety margins. With respect to closure and post-closure, no change in concept performance is expected.

Turning to the impact that the new information has on CNSC staff's assessment of cumulative effects in PMD 13.P1.3, OPG's response clarified possible changes in timelines, description of the waste; mitigation for pre- and post-closure safety.

Having said that, the clarifications did not change the impacts of the DGR project relative to the conceptual expansion that was described in the EIS. The expansion of the DGR project remains a reasonably foreseeable project, adequately described and assessed

conceptually for the purposes of cumulative effects assessment and the information in PMD 13-P1.3 remains valid: No likely adverse cumulative effects on the environment from the DGR project.

The impact that the new information has on CNSC staff's assessment of the licence application confirmed that the expansion is not part of OPG's licence application for site preparation and construction and that the information in PMD 13-P1.2 remains valid.

CNSC staff remains satisfied that OPG is qualified and will make adequate provisions to protect persons and the environment. In the event that OPG would want to move forward with an expansion an application for a licence and an environmental assessment would need to be conducted.

That concludes CNSC staff's presentation. We are available to answer any questions the Panel might have.

**THE CHAIRPERSON:** Thank you. We will now proceed directly to the presentation by Environment Canada which is PMD 14-P1.4.

Ms Ali, please proceed.

**PRESENTATION BY / PRESENTATION PAR  
ENVIRONMENT CANADA**

**MS ALI:** Okay. Good morning, everyone. My name is Nardia Ali and I'm the Manager of Compliance, Promotion Expert Support in Nuclear Operations at Environment Canada.

With me today is Sandro Leonardelli, Senior Environmental Assessment Coordinator for the DGR EA review at Environment Canada.

We also have experts available via phone if needed.

Environment Canada was requested to be here today to present our review of the OPG response to EIS 12-512, EIS 12A-512 and EIS 12B-512 regarding the effects arising from an expanded DGR. For brevity, I will hereafter refer to this as Information Request EIS 12-512.

For the presentation today, first I will briefly describe Environment Canada's role in the environmental assessment process, Environment Canada's mandate and expertise related to the DGR project review and the focus of the review of the project. Then, I will



summarize Environment Canada's submission to the Joint Review Panel dated July 2nd, 2014 related to our review of OPG's responses to Information Request EIS 12-512.

I will now explain EC's role in the EA process.

Environment Canada participates as a federal authority under the *Canadian Environmental Assessment Act* to provide specialist information and knowledge related to our mandate as requested by the Joint Review Panel.

Environment Canada has actively participated in review of the Environmental Impact Statement, provided a written submission to the JRP on July 23rd, 2013 on the findings of our review and actively participated in the 2013 public hearings.

Following those hearings in November 2013 the JRP issued additional information requests to OPG on several topics. OPG provided its responses to those information requests over the subsequent months.

On June 9th, 2014 the JRP requested that Environment Canada provide a

written review of OPG's responses to three of the information requests and to participate in these public hearings.

Environment Canada provided a written submission to the JRP on July 2nd regarding the adequacy of the OPG responses.

On August 15th the JRP again wrote to Environment Canada requesting a presentation on our submission on two of the topics. We are here today to present our review of Information Request EIS 12-512 which deals with the potential expansion of the DGR.

I will now describe EC's mandate, expertise and focus of review.

Environment Canada's mandate and expertise in relation to the DGR project is with regard to impacts on and related to water quality, water quantity, air quality, accidents and malfunctions, migratory birds, species at risk, ecological risk assessment and effects of the environment on the project.

Environment Canada's review was focused on potential effects of the project upon the surface environment primarily during the construction, operations and abandonment phases.

Specifically, Environment Canada reviewed the environmental effects arising from the surface facilities, particularly the implications of a DGR expansion to the waste rock management area and the stormwater management system, and air quality mitigation measures for ventilation shaft emissions given the nature of the decommissioning wastes.

The potential migration of contaminants out of the repository during the abandonment and long-term performance phase was outside the scope of Environment Canada's mandate and expertise.

Environment Canada's review focused on whether the predictions and conclusions in OPG's response were valid and consistent with our own views and conclusions.

I will now provide EC's general conclusions on several different topics.

In light of the conceptual level of detail available from the proposed expansion, Environment Canada's comments and conclusions are qualitative in nature.

However, our conclusions about the DGR expansion are supported by the

quantitative effects assessments conducted for the original DGR project, that is, they act as a proxy for the effects anticipated from an expanded DGR both in terms of types of effects and their significance.

The information available from the original EIS does allow for a higher degree of certainty in these qualitative evaluations than if there had been no prior effects assessments.

Environment Canada has commented upon the same issues that were discussed in our original submission to the JRP dated July 23<sup>rd</sup>, 2013.

So my first topic is water quality.

Regarding water quality, Environment Canada generally concurs that the stormwater management pond, if designed in accordance with Environment Canada's previous recommendations, would be able to provide the same functionality for the expansion phase.

Similar effluent quality and quantity would be expected for an expanded DGR considering that the same sources and levels of

contamination to water will exist. However, consideration should be given to ensuring that the overall stormwater management system will be designed to handle an expanded facility or allow for additional capacity to be implemented should it be required.

Also, the expansion does not create any new issues in terms of spill scenarios. The expanded DGR does not change the type or location of spills that are possible.

One notable difference arising from an expanded DGR would be the timing of the cessation of effluent treatment. Considering the increased tonnage and volume of waste rock at surface, contaminant levels in the leachate and runoff from the waste rock management area may take longer to decline as compared to the original DGR.

In any case, a decision to stop treatment should be based on the untreated stormwater management pond water quality as monitored over the course of the operations phase and decommissioning phase as per Environment Canada's previous recommendation 3.11.

Other than timing of the

cessation of treatment, Environment Canada's prior conclusions and recommendations are still valid.

I will now move on to water quantity.

Regarding water quantity issues, the only difference that the expansion creates is in relation to maximum flood hazard assessment and the hydrological modelling that supports the design of the stormwater management pond.

The revised flood hazard assessment that was previously recommended by Environment Canada in our original written submission in recommendation 3.13 and the revised hydrological modelling for the stormwater management pond per Canada Environment recommendation 3.3 should incorporate any relevant changes arising from the DGR expansion.

The expansion will also mean a longer operations phase. The importance of factoring the effects of climate change for both the maximum flood hazard assessment and the design of the stormwater management pond increases when considering a longer operations phase.

The expansion as proposed will not affect the northeast marsh, nor will it increase the small effect to Stream C previously identified, that being a 0.8 percent flow reduction.

The next topic is air emissions conventional parameters.

With respect to conventional air emissions, Environment Canada generally concurs that air emissions resulting from the construction of an expanded DGR would be similar to those occurring during the original DGR construction. The same can be concluded for the operations phase.

Therefore, the effects on air quality from the expansion are bounded by the air quality scenarios developed for the original DGR proposal.

Depending on the timing of the expansion, which OPG indicated would occur approximately in the 2040s, background air quality may differ from existing conditions. Updated air quality modelling may be required at that time.

For air emissions, radiological.

As per radiological air emissions, Environment Canada has not evaluated the implications of the increased radionuclide inventory, that is, quantities and range of radionuclides since Environment Canada does not have the expertise to verify OPG's description and quantification of these changes.

With respect to the effect of the expansion upon the underground ventilation exhaust, there may be a need to sample additional radionuclides in the ventilation exhaust. This will depend on the nature of the decommissioning wastes and the expected radionuclides.

The CNSC should be consulted for advice on this based on changes in the radionuclide inventory.

Next topic is the terrestrial environment.

Regarding the terrestrial environment, assuming the expansion remains within the existing footprint of the DGR site, no additional terrestrial impacts are anticipated.

Our last topic is ecological risk assessment.

IR EIS 12-512 did not request an



evaluation of how the expansion might affect radiological dose to non-human biota. Therefore, there is no new information in this regard for Environment Canada to comment on.

That brings me to the end of the presentation. Thank you for your attention, and we will be pleased to address your questions.

**THE CHAIRPERSON:** Thank you.

Panel Members, may I perhaps start with Dr. Archibald?

**MEMBER ARCHIBALD:** Thank you very much.

This is to OPG. And on slide 6, the description of the expanded facility features underground include, by description, Cobourg formation excavations, underground services, ground support, ventilation and remobilization for construction.

My first question is, does the underground drainage expansion fall under any of these topics and would any sump expansion or new sump construction be needed for development?

**MR. WILSON:** Derek Wilson, for the record.

With respect to the underground

drainage system that would be expected for construction, the movement of the panels in the direction to the south actually enables to maintain the same drainage configuration as we have planned for the proposed DGR Panel 1 and 2.

As such, there may be some consideration for intermediate sumps at the end of the panels and then perhaps pumping to the main sump, but the main sump located at the shaft location is sized adequately because, again, it's sized based on the type of water consumption that was expected during construction.

**MEMBER ARCHIBALD:** So just for further clarification, the expansion will be coplanar with the planned DGR as is now and then drainage will be passive over gravity.

**MR. WILSON:** Derek Wilson, for the record.

As we have in the current configuration, specifically at the end of Panel 2, for instance, we actually have consideration for sump pumping to the main sump. But again, it's because of the long access corridor between the panels.

That would be the plan for the

expansion as well, but once it gets to the point of the main sump, then it is passive in gravity. That's correct.

**MEMBER ARCHIBALD:** Well, for the features, the description of the expanded facility features that I had mentioned and that were in your slide, Cobourg excavations, underground services and so on, which of the underground facilities listed would be considered by OPG to be most critical for maintaining an effective pre-closure safety case under normal operating conditions?

**MR. WILSON:** Derek Wilson, for the record.

The -- all of the facilities that are planned in the shaft services area are planned to be maintained. And again, similar to the plans for, say, configurations for the expansion. Those would follow a similar path as what we were planning for Panels 1 and 2.

But the ventilation system, the dewater systems, the refuse stations are the critical components that we maintain through the duration of those. The underground shop facilities and so on are not as important, but

are planned to be maintained in the long term as well in the expansion scenario.

**MEMBER ARCHIBALD:** For all waste operations both prior to and post-expansion, the emplacement rooms, one of the principal strategies for safety management is the -- that the emplacement rooms containing waste would be isolated using both in-room walls and closure walls between panels.

And in view of what we have heard on the WIPP situation, for example, where somewhat accidental -- accidents of a large nature have occurred, what special measures might be required to ensure that worker and excavation safety could be maintained against accidental releases of radiologic contaminants from closed emplacement rooms during either operational period?

Are there any features that could be planned or would be planned to mitigate accidental releases of radiologic materials before, for example, panel closure walls are in place but where room closure walls are in place?

**MR. WILSON:** Derek Wilson, for the record.

Just perhaps I could paraphrase just so I am clear on the question. This is related to the operational phase prior to the start of construction?

In the expansion -- in the expansion considerations, there would be no operational activities under way prior to construction. And the establishment of the closure walls, which are the large monolith closure walls that would be there to withstand potential gas pressures in behind it, would be installed prior to the initiation of construction activities, so there's no connectivity to the radiological inventory in the repository to that during construction.

**MEMBER ARCHIBALD:** Let me change the question, then.

Prior to the emplacement of closure walls either during the pre-expansion phase of post -- in post-expansion when the waste is going in, either early or late scenario, would there be any updated design feature plan changes to monitor and enhance the safety of operators who are undergoing the work forum placement?

**MR. WILSON:** Derek Wilson, for

the record.

As we discussed previously, the intention is to close a series of emplacement rooms or a panel in its entirety under the current plan. But again, each of the emplacement rooms themselves have the ability to have closure walls established.

There's an end wall for management of ventilation control and monitoring and inadvertent intrusion along the ventilation exhaust drift. But at the front of the rooms -- each of the front of the rooms, we've allowed for eight metres in the event that we've had to go in and install a closure wall on any given panel for, let's say, in the case of there was release from specific emplacement room itself.

So we have consideration in the design currently, and that would be the plan moving forward to be able to isolate any given emplacement room should that need to be.

**MEMBER ARCHIBALD:** And would such plans for safety measurement include, as we talked about before, failure of equipment, radiologic monitoring equipment, would these be essentially established throughout the

underground networks including in front of these closure walls or in the ventilation exhaust pathways to give you an indication of any untoward incidents as radiologic releases?

**MR. WILSON:** Derek Wilson, for the record.

During the construction phase and, again, if I understand the question, is should there be a release during the construction phase where it's supposed to be a clean facility, we would be monitoring for that, yes.

**MEMBER ARCHIBALD:** Now to go to conventional safety.

What features would be required to be implemented at a conceptual DGR due to expansion in both time and size in terms of support monitoring and refurbishment and assessment of excavation integrity as methods for maintaining operational safety over the long term?

**MR. WILSON:** Derek Wilson, for the record.

In our response, we pointed to several of the ongoing monitoring activities that are planned for the DGR facility as well as the

long-term modelling requirements that we had for opening excavation, stability, ground support, design and so on.

It would be a combination of those activities, ongoing monitoring, monitoring of the ground support systems themselves, monitoring of the displacement of the emplacement rooms, the pillars and so on.

So perhaps the geoscientific verification plan discussion on Thursday would also provide additional information with respect to the planned monitoring activities to be able to monitor the stability because whether we have an extension of operations or we have the planned DGR proposal, this ongoing monitoring is required because, again, we want to be able to ensure that we have the integrity of the openings for safety -- for both pre-closure safety as well as post-closure because there's an assumption of the emplacement rooms remaining open for extended periods of time.

**MEMBER ARCHIBALD:** And where I'm leading with those questions basically is to look at conventional support.

In your conceptualization, we are



going to be placing the DGR repository within a saline environment. The water inflow will cause a change in the atmosphere in the excavations.

Would corrosion of support media over the long interval of repository expansion be anticipated or could it be anticipated when it is known that a steady inflow of the concentrated saline solution will occur? And remembering that you have mentioned analogues, the Norton mine, for example, is this under the same environmental conditions as saline inflow?

**MR. WILSON:** Derek Wilson, for the record.

We have considered the saline nature of the groundwater in terms of the ground support design. We've looked at it both in terms of how we would be able to mitigate it in the proposed, looking at protection of the ground support system as well as cathodic protection of cable bolts -- you know, looking at cable bolts, we'll have it grouted -- epoxy grouted and as well as having cathodic protection on it.

But we do anticipate that there is the potential for the degradation of the ground support system over time because of the

ceiling conditions, and the monitoring of the ground support system is designed in order to be able to identify the potential through NDE examination of bolts and so on and the bolt program to be able to address this so that we can anticipate replacement requirements.

**MEMBER ARCHIBALD:** Thank you for mentioning the cathodic protection. I was going to ask you what kind of features you would be looking at to characterize, and the non-destructive testing of the rock bolts.

The current or the standard feature in most underground mining operations is for destructive testing. Its actual pull tests where the supports are pulled from the walls.

Would you consider also doing such testing, or would it all have to be non-destructive, knowing that should you do destructive testing, you're damaging the rock wall and you would have to replace either in another hole or in that hole with enhanced construction?

**MR. WILSON:** Derek Wilson, for the record.

No, we will also be doing pull

testing of the ground support as well. That is already planned as part of the DVP.

**MEMBER ARCHIBALD:** Thank you for your examples, too, of support technology.

On slides 13 and 14 -- and this is for the early scenario plan. On slide 13, assumed expansion activities have been outlined and will include two years of additional site characterization work.

On slide 14 on the early scenario plan plot, can you confirm that this process will take place concurrent with emplacement operations for the existing waste and refurbishment waste?

This would be shown on slide 14 specifically, the two-year characterization phase and emplacement.

**MR. KETO:** Jerry Keto, for the record.

Yes, that investigation would be concurrent with operating activities.

**MEMBER ARCHIBALD:** Is there any consideration in the safety case for those workers who would be doing the characterization work which would be fairly long-term, no doubt, at the same time that emplacement operations are

under way?

They would be most likely exposed to a larger dose effect because they would have to work concurrent with emplacement operations.

**MR. KETO:** Jerry Keto, for the record.

For the most part, this would be surface investigation. Any investigation from the underground would be by workers trained in radiation protection.

**MEMBER ARCHIBALD:** Thank you. Then that's my next question.

What types of activities would characterization include, and part of that was would it be consideration of horizontal drilling from site below ground or would it be drilling vertically from sites above ground?

**MR. WILSON:** Derek Wilson, for the record.

The level of detail of what the characterization activities would be has not been determined at this point. There would be, obviously, the consideration for horizontal drilling to ensure the continuity of the Cobourg formation from the DGR. However, the current

planning assumption right now is that we would have a series of, again, vertical boreholes from surface and the observations of the underground response during the operations phase. If there would be a need or a benefit from horizontal drilling, it would be considered.

**MEMBER ARCHIBALD:** The reason I raise that is you would already have access to horizons at depth and normal mining procedure is to drill from the site to minimize the amount of drilling so -- that is, long as cost is no concern. It's -- okay.

Thank you.

My next question is based upon EIS 12A-512 on page 9.

From either the early or the late closure scenarios for Panels 1 and 2, the initial rooms of Panel 1 are shown to be available for rail-based waste emplacement. These are special wastes designed for short transport distance heavy weight, and in the larger rooms.

The requirement to accommodate additional decommissioning waste would also most likely have rail-based waste types that will need to be in place. Is that correct?

**MR. KETO:** Jerry Keto, for the record.

Yes, that's correct.

**MEMBER ARCHIBALD:** Where in the early or late expansion sequencing layouts shown in Figures 4 and 5 would such -- would additional rooms be located for these materials, or do you plan to have all of the special waste materials from current and decommissioning processes be capable of being placed in only the initial five rooms of Panel No. 1?

**MR. KETO:** Jerry Keto, for the record.

We would have that panel available to us for the early scenario for rail-based waste. On the late-based, we'd have to, obviously, explore some alternatives such as different type of packaging or transport underground.

**MEMBER ARCHIBALD:** If you are going to the late-based scenario there, that means that the equivalent waste materials that would have been placed in the first five or so rooms of Panel 1 would need to be replaced in equivalent rooms of such a size and with a railed

transport delivery system built to it in --  
somewhere in Panels 3 and 4.

Is that correct?

**MR. KETO:** Jerry Keto, for the  
record.

Yes, that's correct. Or  
repackaged.

**MEMBER ARCHIBALD:** And that  
would, therefore, require the inclusion or  
installation of new rail-based transport systems,  
new steel works and fairly heavy structural work  
to accommodate the large waste.

The question here is, would all  
of the rail infrastructure be left in place or  
would that be withdrawn as the final closure  
takes place? Because this might be another  
source of gas production because of the steels.

**MR. WILSON:** Derek Wilson, for  
the record.

Our current assumption is that  
the rail base -- the rail-based transport for the  
proposed DGR remains in place and it's calculated  
as part of the overall gas generation  
calculation. And again, if we look at the  
expansion, should there be a need to add rail, it

would be very much similar to what we did in the first case, which is limit the amount of rail that would be required and bring it to the closest facilities available to do that.

**MEMBER ARCHIBALD:** And one last question for OPG. Mr. Keto, in your initial opening statement you made the statement that the planned DGR and expanded underground repository facilities will all lie within the boundaries of the Bruce nuclear site. Is that correct?

**MR. KETO:** Jerry Keto, for the record.

Yes, that is correct.

**MEMBER ARCHIBALD:** From CNSC's slide 6 the statement is made that expansion concept is to remain within the DGR project fence line, and we seem to have a discrepancy here.

Would anybody be able to tell me which is the correct statement?

**DR. THOMPSON:** Patsy Thompson, for the record.

We indicated on slide 6 that that would be the surface infrastructures would be within the fence line.

**MEMBER ARCHIBALD:** The basis of



my question is are there any legal limits in place that would restrict the repository and expansion facility to have to lie within the Bruce nuclear site or the DGR planned areas?

Are there any legal restrictions for underground placement and boundaries?

Seeing as this is not considered by Ministry of Natural Resources to be a mine and does not have to be claim staked to gain ownership.

**MS SWAMI:** Laurie Swami, for the record.

Just for clarity, that the planned expansion takes place far into the future, and at that time OPG will receive all of the lands back. That is the current vision of what would take place, so there is no legal restriction in the future for that type of an expansion.

**MEMBER ARCHIBALD:** Thank you very much for that clarification.

**THE CHAIRPERSON:** Dr. Muecke?

**MEMBER MUECKE:** Yes, my questions are directed to OPG.

Plans for the expanded DGR use the same access shafts as the proposed DGR. This positions them in the northern extremity of the expanded DGR.

Haulage distances for waste and personnel during the construction phase and haulage of waste packages and personnel during the operational phase will be increased as a result.

Mining accidents most commonly involve movement of equipment. I think that has been mentioned before. How has this factored into conventional safety assessments for the expanded DGR and how does this conform with the statement on slide 11 that conventional safety is very similar to the original planned DGR?

**MR. WILSON:** Derek Wilson, for the record.

With respect to the vehicular movement both during the expansion phase for the construction equipment as well as that for the operations phase, although there is an increase in the length travelled versus the option of perhaps putting an additional shaft closer to those workings was considered, the amount of

transport occurring during the operations phase is somewhat limited. The plan is for 24 low-level bins or four intermediate-level packages in a given day.

So the transportation of equipment underground during the operations phase is somewhat limited. In construction it is a little bit more aggressive, but again it is using a similar infrastructure for waste rock handling at the shaft services area, which has already been considered as part of the conventional safety assessment for the proposed DGR project.

One of our key considerations was creating another pathway for the long-term closure and post-closure scenario, which we felt that the addition of an additional shaft requires additional seals and there is the potential to again position that closer to the existing panel.

So moving away from the shaft area from a post-closure perspective is actually more preferential because again you are removing the waste further and further away from the closest path.

**MEMBER MUECKE:** So if the Panel understands correctly, a third shaft, in your

estimation, would potentially provide yet another potential pathway to the surface and that outweighs any safety concerns regarding conventional mining methods which would involve the longer distance?

And in addition of course, a third shaft would provide escape in terms of accidents and radiological malfunctions during the working phase?

**MR. WILSON:** Derek Wilson, for the record.

We have every confidence that we have the ability to protect the workers in this scenario. Looking at existing experience within mining operations within Canada where these types of haulage distances are not out of the norm, the use of refuge stations as we have proposed enables for a quick retreat of individuals and allows us then to again be able to have the protection mechanisms for the workers.

And then, again, it is a balance of looking at it more in terms of post-closure analysis because, again, we have every confidence that the safety of the workers is maintained within the proposed expansion layout.

**MEMBER MUECKE:** On a completely different vein, could you confirm what the plans are regarding drilling additional vertical test holes in the area of or around the area of the expanded DGR?

**MR. WILSON:** Derek Wilson, for the record.

I am going to give you an initial response and then ask perhaps Mark Jensen to add some additional information.

Again, the details of a site characterization program for the expansion hasn't been drafted in any great detail. However, we would want to be able to again confirm the extent of the vertical stratigraphy within the site as we move to the south to ensure, again, because we have -- the shield cap rock is of importance to us.

So we would want to verify again the continuity of the lateral extent of that. Again, we talked about the opportunity to look at horizontal drilling at the Cobourg level horizon itself, but again we would want to have confidence in the lateral extent of the vertical stratigraphy as well.

I don't know if Mr. Jensen has anything to add?

**MR. JENSEN:** Mark Jensen, for the record.

The surface base site characterization using vertical and inclined bore holes would be very similar to what has happened over the last -- the period between 2006 and 2010. The bore holes would be drilled from secure sites, measuring 50 x 50 metres. They would be vertical and they would be planned so that they would not intersect the repository footprint. We would still have that 100 metre respect distance.

But as Mr. Wilson mentioned, a key will be looking at the integrity and continuity of these units to ensure that they can contain and isolate the waste.

**MEMBER MUECKE:** And these would be planned down to the Cobourg formation or perhaps even deeper?

**MR. JENSEN:** Mark Jensen, for the record.

These holes would be planned into the top of the Cambrian and to ensure that we

have the entire sequence above and below the repository level.

**MEMBER MUECKE:** When would you plan to drill these holes?

**MS SWAMI:** Laurie Swami, for the record.

The planning for drilling of the holes would not -- we wouldn't plan that until there was a business decision to proceed with an expansion of the DGR facility, that that is a decision that would take place in future as we consider how to manage the decommissioning waste.

While I know we have said it is a plan, it is a consideration for us, it is not yet a business decision. And so the drilling operations would not take place until there was a business decision to proceed.

**MEMBER MUECKE:** Has OPG considered the possibility of drilling these holes prior to construction of the first DGR in order to further evaluate the continuity of the strata at the site and to expand the database on the physical and chemical characteristics of the strata of the repository and the cap strata?

Such activity could be considered

part of the Geoscience Verification Plan.

**MS SWAMI:** Laurie Swami, for the record.

As I mentioned just now, we have not made a business decision to proceed with the expansion of the DGR so, no, we have not considered doing that work at this point in time.

**MEMBER MUECKE:** On slide 10 it states that for decommissioning waste, low-level waste, the contamination is largely surface-based and the material could be decontaminated to reduce the amount of metal placed into the repository.

Could you provide the Panel with more information on the fate of the radionuclides connected during the decontamination process?

**MR. KETO:** Jerry Keto, for the record.

Any decontamination processes for surface contaminated metals, whatever methodology was used, whether it is, you know, physically wiping or grinding or whatever the technique is for removing any surface contamination, that surface contaminant would become or continue to be part of the inventory for the DGR.



**MEMBER MUECKE:** Would some of this material be in a liquid state?

**MR. KETO:** Jerry Keto, for the record.

No.

**THE CHAIRPERSON:** We will now take a break before the Panel resumes its questions.

So let us reconvene at 10:40.

--- Upon recessing at 10:25 a.m./

Suspension à 10 h 25

--- Upon resuming at 10:42 a.m./

Reprise à 10 h 42

**MS MYLES:** Could everyone take their seats please?

Thank you.

**THE CHAIRPERSON:** The Panel will now resume its questions based on the three presentations of this morning.

This question is addressed to both OPG and CNSC, and it pertains to the post-closure safety case under the expansion scenario.

Would you confirm that the

conceptual models used for both normal operations and disruptive scenarios for the possible expansion case are at least as conservative in their assumptions as the conceptual models used for the proposed DGR, and that the individual calculation cases adequately bound both normal and disruptive scenarios for the expansion case?

OPG?

**DR. GIERSZEWSKI:** Paul

Gierszewski, for the record.

So with respect to the conceptual models, the answer is yes, they are appropriate for the expansion case. And with respect to them being bounding, again I just would want to emphasize at this point the calculations are preliminary, the estimates of inventory are preliminary.

So in that context I can't say that they are absolutely bounding until we have more information on the inventory. But within the assumed inventory that we are asked to assess, yes.

**THE CHAIRPERSON:** CNSC?

**DR. THOMPSON:** Patsy Thompson. I will ask Dr. Son Nguyen to respond.

**DR.. NGUYEN:** Son Nguyen, for the record.

I agree with OPG's -- NWMO's statement on this thing. So the calculations -- actually, it is just double the inventory and the rock characteristics, and the favourable properties of the geosphere at the same in order to do this extrapolation. So CNSC concurs with this assessment by OPG.

**THE CHAIRPERSON:** So as a follow-up question to both OPG and CNSC, what are the primary differences in uncertainties between the proposed DGR safety case and the safety case for expansion?

And what are the primary consequences of these differences in uncertainties on the results of the two safety cases?

**DR. GIERSZEWSKI:** Paul Gierszewski, for the record.

I think, as was discussed in the submission, that some of the differences are related to the characteristics of the waste material. So there are some differences in the nature of the radionuclides that we expect to be

important. We have done a preliminary assessment of those, but we would want to get more information on the quantities of those radionuclides.

We have talked about the difference in the metal content in the waste, which will affect the gas generation store. And again, that would need more detailed assessment if we were submitting this as an actual licence application, to have confidence in that aspect of it.

And it probably would be handled, as we have already noted, through going back -- taking this as planning information, going back to the decommissioning folks and saying, okay, metal is important here, so be more careful in your next iteration about rather than just assuming it is all going down.

So there is information that maybe it is uncertain at this point, but it is feedback to the design and an opportunity to reduce that uncertainty going forward.

Otherwise, the wastes are of the time that we have already addressed, the repository is in the Cobourg formation. And

again, the site characterization needs to be done to just affirm the lateral predictability that we are expecting. So that is another class that we would want to affirm.

I think those are the three points that occur to me.

So the consequences of the uncertainties. In terms of the radionuclides, the decommissioning has -- sorry, the estimates that we have done so far have indicated that the key radionuclides, even with decommissioning, are likely to be the same ones that we already have considered in the current planning.

And again, those would be -- they are kind of core radionuclides that are produced in bulk and we have a reasonably good estimate for those inventories. So I think that particular uncertainty can be addressed well.

I think the physical composition, again, we don't have that information now, but I believe that that can be addressed well as we go through the actual planning and characterization of them and that the site characterization, again from a planning point of view, the current information is that we do have that lateral

predictability, but again, from the site characterization program I think will help nail down that as a certainty.

So I don't have a quantified estimate off it, but I can see these kind of uncertainties are all amenable to reduction as we go forward into the more detailed planning stage.

**THE CHAIRPERSON:** And as a supplemental, Dr. Gierszewski, could you provide the Panel with a specific example of how the uncertainty around the radionuclide -- the specific radionuclides in the decommissioning expansion case were accounted for in your bounding calculations?

In other words, can you succinctly state to the Panel again that you are really -- that you are confident that, notwithstanding the uncertainty you have just described around the radionuclide characteristics in inventory in the expansion case, you are confident you are bounding that uncertainty in your safety case?

**DR. GIERSZEWSKI:** Paul Gierszewski, for the record.

So, again, I just want to be

cautious. We haven't submitted a licence class safety assessment at this time, so I just want to be cautious about expectations around bounding, but within the information that we have available we expect, for example, a much larger amount of nickel radionuclides in the decommissioning waste because that is a component of steels and there will be more steel from the metal components, the calandria and so on, so there is an example of the nuclide that we would expect to see much more of in decommissioning waste than we have in the current operational waste.

But when you look at the results of what the post-closure safety assessment tells us, while nickel, short and long-lived radionuclides are important, they are just not the dominant dose contributors to the total dose. So uncertainties in those, again, aren't critical to the safety case, it is more driven by radionuclides there would be more confidence in.

**THE CHAIRPERSON:** CNSC, would you respond to the same question, please?

Do you need me to repeat it?

**DR. THOMPSON:** Patsy Thompson, for the record.

We did mention in our presentation that there is a difference in the peak dose, but it still was quite a bit below the assessment criteria and that difference was attributed essentially to the difference in inventory between the proposed project and the expansion scenario.

Dr. Nguyen will go into more detail in terms of your question.

**DR. NGUYEN:** So I agree with Dr. Gierszewski's comments about the uncertainty on the waste inventory.

With respect to the characteristics of the geosphere of the rock mass, the host rock formation and the caprock formation, at the present time, if we are planning for the present, if we are looking at uncertainties at the present day for the expansion scenario, maybe there is a little bit of additional uncertainty related to the favourable characteristics, like the low permeability, the lack of major fractures and all this kind of thing because the footprint is outside the area of the current proposed DGR. So this would be narrowed down.



At the time when the expansion is actually considered, the uncertainties would be much more reduced because after 60 years of operation with the GVP and additional borehole characterization, I believe at that specific time the uncertainties associated to both the current DGR and the expanded DGR would be much more reduced as compared to present time.

**THE CHAIRPERSON:** Again, a supplemental to the CNSC, we understand, Dr. Nguyen, your explanation regarding reducing uncertainties if the expanded proposal comes forward to the CNSC; that is not the question.

The question is, in the current cumulative effects assessment, is CNSC confident that the acknowledged uncertainties with -- particularly the three sources of uncertainties we have just heard about from Dr. Gierszewski, have been adequately addressed such that we can be confident that the cumulative effects under the expansion scenario have not been underestimated?

**DR. NGUYEN:** Son Nguyen, for the record. Thank you for that clarification.

I believe so, because with

respect to the rock formation there are many lines of evidence from the site characterization program and the regional data that it is relatively uniform and predictable, so I believe the uncertainties do not affect the overall conclusion.

**THE CHAIRPERSON:** Thank you.

My next question is to both the CNSC and the Ministry of Transportation.

So first to CNSC. Are there any specific regulatory requirements to staff's knowledge to ensure safety when transporting decommissioning wastes?

--- Pause

**DR. THOMPSON:** Patsy Thompson, for the record.

The Transport and Packaging Regulations of the CNSC would essentially ensure the safety of the transport of the decommissioning waste or waste arising from decommissioning and essentially the types of radionuclides, the radiation fields and characteristics of the wastes would essentially fit within the currently approved packages and practices that have been in place for

transporting radioactive waste.

So there is not a category of waste that would be -- the results of decommissioning activities that would not already have been transported and for which packages are not actually currently approved.

**THE CHAIRPERSON:** A supplemental to CNSC. Therefore, the Panel understands that -- staff understands from CNSC that, for example, very large decommissioning components are also encompassed by your current guidelines and regulations?

**DR. THOMPSON:** Patsy Thompson, for the the record.

There is a regulatory process in place for what are called accepted packages, so things that don't fit into sort of standard packages that have been tested. So there is a protocol to have accepted packages approved for transportation of certain things with the testing requirements in place.

**THE CHAIRPERSON:** Thank you.

The Ministry of Transportation. Does your Ministry have specific requirements or regulations associated with decommissioning

waste?

**MR. FAVELL:** Martin Favell, for the record.

My understanding is that with respect to regulatory requirements we are likely talking about the *Transportation of Dangerous Goods Act*, so I am looking to Warren Reynolds who is on the telephone on teleconference to hopefully help me out with that question.

**THE CHAIRPERSON:** Mr. Reynolds, did you hear the question?

Mr. Reynolds, are you there? Perhaps you are on mute.

Hmmm... We will pause for a minute and hopefully the Ministry of Transportation individual will be able to patch in through the telephone and we'll return to this question, but I do have a supplemental while we are waiting back to CNSC.

Does the CNSC, to staff's knowledge, interact explicitly with the Ontario Ministry of Transportation regarding the various jurisdictions, provincial versus federal, governing transport of dangerous goods?

**DR. THOMPSON:** Patsy Thompson,

for the record.

The short answer is yes, but for any more details I would have to get information from our Transport Division staff at the CNSC.

I could come back in the afternoon, if you like.

**THE CHAIRPERSON:** That won't be necessary. We just needed to confirm there were communication channels.

I will try one more time. Ministry of Transportation, are you on the phone?

**MR. REYNOLDS:** I am now.

**THE CHAIRPERSON:** Excellent.

--- Laughter / Rires

**THE CHAIRPERSON:** So the question was, under *Transportation of Dangerous Goods*, are there specific requirements that would address the nature of the decommissioning wastes, particularly the sizing issues?

**MR. REYNOLDS:** May I ask a few questions?

**THE CHAIRPERSON:** Of course.

**MR. REYNOLDS:** In regards to decommissioning waste, what kind of waste would we be talking about, first of all? Like are we

talking during the transportation, are we -- and specifically when you talk about decommissioning, are you talking about whether or not this would be regulated at that point in time, given the size or the weight of the product?

**THE CHAIRPERSON:** I'm asking whether there would be specific regulations that, yes, would apply to the range of characteristics of decommissioning waste, acknowledging that the radiation related concerns are in the purview of the Canadian Nuclear Safety Commission, but in terms of safety from the conventional safety point of view in the transportation of the range of types of materials, which the Panel understands can include some rather large and unwieldy components, but I would ask OPG to clarify our understanding of that.

So perhaps, first of all, Mr. Reynolds, we will ask OPG to clarify the range of types of packages and then I will go back to you.

**MR. REYNOLDS:** That would be good; thank you.

**MR. KETO:** Jerry Keto, for the record.

At this time in the planning for decommissioning we expect that any large component segmentation would occur at the site being decommissioned and waste would be shipped via conventional road transportation, much like it is today.

**THE CHAIRPERSON:** So, Mr. Keto, the Panel understands from your response that the larger components would be reduced in size by whatever means so that they would fit into a standard, for example, tractor trailer type conveyance?

**MR. KETO:** Jerry Keto.

Yes, that's correct.

**THE CHAIRPERSON:** Mr. Reynolds...?

**MR. REYNOLDS:** For the record, the *Transportation of Dangerous Goods Regulations*, there is specific exemptions for quantities that are less than 150 kilograms. They aren't regulated in that particular case. However, though, when it comes to nuclear waste, there probably is -- they would be regulated, no question about it.

I haven't got the specifics in

front of me exactly. What I can do is as an undertaking I can get back to the Panel, to the Committee in that regard, and it should take me less than an hour.

**THE CHAIRPERSON:** Thank you, Mr. Reynolds. We won't grace it with the formality of an undertaking, we will just wait for your response after lunch. That would be most appreciated.

**MR. REYNOLDS:** Okay.

**THE CHAIRPERSON:** So on the same theme of transportation -- and this is directed to OPG -- please confirm for the Panel our understanding that the cumulative effects assessment assumed no additional safety considerations or incidents on the highways and the roads with respect to transportation of the decommissioning waste.

**MS SWAMI:** Laurie Swami, for the record.

Generally, we didn't see an increase in safety incidents as a result of this proposed project.

**THE CHAIRPERSON:** And may the Panel ask the basis for this assumption?



**MS SWAMI:** Laurie Swami, for the record.

We currently transport low and intermediate level waste routinely, as we have discussed through this hearing process, due to our operations and will be for refurbishment waste streams and when we move into the actual decommissioning waste transportation, that type of waste transport will have ended for that particular facility and so there will be an offsetting effect.

**THE CHAIRPERSON:** Thank you.

This question is also to OPG.

Given the possible timing of the expansion, anywhere from 30 to 40-plus years from now, is the assumption that equipment and construction methods will be the same for expansion a conservative assumption?

--- Pause

**MR. WILSON:** Derek Wilson, for the record.

Yes, that would be a conservative assumption.

**THE CHAIRPERSON:** Thank you.

I will now turn to the CNSC and I

would draw your attention to the recommendation of the CNSC No. 13, which we also discussed yesterday. So we are talking now about the stormwater management pond and I will read out the recommendation.

"CNSC staff recommend that OPG confirm the size of the stormwater management pond based on an updated PMP before construction begins."

"An alternate design that would minimize while maintaining the structural integrity of the pond, the potential for the release of untreated water and pond sediment during large storm events would also be considered." (As read)

Given that recommendation, would CNSC staff clarify for the Panel what the definition of "minimize" means and would this definition change in any way for the expansion case?

--- Pause

**DR. THOMPSON:** Patsy Thompson,  
for the record.

I will provide some information  
and then, if more information is required,  
Dr. Shizhong Lei is back in the office and we can  
confer with him at lunch time.

Essentially the expectation is  
that if the project is approved that OPG, as part  
of the detailed design, provides a demonstration  
essentially that the pond could, with the  
expected weather conditions that have been  
modelled, hold the amount of water required to  
take into consideration severe rain events.

In terms of what we would expect  
in terms of minimization is to conduct an  
assessment that would essentially go through  
scenarios and those scenarios that would result  
in the discharge of untreated pond water or pond  
sediment would have to have a very low occurrence  
and when they occurred that the impacts on the  
environment would need to be within an acceptable  
range, so would not lead to significant  
environmental effects.

**THE CHAIRPERSON:** Similar  
question -- sorry.

**DR. THOMPSON:** Sorry, but I don't think for the time being that we have set, you know, minimize as a recurring period.

**THE CHAIRPERSON:** Thank you.

Directing a similar question to Environment Canada.

So in your submission you note that:

"A notable difference arising from an expanded DGR would be the timing of the cessation of effluent treatment."

Given that statement, would Environment Canada provide the Panel with more rationale for why you feel the expansion case would not in any way change your conclusions or recommendations regarding the sizing of the stormwater management pond, considering it is going to have to operate for quite a bit longer in time and over into -- well into the period of predicted climate change?

**MR. LEONARDELLI:** Sandro Leonardelli, for the record.

So, again, we have emphasized throughout the hearings process and in our

submissions that we feel that the stormwater management pond should be sized while taking into account the potential effects of climate change. So that would be to increase the capacity of the pond in order to negate any potential future increases in precipitation or, you know, in the intensity and frequency of the events. So we are looking for additional capacity to accommodate potential effects of climate change. So we have said that throughout, we have been consistent on that.

I'm not sure why you understand that we are different in this regard in terms of the expanded facility, because we are not. We have stated somewhere in here that -- yeah, okay, so Nardia has found the appropriate reference, thank you.

We say here that:

"...consideration should be given to ensuring that the overall stormwater management system will be designed to handle an expanded facility, or allow for additional capacity to be implemented

should it be required."

Now, that is still factoring in our position in regards to additional capacity reflecting potential effects of climate change.

So we are not different than -- in anywhere else that we have stated that.

**THE CHAIRPERSON:** Next question is to both OPG and CNSC and we are shifting gears again back to metals.

OPG noted that metal decontamination can or will occur to reduce the overall volume of metal potentially going into the repository should expansion scenarios go ahead.

So to OPG and to CNSC, are either of your organizations sponsoring development of decontamination and recycling methodology for metal components?

**MR. KETO:** Jerry Keto, for the record.

As Lise Morton stated a couple of days ago, we are embarking on some pilot projects looking at techniques such as decontamination of large metal objects. So this is something we are in the very early stages of exploring.

**THE CHAIRPERSON:** So just to confirm, what Ms Morton was describing the other day did in fact include these large metal components and you already have some to work with?

**MR. KETO:** Jerry Keto, for the record.

Yes, that's correct. We have some steam generators from Bruce Power that were replaced during refurbishment.

**THE CHAIRPERSON:** Thank you.

CNSC...?

**DR. THOMPSON:** Patsy Thompson, for the record.

We are not sponsoring work for research related to decontamination methods. We have and are participating in international work, for example, at the IEA to set regulatory requirements for the contaminated material so that -- in relation to clearance levels that they can be safely taken out of regulatory -- out of regulation, for example, for scrap metals and things like that.

So we are doing that type of work, but not actually sponsoring research or

work in terms of engineering or technical methods for decontamination.

**THE CHAIRPERSON:** So, Dr.

Thompson, to paraphrase, just to make sure the Panel understands. So the CNSC is participating in international dialogue with respect to when a, for example, metal object that has had the surface radioactivity removed is low enough to no longer qualify as radioactive waste; is that correct?

**DR. THOMPSON:** Patsy Thompson, for the record.

That's right, and it's not just dialogue there's actually IEA safety standards and safety guides that have been developed looking at various uses of the contaminated material to ensure that they can be safely put into outside of regulation, they are low enough essentially to be removed from regulation, or cleared from regulation, as the word says.

**THE CHAIRPERSON:** Thank you.

The next question is to OPG and I have a couple of questions regarding the waste rock management area.

So my first question is: Is OPG



considering modifications to the original waste rock management area design for the licence currently sought, so for the proposed DGR, to help ensure that possible future increases in the waste rock management area can be accomplished sustainably with no or minimal disruption of already reclaimed areas and continued protection of the wetlands?

The Panel is referring, for example in your submission to your use of the term "holistic planning". So that's the context of this question.

**MR. WILSON:** Derek Wilson, for the record.

Yes, we have considered -- now, we are not considering changes to the proposed areas or the methods in which we would establish the waste rock management area for the proposed DGR, but what we have considered is the ability to be able to put the waste rock management for potential expansion within the same footprint or generalized within the same footprint of the existing without the need to introduce new ditch systems and to have changes to the overall stormwater management system on the site so that

the proposed stormwater management system is set and the expansion of the waste rock pile would fit within that.

So we have considered it such that we wouldn't have to go in and, as you say, disturb areas to perhaps move drainage ditches or other activities. The drainage system as proposed would be sufficient.

**THE CHAIRPERSON:** Thank you.

As a supplemental to that, the Panel would be interested in OPG again reminding us whether you were planning ongoing reclamation of the waste rock management area in any way?

**MR. WILSON:** Derek Wilson, for the record.

As we had discussed previously, the current reference for reclamation of the waste rock management area is at the close of the DGR project and this is one of the considerations for that.

**THE CHAIRPERSON:** The next question regarding the waste rock management area now brings in back to air quality issues.

So can we confirm that Mr. Rawlings is on the phone?

**MR. RAWLINGS:** Martin Rawlings, for the record. Yes, I am on the phone and available.

**THE CHAIRPERSON:** Thank you.

So the question is: Is there any reason to expect increased particulate emissions or emissions of any other constituents of potential concern from the expanded waste rock management area?

**MR. RAWLINGS:** Martin Rawlings, for the record.

So I will limit my responses to non-radiological releases, which is really what the air quality assessment looked at. The potential releases of radiological compound either from the project or the waste rock pile were dealt with as part of the safety case and the radiation and radioactivity TSD.

The expectation would be that the waste rock pile would be constructed, in the event of an expansion, with the same type of materials, same size of materials and same processes that were generally used for constructing the waste rock pile.

The material has the potential to

emit dust during its construction with the activity of equipment, the placement of the material and activities of equipment on the waste rock pile positioning it, such as bulldozers and things of that nature.

Those emissions were quantified and included in the air quality assessment and the assumption would be that in the event of an expansion in the future there would be similar sorts of activities, similar sorts of emissions.

Once the placement of the waste rock pile had been completed, so at the end of construction, the surface of the waste rock pile is going to be made up largely of coarse material. The average size I think is 305 mm in diameter. So once the pile has been constructed and construction is finished, there is not an expectation there will be a lot of dust or sort of air quality compounds of concern that were considered in the air quality assessment emitted from that waste rock pile.

**THE CHAIRPERSON:** Thank you, Mr. Rawlings.

As a supplemental, so can OPG please confirm that the increased height of the

waste rock management area did not result in any increased potential, in particular, for dust production and deposition?

In this case the Panel would like some clarity with respect to dust deposition at the fence line or at the nearest human receptor.

Mr. Rawlings...?

**MR. RAWLINGS:** Emissions from the waste rock pile are going to be at the surface and under the vast majority of all situations those emissions would remain with the surface. So the air would flow up and over the pile and then down the back side of the pile carrying emissions with them. Therefore, the height of the pile wouldn't really affect the transport, the concentrations or the deposition of particulate matter.

**THE CHAIRPERSON:** Thank you.

Back now to CNSC. What was the basis for CNSC staff's conclusion that there were no changes in the general physical description when the repository would double in size and the waste rock management area would increase in area and height and the expansion would take place under potentially greater magnitude or frequency

weather events due to the progression of climate change?

**DR. THOMPSON:** Pasty Thompson, for the record.

I will respond and then ask my colleagues if I missed anything.

The basis for this statement in terms of no change in terms of the general physical description is the fact that, as we have heard, the drainage ditches, the surface, the stormwater management pond would not be expanded.

The potential expansion project would use the same surface infrastructures that would exist for the proposed project and the equipment underground in terms of the material used for construction and potential operations would be the same.

That's not to say that the underground layout would be the same, but essentially what would contribute to potential environmental effects in terms of releases, those are the aspects that we looked at in relation to the infrastructure where potential emissions would take place.

I'm looking at Ms Francis and

Klassen to see if I missed anything.

MS FRANCIS: Kiza Francis, for the record.

I think the main message is that the no change that we are really trying to focus on is the no change from what was originally assessed in the EIS. So when we did our original cumulative effects assessment we are saying that the new information did not provide any further information to change our cumulative effects assessment. That's really what we are focusing on with the no change.

**THE CHAIRPERSON:** So leading on from that response, CNSC, are staff convinced or satisfied that all other reasonably foreseeable human activities that were included in the cumulative effects assessment would remain at the same level and cause the same effects as assumed in the cumulative effects assessment for the proposed DGR, even when accompanied by decommissioning waste related, induced or spinoff activities?

--- Pause

**DR. THOMPSON:** So Patsy Thompson. I will start responding and then I

will ask again my colleagues to complete.

Essentially what we looked at was in terms of overall timing of the project and, as Ms Francis explained earlier, the overlap in time, space and types of effects.

And so in terms of the assessment of potential cumulative effects, for example, if we looked towards the end of the time period that OPG has provided, if it was towards the later period then the operations of the Bruce NPP for example would have ceased.

So taking into consideration essentially that this facility is essentially similar to what was assessed for the EIS would actually be conservative, as we are assuming emissions from the NPP, when in fact it may have been shutdown safe storage.

**THE CHAIRPERSON:** Thank you.

This question is now to OPG. Were there any reportable spill incidents during site characterization for the proposed DGR, especially with respect to drilling?

**MR. WILSON:** Derek Wilson, for the record.

No, there were no reportable



spills associated with the details like characterization or the site investigations that were undertaken from 2010 through 2013 essentially.

**THE CHAIRPERSON:** So supplemental to that. Therefore, the Panel -- confirm the Panel's understanding that you assumed a similar no reportable spills for the decommissioning-based characterization phase?

**MR. WILSON:** Derek Wilson, for the record.

That is correct.

**THE CHAIRPERSON:** Environment Canada, was that also your understanding in terms of the assumptions that went into the cumulative effects assessment for the expansion?

**MR. LEONARDELLI:** Sandro Leonardelli, for the record.

So we did consider spills and because none of the layout changes or the facilities change, the underground operations are essentially the same, they pump water from underground, et cetera, there fundamentally is no change in terms of the potential types of spills or the locations of the spills because the

surface facilities and the underground operations are essentially the same as would be occurring during the original DGR phase.

**THE CHAIRPERSON:** OPG, would you confirm for the Panel the Environment Canada's understanding that none of the, for example, additional boreholes created for the additional site characterization would be any closer to Lake Huron and, therefore, the consequences of any spill would be similar to the proposed DGR project?

**MR. WILSON:** Derek Wilson, for the record.

Looking at the positioning of the proposed two panels, they are no closer to Lake Huron. And if we observe the hundred-metre offset, which is the current requirement for any deep boreholes to the closest location of any of the existing emplacement rooms, that themselves would still be no closer than the closest borehole that we have currently proposed.

**THE CHAIRPERSON:** Thank you.

Ms Swami...?

**MS SWAMI:** Laurie Swami, for the record.

I would just like to add that during any activity on the site where there was any potential for a spill, OPG would implement best practices in terms of containment and ensuring that there was no environmental harm as a result of any equipment malfunction, et cetera.

So I think beyond just where the location is there would be processes in place to prevent and mitigate any spills should they occur.

**THE CHAIRPERSON:** So on the theme of spills, now we are into the Ministry of Transportation. You could probably expect we were going to go there.

So with respect to the regulations and procedures in response to a hypothetical spill on a highway that involved decommissioning waste, would there be any material difference between the Ministry of Transportation's response to that versus the existing proposed DGR project?

**MR. FAVELL:** Martin Favell, for the record.

Again I'm going to refer to a colleague on the phone, I am hoping Michael

Morton is there to help me, since this essentially refers to an emergency response and whether or not there is any difference in the Ministry's response protocol.

**THE CHAIRPERSON:** Mr. Favell, what was the name of the individual?

**MR. FAVELL:** Michael Morton.

**THE CHAIRPERSON:** Morton.

Mr. Morton, are you there?

**MR. MORTON:** Hi. Good morning.

Michael Morton, for the record.

And the answer is no, there would be no difference in our response to that sort of accident.

**THE CHAIRPERSON:** Thank you.

The next question is to Environment Canada and to Canadian Nuclear Safety Commission.

In your review of the cumulative effects assessment in the IR responses, and in the original cumulative effects assessment for that matter, did you develop your own alternative future scenarios to create the context for your review; in other words, as a way of confirming staff's confidence that the reasonably

foreseeable scenario assessed by OPG sufficiently bracketed the future scenario that would be of concern to Environment Canada with respect to your mandate and to CNSC with respect to yours?

May we first hear perhaps from Environment Canada on this one?

**MR. LEONARDELLI:** Sandro Leonardelli, for the record.

So if I understand the question, you would like to know if in understanding that the facility was being expanded -- and in our case we would be looking at the surface facilities -- is the OPG description of what might change or what might not change, did we develop our own independent evaluation of whether that seems reasonable?

**THE CHAIRPERSON:** Not so much the evaluation, but the conceptual future environment that would include aspects of that environment that pertain to your mandate.

So as an example, did you consider that in addition to the -- or that as part of the reasonably foreseeable scenarios there may be human activities that would, for example, create cumulative stress on the fishery

or a cumulative stress on the Eastern white cedar such that you are convinced that -- it's the same bounding question I asked for the safety case as I'm asking for cumulative effects, if your agency is convinced that the bases were covered, if you will, with respect to your responsibilities?

**MR. LEONARDELLI:** Sandro Leonardelli, for the record.

So that's not an easy question to answer because it depends on the topic. So for example, in the situation of the terrestrial environment, we would have no basis to assume that the local study area or the site study area or the regional study area would be different from the base case.

So in looking at future terrestrial effects we didn't really consider that there would be a change to that, but then it's also because of the effect that is occurring on the site. The terrestrial effect will have occurred during the initial -- during the original DGR development where they removed the forest on the site.

OPG says that they have no need for additional footprint, they can accommodate

everything within the original site under an expanded scenario, so there would be no terrestrial effect in addition to the one that occurs at the outset of the project.

So to look beyond into the local study area and the regional study area would not seem appropriate for that type of an effect assessment because there is no additional effect that is occurring as a result of the project.

But in the case of air quality we did consider that the modelling that was done, the air quality modelling that had been done for the original DGR project might not be entirely valid 40 years from now because an important contributor to air quality is the background regional air quality. And so we did factor that into our determination -- sorry, our sufficiency review and we noted the fact that that's an important consideration and would need to be factored -- they might need to rerun the air quality modelling in the future.

So I would have to go through each and every example to give you a full answer, but I think that characterizes the type of considerations we had.

**THE CHAIRPERSON:** CNSC...?

**DR. THOMPSON:** Patsy Thompson,  
for the record.

The process we used was to verify the method that OPG used to identify known future projects and to identify foreseeable projects. So we essentially looked at the process they had used to make sure they had used appropriate, for example, land use planning and information that is available on the public record in the region.

We also have on a regular basis information from licensees on potential business plans, for example, for activities that the CNSC would regulate. And so we have looked at that in terms of making sure of the, I believe, 31 projects that had been identified by OPG and then the 13 that were retained -- 19 that were retained for the cumulative effects assessment, that they represented what was reasonably known at this time for the region.

Given that most of the residual impacts of the project are small and often limited to the site or very close to the site, then the potential overlap in time and space would essentially be related to activities on the



site. So in that context we did take into consideration, for example, the future planning of the Bruce Power for the Bruce NPP.

**THE CHAIRPERSON:** Did CNSC staff, in your review, consider in any way the review by Dr. Dunker of cumulative effects methodology employed by OPG whereby they only carried forward residual adverse effects and didn't go back and take another look in terms of the cumulative effects scenario, as he suggested in his review?

And (a), if you didn't; (b), more generally is our staff at the CNSC reviewing standard practice and guidance with respect to how cumulative effects assessments are conducted?

**DR. THOMPSON:** Patsy Thompson, for the record.

We had taken a careful look at Dr. Dunker's submission to the Panel, as well as the presentation that was made I think it was here last year on this topic. At that time, and I believe it was in one of our presentations, is that the methodology that Dr. Dunker speaks about in terms of cumulative impacts is related to what should be or could be or should be done in terms of regional planning and broader-based cumulative

impacts assessment.

In terms of the types of requirements of the *Canadian Environmental Assessment Act* that they are there for project-specific environmental assessments that are within the control of the proponent, those types of cumulative impact assessments are not easy to make and, certainly, for the CNSC as a federal regulator, we have little control over regional planning for example.

So in our assessment or review of the proponent's assessments, we ensure that the best information available from land use and regional planning is used in the project-specific assessments.

**THE CHAIRPERSON:** I have one final question and this is to both OPG and CNSC.

Please confirm whether or not the post-closure safety case for expansion did in fact include consideration of and conclusions related to radiation dose to non-human biota.

**DR. GIERSZEWSKI:** Paul Gierszewski, for the record.

I believe we have Richard Little on the line and I'd like to ask -- pass that

question onto Richard Little.

**THE CHAIRPERSON:** Mr. Little?

**MR. LITTLE:** Richard Little, for the record.

There was no explicit consideration in the calculations that we undertook of non-human biota. We could look at the calculations we have undertaken and look at the concentrations and do some quick calculations to see what the consequences would be. However, given the fact that for the operational and refurbishment waste we found that the consequences for non-human biota were not significant, I would expect that we'd find exactly the same finding for the decommissioning wastes.

**THE CHAIRPERSON:** CNSC, may the Panel please have a comment from staff regarding the lack of any explicit modelling of non-human biota radiation dose?

**DR. THOMPSON:** Patsy Thompson, for the record.

Dr. Swanson, could I confirm that your question is related to the post-closure assessment?

**THE CHAIRPERSON:** Yes.

**DR. THOMPSON:** So Patsy Thompson, for the record.

In terms of the post-closure assessment the normal evolution scenario considered, you know, potential doses to members of the public and there was a generic -- a generalized assessment in terms of -- from our part in terms of what that might mean for non-human biota.

In terms of the disruptive scenarios the impacts on human biota were not considered explicitly. The scenario that would likely result in exposures to non-human biota would be the scenario where a farming family is essentially established on the site and draws water from the disposal level. Those calculations could be done but they haven't been done.

But taking into consideration the levels in the environment and the doses to the critical group, the receptor, the farming family, we would expect the doses to biota would be equally small.

**THE CHAIRPERSON:** Dr. Thompson, a

supplemental and, perhaps, also to Mr. Little, would that statement hold true even though exposure pathways for non-human biota may actually be materially different?

**DR. THOMPSON:** Patsy Thompson, for the record.

I believe so but we could very quickly confirm that if you'd like.

**THE CHAIRPERSON:** Mr. Little, could you also address my question?

**MR. LITTLE:** Richard Little, for the record.

Could I just clarify why you feel that the exposure pathways would be different for the decommissioning waste calculations as opposed to the operation and refurbishment waste calculations?

**THE CHAIRPERSON:** The exposure pathway per se may not be different, Mr. Little, but certainly the -- let us say the nature, duration, extent of the exposure may in fact be very different because, for example, the fish lives in water rather than only occasionally being sprayed with water as a human would be taking a shower or drinking water. So that's

just a small example of what I was alluding to.

**MR. LITTLE:** Well, in that case, I would say that we do consider a wide range of potential exposure pathways for the operational and refurbishment waste calculations that we have undertaken. And it would be relatively straightforward to look at the concentrations that we've calculated in the various media and to evaluate any impacts on non-human biota for the decommissioning calculations that we have done.

I think it's important to stress, as Paul Gierszewski has said, that these post-closure calculations we have done for the decommissioning waste are highly preliminary and they essentially have not been taken to the same extent that we undertook the calculations for the operational and refurbishment waste calculations.

**THE CHAIRPERSON:** OPG, given the fact that the Panel actually had expected the full recalculation for both human and non-human biota, although we acknowledge we didn't explicitly state that in our information request, we would appreciate the results of a quick calculation perhaps simplified for both normal evolution and the two disruptive scenarios that

resulted in the higher estimated doses, i.e. severe shaft failure and human intrusion.

The rationale for this is that the Panel notes, especially for the disruptive scenarios, that the doses are the protein -- the human limit for exposure, albeit not an exceedingly risk factor. And so we would appreciate confirmation that there is no concern regarding on human biota.

**MS SWAMI:** Laurie Swami, for the record.

We can certainly undertake to do that. We would estimate that it would be Thursday when we could complete that assessment.

**THE CHAIRPERSON:** Thank you. Therefore, we are now in an undertaking. I believe we are in No. 74.

So by Thursday if OPG could provide the Panel with calculations confirming that dosages to non-human biota under both the normal evolution and the two specific disruptive scenarios; human intrusion and severe shaft failure (a) have been calculated and (b) are well below thresholds for effect?

Panel Members, did we have any

other questions?

Dr. Muecke...?

**MEMBER MUECKE:** Dr. Swanson explored the effects of the enlarged waste rock management area and its increased size to 35 metres in terms of air quality. I don't believe we have addressed the impact in terms of noise levels and noise dispersion of waste rock dumping on the enlarged waste rock management area.

Could OPG comment on that and then CNSC and Environment Canada?

**MS SWAMI:** Laurie Swami, for the record.

We could generally comment. However, Mr. da Silva, we could have on the phone this afternoon if that would be helpful. He's not on the phone right now.

**THE CHAIRPERSON:** That would be appreciated. Thank you.

Dr. Archibald...?

**MEMBER ARCHIBALD:** I'd like to make one comment based upon EC's presentation this morning.

It was suggested that conventional air emissions would be the same as



for the existing case, but for radiological air emissions Environment Canada suggests to OPG that additional radiologic sampling of ventilation exhaust be conducted due to potential inclusion of additional radionuclides in decommissioning wastes.

My question to CNSC and OPG is are there potential -- is there a potential for additional forms of radionuclide inventory emissions either as gas or particulates that might be released into the exhaust ventilation air and which might pose significant adverse impact to the environment?

**DR. THOMPSON:** Patsy Thompson, for the record.

Our assessment is that the characteristics of the waste and the types of radionuclides that it includes are very similar, have similar physical chemical characteristics. And so we would not expect to have a different mixture of radionuclides released through the ventilation system.

The expectation is that OPG if a licence is granted and we get to a stage where radioactive material would be handled underground

that the monitoring program would take into consideration those characteristics and a very detailed monitoring program would be developed. But for the purposes of the assessment we were satisfied with the radionuclides that were considered for the cumulative effects assessment.

**MEMBER ARCHIBALD:** And is that also OPG's conclusion?

**MS SWAMI:** Laurie Swami, for the record.

Yes, we would agree with the CNSC's conclusion that there would be no significant change between the operational refurbishment waste and decommissioning releases through the ventilation system and, therefore, the monitoring program would be adequate once there is an operating licence in place that would define precisely what the monitoring program would be. We would continue to implement that as we went forward.

**MEMBER ARCHIBALD:** And as a final, there would be no requirement for mitigation procedures as is currently applied?

**MS SWAMI:** Laurie Swami, for the record.

That is correct.

**MEMBER ARCHIBALD:** Thank you very much.

**THE CHAIRPERSON:** That completes the Panel's questions based on the first three presentations of this morning.

Before lunch we will continue with the first intervention from registered participants which is a 30-minute oral intervention by Patrick and Paula Gibbons.

As previously explained, the Panel will direct its questions to the presenters following their presentation. The Panel will consider, time permitting, questions submitted by registered participants at the end of the day.

I would ask each of the individuals and groups making oral presentations to remain available until the end of today's session, if possible, in the event that we have time available to consider questions from registered participants.

--- Pause

**THE CHAIRPERSON:** The first 30-minute presentation is by Patrick and Paula Gibbons which is PMD 14-P1.15.

Mr. and Mrs. Gibbons, you have 30 minutes. When the amber light comes on it means there is five minutes left. Please proceed.

**PRESENTATION BY / PRÉSENTATION PAR  
PATRICK AND PAULA GIBBONS**

**MR. GIBBONS:** I want to thank the Panel for allowing me to speak today. During this oral intervention we will summarize our findings on all six subjects under consideration by the Joint Review Panel at these hearings.

We have provided evidence from a number of expert sources including Dr. Peter Duinker, Dr. Charles Rhodes, Dr. Frank Greening, researchers A.D. Lee and T.S. Nguyen, Supreme Court Justice James Russell and a report from 21 experts from the U.S. National Academy of Sciences. Findings of these experts create critical doubt in and concerned with OPG's DGR proposal.

Prior to the Joint Review Panel hearings in 2013, Dr. Peter Duinker was commissioned by this Joint Review Panel to review OPG's application of environmental assessment and

cumulative effect assessment. In his critique, Dr. Duinker concluded that OPG's analysis embodied in the Environmental Impact Statement and consolidated responses was not credible, not defensible, unclear, not reliable and inappropriate.

Our belief is that there is nothing in OPG that OPG has brought forward since October 2013 that changes his assessment. OPG attempts to justify its poor analysis of adverse environmental effects by using the following definition, and I quote:

"An adverse effect may be considered significant if it is major or catastrophic, widespread, long-term and/or frequent, or irreversible."

Look at the contextual meanings of three key words in this definition:

- Catastrophic; sudden and total failure from which recovery is impossible, momentous tragic event; large scale disaster.

- The word widespread; boundless, universal, worldwide.

- Irreversible; permanent,

doomed, inevitable.

By grounding the significance of adverse effects on the above definition, OPG has clearly decided that there will be no significant adverse effects.

OPG continues to rely on their professional judgment in determining significance of adverse effects and their significance. In far too many cases, OPG has predicted that no adverse effects were likely to occur, thereby eliminating the significance assessment.

On this point Dr. Duinker states that OPG did not follow the step process of the Environmental Assessment Reference Guide which first was to determine whether the predicted effects are adverse; second, determine whether any adverse effects are significant and; third, determine whether any significant adverse effects are likely. OPG has reversed the order of steps two and three in their faulty methodology used.

In his intervention to the Joint Review Panel in September 2013, Dr. Charles Rhodes, mining engineer, predicted that a large volume of water will continually drain into the DGR shaft and finally the repository during

construction, operation, decommissioning and abandonment of the DGR. The result will be radionuclides being released, creating pressurized radioactive gases creating pathways to the surface.

Dr. Rhodes' conclusions are supported by two recently released studies by Le and Nguyen, 2014, which were funded by CNSC. The predictions of Rhodes as well as the research by Le and Nguyen correctly impact the adverse effects related to hydrology, radiation, near surface geology, hydrogeology, surface water quality, human health and the environment.

Dr. Duinker also completed Undertaking 52 for the Joint Review Panel determining that OPG required a more thorough and complete method in determining the significant adverse effects as well as the cumulative effects for this DGR project.

Dr. Frank Greening has detailed several shortcomings with methods used by OPG and NWMO in determining the radioactive waste inventory and levels of radioactivity in intermediate level waste. Some of these radioactive wastes were not even considered by

OPG in determining potential adverse effects. Dr. Greening's revelations directly impact the total radioactive inventory of operational refurbishment and decommissioning waste proposed for the DGR and creates adverse effects of radiation, human health and the environment.

Did OPG misuse their professional judgment and that of their consultants and methods used to determine adverse effects and their significance?

Did OPG fully consider effects of climate change in the DGR over hundreds or even thousands of years or more?

Did OPG complete a full review of the research by Drs. Rhodes, Greening, Duinker as well as Le and Nguyen and the resulting adverse effects of siting a DGR on the proposed site?

Does OPG's response to IR 12-510 and section 7 of the EIS illustrate overconfidence in their safety case?

Moving onto GVP, the focus of OPG's Geoscientific Verification Plan -- I think they wish they were on vacation -- is with the six deep bore holes and two shallow bore holes in the proximity of their proposed DGR site. NWMO



used the same six bore holes to predict the suitability of several towns in Bruce County for a high level radioactive waste site. In at least two nearby Bruce County towns, NWMO used information from these same six bore holes to determine that the geology was not acceptable for a DGR. OPG does not plan to further investigate or verify the geoscience until after the construction licence has been approved.

Many assumptions made by OPG about the geosphere and the safety case are not certain and OPG states that these assumptions must be tested throughout the construction and into the operation stage of the proposed project. It is OPG's hope that the plan will develop in sufficient detail after the licence has been received to allow for the development of technical specifications. Do we not expect this level of detail to be in place and prior to licensing?

OPG's plan on using the observational method to develop the Geoscientific Verification Plan -- this is what OPG says about the observational method:

"Because prediction of

geotechnical behaviour is often difficult, it is sometimes appropriate to adopt the approach known as 'the Observational Method', in which the design is reviewed during construction...

A plan of monitoring shall be devised, which will reveal whether the actual behaviour lies within the acceptable limits."

They go on to say that:

"In the event that actual behaviour values fall outside acceptable limits as established by modeling, then modeling will be redone with new parameter values that were obtained during field verification activities, and design and/or method of construction will be adjusted as required. The limits and

mitigation actions will be defined at a later date..."

This plan remains without adequate detail going forward and is relying on experimentation throughout the construction and operations stage of the proposed project.

While OPG is hoping for no changes in the plans for the big blast and dig, they must consider every possible outcome including cave-ins, groundwater infiltration of several degrees higher than anticipated, excavation rock damage zone enlargement, failure of shaft seal or the shaft, microbiological activity that could interfere interfere with radioactive waste disposal; grout failure, to name a few.

Two recent reports reveal possible issues with argillaceous limestone as a host rock for the DGR. These two studies indicate many uncertainties created by disturbing the sedimentary layers.

Long-term safety assessment and the design of geological repositories for nuclear waste depend on a complete characterization of the excavation damage zone and the evaluation of

the extent of the damage. Damage zones created by excavation or by high gas pressure clearly influence the gas flow rates and the direction and impacts the design and the safety assessment of the repository.

Gases generated inside a repository could affect host rock performance. The researchers say this requires further investigation. Gases like hydrogen, hydrocarbon, carbon dioxide could be generated and released as a result of corrosion of metal components of the waste or containers and by thermal or microbial degradation of organic compounds within the waste, the backfill or the surrounding rock.

These gases pressurize sealed areas, micro cracks and macro cracks form and the resulting cracks provide transport of volatile radionuclides.

At high gas pressure, significant fractures occur within the rock and irreversible damage occurs, resulting in high permeability of the rock. Mathematical modeling alone is not conclusive. In a repository context, other preferential flow paths for both water and gas also need further consideration, according to the

researchers.

Some of these are interfaces between sealed materials in the host rock and discrete cracks.

The reaction of radionuclides with heat and water results in the creation of gases that create pressure within the rock. Gas pressure results in permanent cracks in the rock that enlarge over time, allowing transport of radionuclides to move more quickly, possibly to the surface.

In June 2014, Canadian Federal Court Justice James Russell ruled that the safety plan and assessment of environmental effects are to be carried out prior to the issuance of a construction licence or operating licence of a nuclear facility.

Perhaps the most important take-away message from Justice Russell's ruling is that, generally speaking, the Joint Review Panels must do the work of actually assessing potential environmental effects and their mitigation.

This is a necessary consequence of CEAA's two-step decision-making process. Democratic accountability is hindered where the

evidence with respect to potential adverse environmental effects is missing, inadequate or postponed to some future regulatory proceeding.

OPG's plan that is seemingly systematically approved by CNSC relies on the verification of their safety plan after construction begins and, in many cases, after the DGR is in operation.

This goes against the conservatism demanded by a project that brings with it risks to people, other biota and the environment into eternity.

OPG's geoscientific verification plans continues to lack detail and confidence. Many variables and potential challenges of the geology result in a dubious safety plan.

Reliance on the observational method to determine the construction process for the shaft and repository area makes this proposal a huge unproven experiment.

Deferral of consideration of adverse effects to future regulatory stages is contrary to the environmental assessment process as OPG has shown an overconfidence in their safety and have they created a safety culture not

unlike what is seen as WIPP and Fukushima.

Much more research must be carried out and other studies -- or other sites must be considered before any licence is issued to bury nuclear waste in Canada.

During the public hearings of the Joint Review Panel in September 2013, OPG announced their intention to double the capacity of the proposed DGR to 400,000 cubic metres in order to add massive amounts of decommissioning waste of every description and level of radiation. The expansion of the DGR would require an expansion of the waste rock pile, as we have already heard.

During the expansion of the DGR, water will again have to be pumped from the shaft, from the new repository level as well as the existing partially filled repository.

With workers expanding a repository, there is a danger of radioactive contamination from the sections of the repository that will have been partially filled with radioactive waste.

Peak radioactive -- radioactivity doses when decommissioning waste is added will be

over twice the dose of operational and refurbishment waste -- of intermediate level waste.

OPG states that it has only assessed the DGR expansion at a conceptual level. How will OPG consider a 100-plus year design life for a repository when initially the construction of the repository was for a 40-year design life?

As parts and equipment are susceptible to corrosion, metal fatigue, wear and tear, how will OPG guarantee that inspection and replacement will occur prior to unforeseen accidents or breakdowns?

Although OPG is aware of the increased production of gases from decommissioning waste that require additional space in the emplacement rooms, they do not plan to segregate this waste. The volume of ponds required for dewatering the enlarged repository as well as stormwater could result in contamination of sensitive wetlands that access Lake Huron.

OPG does not expect this to result in the need for additional holding capacity of the stormwater management pond.

Despite an expected 100 percent



increase in contaminated emissions from -- for a period of 100 years or more resulting from an expanded DGR, OPG has determined that the ventilating system will not require expansion or filtering. Despite the increase of up to 400 percent of the risk of disruptive scenarios as the shafts -- such as shaft seal failure or human intrusion, OPG states that the risk does not require changes to their safety plan.

Many aspects of the expanding -- expanding DGR to accommodate decommissioning waste involves unknown and unpredictable parameters. We've heard some of them today.

No one will know for sure how the blasting during the expansion could possibly impact the waste that's already stored in the repository or the safe operation of the Bruce nuclear power plant. The extended operation of the DGR would create additional decades of known and unknown adverse effects from the DGR construction.

Is this expansion concept another example of OPG's over-confident safety culture?

Much more research is required and other potential sites must be looked at.

OPG has not assessed any other site for the low and intermediate level waste DGR. The Joint Review Panel requested a relative risk analysis of the four options since OPG's assessment is based on their professional judgment and lacks reliability and defensibility.

The Independent Expert Group selected by OPG experienced difficulty and made several attempts to complete the Joint Review Panel request. In the March 25<sup>th</sup> report from IEG, they chose to place the hypothetical granite DGR near a wetland, a stream and small lake region, a Great Lake and a population of people.

The IEG also assumed that the hypothetical granite site would be fraught with undetermined fractures.

These assumptions result in the IEG further assuming greater risk due to water and gas transport within the rock for the granite hypothetical DGR.

IEG states that there are no detailed analysis available for a low and intermediate level waste DGR in the Canadian Shield granite. Other studies, however, have indicated that Deep Geological Repositories on

appropriate Canadian Shield sites could provide safe isolation and containment for used fuel.

Although the design is somewhat different, the used fuel study has provided an indication that the Canadian Shield would be an acceptable host.

The May 8<sup>th</sup> report of the IEG was to compare the risk perception and risk acceptability among the four options. In part, the IEG concluded that they were unable to compare the acceptable risk of the four options for waste disposal as requested by the Joint Review Panel.

However, these are some of the findings in a report contracted by IEG to Anne Wiles, Risk Science International, that nuclear waste is viewed worldwide as a higher risk than nuclear power plants. That the public perception in Canada is that nuclear energy and nuclear waste is extremely high risk and low benefit to society.

The nuclear waste repository is seen as highly stigmatizing, and this fact has been ignored by OPG.

The public is more concerned with

the significance of adverse consequences than the likelihood of occurrence. The public is concerned with the possibility of an event occurring rather than the calculated probability of the event occurring.

The proponent does not have the trust of the public. Nuclear waste repository holds the potential for serious harm to the environment due to the toxicity of the waste material and the long time period over which it remains hazardous.

The risk controversies, incomplete hazard characterization and uncertainty over the range of adverse effects can be compounded by the propensity of the proponent, often seconded by the regulator, either to play down or deny the scope of the hazard. This is a quote from her report.

Finally, the May 29<sup>th</sup> report of IEG did not provide categorical labels on the likelihood or consequence scales, nor the categorical indicators of levels of risk as requested by the Joint Review Panel.

The IEG investigated risks that were provided to them by OPG. New risks that

require further investigation by the Joint Review Panel were not considered by the IEG.

Some of these were the doubling the size, change in the waste inventory, recent research by Lee Nguyen, to name a few.

OPG used mathematical modelling, estimations and calculations rather than recorded data that was available to determine the level of radiation of the contaminated parts destined to be buried.

OPG did not consider as part of the inventory some of the radiated parts, such as garter springs, that would contain high levels of long-lasting radioactive elements.

Dr. Greening showed evidence that OPG did not follow CNSC's requirements in completing the radioactivity -- the radioactive inventory.

OPG's DGR technical support document also indicates that mandated items were not followed by OPG, and OPG's EIS is in non-compliance with the requirements of CNSC regulations and CEEA requirements and guidelines for the environmental impact statement.

OPG and NWMO documents for

radionuclide inventories associated with CANDU pressure tube refurbishment waste is seriously under-estimated, sometimes to a factor of 100.

Some of the empirical data used varies greatly from one sample to the next, causing problems when trying to scale factor other radionuclides.

CNSC staff found revised data from OPG resulting in package doses that are greater than, in part, what is acceptable.

Over the past several months, Dr. Frank Greening shared his excellent research and expertise with OPG, NWMO, CNSC as well as this Joint Review Panel. Many of these communications have become public record.

The response by CNSC officials was alarming.

We have learned about WIPP and all of its shortcomings. We know about the underground truck fire of February the 5<sup>th</sup> that burned out of control.

We know as much as we're being told about the breach of at least one container of plutonium waste that contaminated workers and the environment on February the 14<sup>th</sup>.

We know that DOE cut back on some of the critical safety aspects of the RAD waste burial at WIPP.

OPG states that evidence about WIPP incidents indicate a theme related to degraded safety culture, ineffective programs and program implementation as well as training. CNSC statement supports OPG's synopsis.

An unpublicized fact is that also on February 14<sup>th</sup>, 2014, the following modifications to the WIPP licence were about to be made.

First, the removal of the need to have concrete block explosion-proof isolation walls because they were considered no longer needed. Instead, walls of salt were being proposed as barriers.

The expansion of the number of emplacement panels from eight to 10, with each panel being made up of seven emplacement rooms the size of football fields were being added, and a reduction in the monitoring of dangerous substances and gases and radionuclide levels was being proposed.

Quietly, on March 21<sup>st</sup>, these

licence changes were cancelled.

When the Joint Review Panel visited WIPP in November 2012, you were told of the safety plan, the safety confidence that all parties had in WIPP. The information that you were given then looks very similar to what OPG has brought forward at these hearings.

The geology seems excellent. The emplacement process seems solid. The safety process seems rigorous. The people involved have confidence in safely isolating the waste for a very long time.

With the conclusions drawn by WIPP scientists -- the conclusions drawn by WIPP scientists were based on science and mathematics. It is obvious that their confidence and safety case were fundamentally incorrect.

Relying on statistical modelling, scatter graphs, Monte Carlo method and probability calculations to assure safety is problematic and susceptible to many errors.

In September, WIPP was the standard that all DGRs should be built by. A few short months later, CNSC and OPG are both critics of the same aspects of WIPP.



In conclusion, this Joint Review Panel decision for OPG's DGR project is unlike any other ever made in Canada. The errors of omission and poor judgment made by OPG have damaged this project from the beginning with no consideration given to another possible site.

Many uncertainties and unknowns with regard to the environmental effects and the geology. Huge voids in the technical plan.

Throughout these hearings, we've learned that OPG used an unscrupulous hosting agreement which, among other things, attempted to buy support from Bruce County elected officials. OPG has attempted to deceive this Panel about the quality of engagement that was carried out in Bruce County, this country and the U.S.

We have learned that numerous not-for-profit organizations receive funds from OPG from our tax and utility dollars, actually. These organizations were later asked by OPG to write letters and give presentations in support of this DGR project.

For 10 years, OPG, along with NWMO, have been holding illegal, secret community consultation advisory group meetings with our

Bruce County elected officials and staff to ensure their support for the DGR, stifle any resistance against the DGR and call for written and oral support that OPG staff offered to compose for the Mayors.

The disaster at Fukushima and, more recently, WIPP, call into question the safety case and over-confident safety culture. We read the report released last month by 21-member community on lessons learned from Fukushima nuclear accident for improving safety culture -- or safety in the U.S. nuclear power plants.

Three of these committee findings are the nuclear industry and regulator must consider beyond design basis events for -- and deal with these unexpected risks and complexities. Some of them include multiple human and equipment failure, violations of operation protocol and extreme external event.

Second, human error has been shown repeatedly to be a significant contributor to the risks associated with nuclear facilities. An Idaho National Laboratory study showed that 75 percent of the significant operating events that

occurred were caused by human error.

And thirdly, the regulator must maintain independence and not be a promoter or seem to be a promoter of the industry.

Much more research is required and other potential sites outside of the Great Lakes Basin must be fully investigated before a construction licence is considered for a DGR anywhere in Canada.

Thank you.

**THE CHAIRPERSON:** Thank you.

Panel Members, did we have any questions?

Dr. Muecke.

**MEMBER MUECKE:** This question is directed at either OPG or CNSC, or both.

Mr. Gibbons cites two recent research reports that reveal possible issues with argillaceous limestone as host for nuclear waste repositories.

Could you confirm or correct the Panel's understanding that these papers address argillaceous rocks such as shales and mud stones rather than argillaceous limestone and, secondly, how do these reports impact on the suitability of

the Cobourg formation?

**MS SWAMI:** Laurie Swam, for the record.

I'll ask Mr. Jensen to respond to that to start the conversation, and perhaps the CNSC specialist would also like to comment on this.

**MR. JENSEN:** Mark Jensen, for the record.

The two new papers, the 2014 papers, are concerning work that was conducted in the Mount Terry facility that looks at the opalinus clay. It is a high clay fraction, I think 50 plus percent, and it is a less indurated clay in which processes of creep might be important.

Those processes don't apply to the Cobourg limestone at all and have no effect on the predictions that have been made in the safety case that's been presented.

**THE CHAIRPERSON:** CNSC?

**DR. THOMPSON:** Patsy Thompson, for the record.

The papers by Lee Nguyen, who's -  
- Dr. Nguyen is actually sitting behind me. But

more seriously, Dr. Nguyen had talked about the -  
- this research last year during the hearings,  
and we had made the two papers available and  
they're on the public registry.

So I'll let Dr. Nguyen speak  
about the implications of that research for the  
DGR project.

**DR. NGUYEN:** Those research do  
not impact the DGR projects. They are done in  
the spirit of continual learning, so what we did  
is -- was to study opalinus clay at the Monterey  
project where a set of experimental data were  
available from laboratory experiments and large  
institute experiments.

The type of clay, the opalinus  
clay, has much lower strength than the Cobourg.  
It has a higher argillaceous content, clay  
content, so creep might be a factor which  
influences the behaviour of that clay.

The Cobourg limestone with the  
experimental data which were available from OPG  
and NWMO behaves more like hard rock. It has  
higher strength, so the time -- it affects the  
time dependency. The behaviour might be much  
less pronounced.

When we wrote those papers, in the introduction we point out several potential aspects that has to be looked at, for example, the formation of the EDZ, how it could influence preferential pathways, the fact that gas could be generated and the pressure can increase to such an extent that cracks could be formed.

So those are potential problems which are identified in the introduction.

The conclusion is a different story. When we study those -- the experimental data and with that research model in order to look at those data, the potential problems might or might not be present, depending on the circumstances.

For example, the generation of gas pressure can induce cracks already in the case when the pressure exceeds the minimum principal stress in the system.

So it's not always the case, and particularly not the case for the OPG DGR in Cobourg limestone.

**DR. THOMPSON:** Perhaps, Dr. Muecke, just to close off what Dr. Nguyen has stated, a lot of the research that has been

conducted by the CNSC by Dr. Nguyen and his colleagues has been used to inform CNSC's staff review of the proposed geoscientific verification plan for the DGR project.

**MEMBER MUECKE:** So just to recapitulate, the studies involved rock types which have a very high clay fraction as opposed to the argillaceous limestones of the host formation, which the clay fraction is much lower and, therefore, changes the properties of the rocks significantly.

**DR. NGUYEN:** Son Nguyen, for the record.

That's correct. And in particular, also, some of the test conditions are very severe in order to induce the very traumatic -- I wouldn't say traumatic -- the effects that might be in the worst case scenario like the generation of cracks or some of the tests performed in the lab are in situ. In that type of opalinus clay, the pressure was on purpose raised to such a level that the cracks would be formed.

**MEMBER MUECKE:** Thank you very much.

**THE CHAIRPERSON:** Dr. Archibald.

**MEMBER ARCHIBALD:** Mr. or Mrs. Gibbons, on page 11 of Section 4.2 of your presentation concerning the expanded repository, you have stated that there will be a need for increased pumping from the repository.

I'd like to pose a question to OPG, please.

Would OPG have any conceptual estimate of a potential increase in combined water pumping requirements that might occur and would such increased outflow have any significant impact on surface water management pond operations?

**MR. WILSON:** Derek Wilson, for the record.

No, we don't -- we wouldn't expect to see any increase in volume of pumping water for the expansion case. The current proposed 22 litres per second which is the design basis for the proposed DGR is already extremely conservative, and again, we don't expect to have water coming in from the excavations themselves, so again, it's really the contribution of the equipment, the processed water required to



construct that is feeding the 21 litres -- or 22 litres per second.

So keeping the assumptions of the same type of technology to expand the DGR, drill and blast, and that type of activity, we see no reason to increase the water pumping requirements.

**MEMBER ARCHIBALD:** And it's my impression, therefore, that the presence of closure walls and so on would cease any water flows from the panel rooms that had already been encased.

**MR. WILSON:** Derek Wilson, for the record.

If there was any seepage into the excavations themselves, that's correct, the closure walls would isolate those.

**MEMBER ARCHIBALD:** Thank you very much.

**THE CHAIRPERSON:** This is an appropriate place to stop for a lunch break. We will resume today's hearing at 2:00 p.m. with a presentation by North Watch and affiliates.

--- Upon recessing at 12:28 p.m. /

Suspension à 12 h 28

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

Reprise à 14 h 02

**THE CHAIRPERSON:** Good afternoon everyone. The Panel understands that the Ministry of Transportation does have a response based on the question from this morning.

Please proceed.

--- Pause

Hello? That little chime was not a good sign.

Okay. While we are waiting for the Ministry of Transportation person to get back on the line, perhaps Mr. da Silva is available to answer Dr. Muecke's question. OPG?

**MS SWAMI:** Laurie Swami, for the record.

That is correct. Mr. da Silva is on the phone now, but I think it might be helpful if we had the question over again. Thank you.

**MEMBER MUECKE:** Okay, Mr. da Silva?

**MR. da SILVA:** Yes, I am here.

**MEMBER MUECKE:** Okay. Could you,

for the Panel, address the effects on noise and noise propagation when the waste rock management area is projected to increase in height up to 35 metres, how will this affect noise levels and noise propagation in the area?

**MR. da SILVA:** For the record, Danny da Silva.

With respect to the waste rock management area, that was one thing, as we indicated previously I believe during the technical information session and during the hearing last year, that we did not use the shielding that could be provided by the waste rock to mitigate or reduce the predicted sound levels off site.

So at the various receptor locations we didn't recognize the benefit that the shielding from the waste rock pile would provide. So with respect to that, increasing waste rock stockpile from the equipment that would be working behind it there would be an improvement in terms of the level of reduction provided.

For the trucks that would be on top, they would be slightly further removed from

the receptor, but the overall level -- there wouldn't be a marked change from the trucks alone. Because when we predicted the levels associated with site preparation in construction we account for all of the equipment. The trucks are one of those pieces of equipment that we have included in our model.

Most of that other equipment, the more significant sources would be lower to the ground, so I wouldn't anticipate there being a real change in the predicted levels.

**MEMBER MUECKE:** Just locating a sound source higher up from the ground is often used as a means -- take a rock concert -- of disbursing the sound more efficiently. Would that principle not apply in this case?

**MR. da SILVA:** For the record, Danny da Silva.

It would, and it would facilitate I guess the propagation of the sound wave from that source. But again, I have just run a couple of quick numbers here with the trucks, and the levels are more than 10 dB below just for the trucks alone. You know, so they are like 28, 29 dBA, that is well below World Health, Ministry of

the Environment limits.

And with all of the other equipment down below, the contribution from that equipment would be reduced as a result of the increased height in the stockpile.

So overall, the contribution of just the trucks is not sufficient to increase the predicted levels beyond what we have already.

**MEMBER MUECKE:** One last question then. In your opinion, the truck noise levels would be in excess of the level of noise resulting from the dumping of these trucks?

**MR. da SILVA:** When they are hauling the rock up into the waste rock management pile or management area, yes, overall the mechanical noise from the truck is dominating.

**MEMBER MUECKE:** Thank you very much, Mr. da Silva.

**THE CHAIRPERSON:** Do we now have the Ministry of Transportation person on the phone?

**MR. REYNOLDS:** I am here, yes.

**THE CHAIRPERSON:** Great. So I understand you are getting back to the Panel

regarding our question about specific TDG regulations for the types of waste generated by decommissioning?

**MR. REYNOLDS:** Yes. First off, Madam Chair, I apologize for the delay on that. If you would, would you please re-ask me the question?

**THE CHAIRPERSON:** Yes. The question from the Panel is are there specific transport of danger goods regulations that would apply to the types of waste generated by decommissioning?

**MR. REYNOLDS:** The answer to that, for the record, is yes, there is specific regulations that pertain to that and applies under the radioactive material class 7 requirements, similar to all other deemed regulated dangerous goods as well requiring training of the driver, placarding of vehicles, appropriate documentation and whatever small means or large means of containment that the material is in may also need additional safety marks as well.

**THE CHAIRPERSON:** Thank you.

And may I ask you to identify

yourself please, for the record?

**MR. REYNOLDS:** For the record, my name is Warren Reynolds.

**THE CHAIRPERSON:** Thank you, Mr. Reynolds.

The Panel understands that CNSC, OPG and Environment Canada all have some information for us regarding getting back to us from some of the items that came up this morning or other items?

If I could start with OPG please?

**MS SWAMI:** Laurie Swami, for the record.

I believe we are going to provide you information on total suspended solids from yesterday afternoon.

If that is what you were thinking about, Mr. Wilson will provide our response.

**THE CHAIRPERSON:** Thank you.

Mr. Wilson?

**MR. WILSON:** Derek Wilson, for the record.

And just to recap our understanding of the question, it was what would be some of the predicted ranges of total

suspended solids in a significant storm event which could overtop the stormwater management pond that is currently designed?

We had undertaken preliminary modelling of various scenarios for the site preparation construction and operations phases for a series of storm events.

And in the site preparation phase, with the largest disturbance of the site due to the activities undertaken, we have a range of 200 to 400 milligrams per litre in varying flood arrangements, the highest being in the one in a 100-year storm event.

During construction we have conservatively assumed 500 milligrams per litre of effluent from the underground discharge which is, if you recall last year we talked about, you know, basically the thickest sludge we could pump from underground in terms of the total suspended solids being introduced.

And those gave us ranges of about 500 milligrams per litre, which indicated that there would be a need to have mitigation or treatment of that either through sump recirculation or even removal of total suspended



solids.

During the operations phase, however, and if you looked at it that if you were to do discontinue the pumping under those assumptions, in all the storm events the total suspended solids is actually below our criteria of 40 milligrams per litre, even included in the 100-year storm event.

**THE CHAIRPERSON:** Thank you, Mr. Wilson.

CNSC?

**DR. THOMPSON:** Patsy Thompson, for the record.

So we asked Dr. Kevin Lee and Dr. Shizhong Lei to review the information and provide us the response.

The information we have from the essentially baseline characterization that has been done is that the total suspended solid concentrations in the stormwater were measured between 2007 and 2009 and the values range from 24 to 90 milligrams per litre.

There are some data dating back to 1996 when there was a fairly significant event where the values were as high as 775 milligrams

per litre. So that is in line with the higher values that OPG has just mentioned.

In MacPherson Bay the baseline characterization identified that the total suspended solid concentrations varied between less than 10 milligrams per litre to approximately 35 milligrams per litre.

The Canadian water quality guideline for the protection of aquatic life specifies that the maximum increase of 25 milligrams per litre above background levels should be the target. And in the situation of MacPherson Bay and taking into consideration some of the numbers I have provided for the baseline characterization, there are storm events where there would be an increase above 25 milligrams per litre in MacPherson Bay.

It is difficult to actually assess the area that would be impacted in MacPherson Bay because without knowing the types of storm events that could happen, there is a lot of wave action. And, you know, the area that would be affected would be a consideration.

But to answer your question from yesterday, there are situations where, for

various large storm events there would be a potential for entrainment, that is why some of the mitigation measures were identified specifically to address this type of event.

**THE CHAIRPERSON:** Thank you.  
Environment Canada?

**MR. LEONARDELLI:** Sandro Leonardelli, for the record.

So I have been looking at two different documents; one is on the CEA Registry 954, analysis of stormwater runoff, and CEA Registry 936, water quality monitoring results for the stormwater management pond.

So what I see in one of these documents, and I was focusing on total suspended solids, the modelling shows that TSS levels are decreasing with larger storm events, which seems to be counterintuitive.

But it makes sense when you consider that they had assumed in the model that the underground water had a TSS level of 5,000 milligrams per litre. That was an assumption that was made.

So essentially, the modelling is showing dilution of the underground sump water

when there is a larger storm event.

However, if you take this source of total suspended solids out of the equation, you would then expect to see the more traditional expectation that TSS levels would increase and that the model would show higher levels of TSS with a larger storm event, but probably at a lower level because you don't have this large source of total suspended solids from the underground.

So I can't answer with any definitive clarity what the level would be in a 100-year storm event based on what I have been looking at so far.

And I don't know if there is any additional information. The information that Mr. Wilson was referring to, I'm not sure if I have that in my hands or not.

So in any case, our original submission said that we thought that these models would need to be rerun at some point after confirming the type of process flows and groundwater inflow rates and, you know, the type of contaminant levels from the various sources that contribute overall to the stormwater pond.

And so I can't answer with any definitiveness as to what level it would be. But that is what I have seen so far in these two papers that I have been talking about. And if there is anything else that is pertinent to this, I would appreciate it being shared with me so that I can continue the analysis.

**THE CHAIRPERSON:** Thank you.

OPG, perhaps you could confirm with the Panel Mr. Leonardelli's understanding that one of the modelling exercises performed by OPG assumed very high total suspended solids in the underground water. And if that is true, remind the Panel what OPG were -- the main line of mitigation that you were going to be using to apply to that very high TSS.

**MR. WILSON:** Derek Wilson, for the record.

Again, and as I just mentioned as well, one of the conservative assumptions in that initial modelling was that we had a very high TSS coming from the underground at 5,000 milligrams per litre, all below the 100 micron. So again, very fine silt at very high concentrations.

And again, it was to see how the

stormwater management pond would actually perform and how the overall site would show.

So as Mr. Leonardelli had pointed out, we are actually seeing a decrease as a storm event comes in because we are actually having a larger influence from the surface runoff counteracting that, and we are seeing a reduction.

And I am just trying to pull the record that Mr. Leonardelli referenced as being 954 and 936, and perhaps he does have this information available through those sources.

And again, we looked at the mitigation being the ability to settle that effluent underground through the sump system and pump a much smaller TSS concentration to the surface. And then we would take that forward.

But again, we wanted to look at it unmitigated to see how the system performed.

Further to that, as we look at the potential to resize the pond, that will also have a significant impact on what the outflow conditions would be.

So again, in the site preparation and construction it is a very typical response.

You are seeing that the TSS is increasing with the flow. As the site becomes more mature and more vegetated, you see that reducing. And then, again, it becomes the main contribution from the underground.

And then during the operations phase where we really have negligible underground pumping impacts, we are seeing that the re-vegetation or the more mature surface facilities is reducing that level to below our criteria of 40 milligrams per litre.

**THE CHAIRPERSON:** Thank you, Mr. Wilson.

Were there any other matters that were going to be addressed before we proceed?

Environment Canada, yes?

**MS ALI:** Nardia Ali, Environment Canada, for the record.

Yesterday we had several questions. There are a few of them that we won't be able to answer until tomorrow afternoon, but I have the answer for one.

**THE CHAIRPERSON:** Please proceed, yes.

**MS ALI:** So the question that I

wanted to answer is the one related to recommendations for best practices for protection of groundwater at mine sites.

So I spoke with our people in our Minerals and Processing Division. So two things we talked about. First of all, the metal mining, effluent regulations developed under the *Fisheries Act*. It is the primary means of protecting fishery waters from the impact of releases of all effluents from metal mine sites.

As a result, they are not principally aimed at groundwater protection, because the *Fisheries Act* deals mainly with surface water.

However, all mines that are subject to the regulations, in accordance with these regs, are required to control all effluent, including the seepage that percolates through the ground cover so that they meet the specified standards in Schedule 4 of the metal mining effluent regulation. And this seepage must also not be lethal to fish prior to being released from the site.

This may require that the proponent install impervious liners and tailings



in waste rock disposal areas to prevent this seepage from occurring. But the method that is used is the proponent's choice.

The key requirement is that the seepage be collected and demonstrated to be in compliance with the MMER through whatever treatment may be necessary prior to final release to fishery water.

And then we also have, it is not a regulation, but there is an environmental code of practice for mines that provides guidance on best practices to protect surface and groundwater.

The code of practice encourages the design and implementation of measures to manage seepages and protect surface water and groundwater through things like drainage and diversion ditches, monitoring of the seepage, appropriate treatment.

**THE CHAIRPERSON:** Thank you, Ms. Ali.

The Panel has one more matter to deal with before we proceed finally with the Northwatch presentation.

As per Ms Lloyd's question on

September 10, OPG has provided the document entitled OPG's Deep Geologic Repository for Low and Intermediate-Level Waste/Preliminary Waste Acceptance Criteria.

The Panel has determined that this document is to be posted on the registry as part of the record for the DGR project.

Thank you.

So now we are ready to proceed with the presentation by Northwatch.

Ms Lloyd?

**PRESENTATION BY / PRÉSENTATION PAR:  
NORTHWATCH, BRENNAIN LLOYD WITH PETE ROCHE,  
NORTHWATCH AFFILIATE AND STUART HASZELDINE,  
NORTHWATCH**

**MS LLOYD:** Thank you, Dr. Swanson and thank you Panel members.

And I am now going to attempt that which has never been done before, I am going to try to double-click my way through the presentation, so we will see how that goes.

I do thank you for the presentation time and the opportunity to share

our review findings.

My name is Brennain Lloyd and I am Project Coordinator with Northwatch, and I am going to be joined this afternoon in a panel presentation by two of our experts: Pete Roche from the Edinburgh Energy and Environment Consultancy who was jointly retained by Northwatch and Zero Waste 4 Zero Burning; and Dr. Stuart Haszeldine, who was retained jointly by Northwatch and the Inverhuron Committee. And we do have members of both those partner organizations here with us today.

So as you may recall from our September presentation, September 2013 presentation, Northwatch is a regional coalition of environmental and social organizations in northeastern Ontario. And our formation in 1988 was hastened by a proposal for a high-level nuclear fuel waste burial in our region.

And this DGR is important both in its own right as a repository beside Lake Huron, but also as precedent. And our region includes Manitoulin Island and the north shore of Lake Huron, the Canadian Shield section of the north shore of Lake Huron. And we are Shield dwellers.

We have heard many references to the Canadian Shield over the last few days as if it is someplace far away from everywhere.

Well, I am here to say it is absolutely somewhere and there is not a section of the Shield that doesn't have some people have a relationship to that land and that water. And I think that that is something that we all need to keep in mind as we make these comparisons between the Canadian Shield and sedimentary rock formations.

A summary of our findings: OPG's group of independent experts have confirmed that OPG's design will ultimately rely on dilution. The uncertainties with respect to the waste inventory appear to have increased rather than decreased.

There are increased uncertainties with the generally held expectation that the addition of decommissioning waste will increase the amount of gas generated which then in turn has multiplying uncertainties for the long-term performance of the repository.

Issues persist with respect to the geoscience verification plan. The function,

the barriers, the shaft seal and OPG's claim of a successful operation having been demonstrated through the WIPP I think now is seen to be quite unfounded.

So very briefly I'm going to review OPG and CNSC PMDs.

For the most part OPG's PMD was a restatement of their Information Request responses and CNSC's was largely a restatement of OPG's material, but there were a couple of comments -- a couple of points in the CNSC PMD which I would like to comment on.

One is -- and I think this is an overarching comment -- the CNSC conclusion that the DGR project is not likely to cause significant effects, adverse environmental effects taking into account implementation of mitigation measures, OPG commitments, CNSC staff recommendations, that's a pretty tall order and as, you know, I will comment on later, CNSC -- OPG operations have a track record of not being in compliance with the licence conditions.

So given all those requirements, given all those conditions, what happens when the non-compliance with licence conditions become a

regular occurrence? Can staff hold a reasonable expectation that the conditions will be met and at what point does that likelihood of no adverse effects shift when enough of those conditions and qualifiers aren't met?

I would also like to just briefly comment on our fascination with the CNSC's apocalyptic world view. This comes up again and again not just in this proceeding, but CNSC holds the view that loss of institutional control is not only a possibility at some point down in the future, but they state that it's a high likelihood of occurring within a few hundred years. I don't find that anywhere in the literature outside the nuclear sector. Mostly nuclear regulators, and there is a bit of a circular discussion on that, but where is the quantitative or qualitative risk assessment that says social collapse is imminent, 100-200 years? And how does that coincide with CNSC's licensing decision which would include licensing new building reactors which are at least a century out before decommissioning could take place?

So there's just a really -- we have real curiosity about this apocalyptic world

view that we hear expressed again and again.

So we are going to review OPG additional information and, given the time constraints, we will do this in a pretty rapid fashion, but I would suggest that the review criteria for all the additional information is -- has the additional information provided -- is it credible, is a well referenced, is it seemingly reliable, does it promote confidence in the information product itself and does it provide sufficient confidence in the proposal?

Does it build confidence in the proposal, which I think last year we had a pretty good sense that there was not cause for confidence in that?

So first of all, the narrative: Significance of adverse environmental effects. In our written submission we noted to you that we would be relying on the submissions of other interveners, but I did want to make a comment, and I think this was sparked by conversation earlier this week in the discussion -- I guess that was just yesterday, the discussion of valued ecosystem components and particularly I'm focusing the question on deck No. 8 on radiation

and radioactivity.

If we look just at that response, did it meet your direction or did it rely on an already acknowledged to be inaccurate inventory? The references were largely in-house reports.

I think you had directed them to provide material references supported from the literature, at least the grey literature. They were largely in-house industry literature.

It provided, from our assessment, very little new information or assessment or insights into their assessment methodology and it allows for that silo approach.

And we have seen this in other places where they argue for their application, a silo approach, and in the case of the risk assessment a silo approach is looking at a single point in time, a single information product, looking at it through a single lens, which is not necessarily representative of the proposal or the project as it is likely to play out.

So the geoscientific verification plan, we will hear from Steve Frishman tomorrow on this, one of our expert reviewers, but I did want to comment briefly on CNSC PMD.



Section 2.2 raises multiple questions about the geoscience verification plan. They write that if reaching a trigger -- so they write that reaching a trigger -- reaching a value would trigger a course of action, but the trigger levels aren't identified, the values aren't identified.

So again, there is a real murkiness even in the revised or updated geoscience verification plan about what triggers failure, what signifies, how is that going to be measured? And CNSC staff are going to be doing the measuring, we assume. By what measure will those decisions be made?

It appears to be -- if it's a certain set of values, could a combination of two or more values be deviant enough to result in a combined pulling of the trigger? And it's not -- you know, I think it raises as many questions as it satisfies.

So expansion plans. I'm trying to see if that's where I'm at. Yes, I am. My eyesight is not what it could be.

So moving on to expansion plans, IR 12-512. Again we will hear other comments

from some of our other presenters today, but I am particularly concerned about some of the comments from both OPG and CNSC.

So OPG states in their PMD, they acknowledge that there's difficulties in the larger volume of problematic waste and with the larger volume of those wastes, including metals and the contribution of metals to gas generation and so the chain goes, but OPG states in their PMD that emerging decommissioning techniques are showing good potential, and they go on.

So it suggests that OPG is going to rely on some solution in the future. I think that's what the industry did in the 70s, they relied on some solution in the future writ large, for the management -- long-term management of waste and OPG is encouraging us to do that again.

But CNSC this morning, and I think OPG joined in to a certain extent, CNSC talked about a different strategy and that is releasing these metals into the marketplace. So working with international agencies to develop regulations or standards which will allow metals to be released -- it's a free-release standard -- released into the marketplace and moved out of

the waste category.

We have a high level of concern of that and I think it's too late in the day to provide additional comments, but our initial concern was with the OPG comment that they would solve it later, but our concerns have heightened or doubled as we go through the conversations this week and here maybe the solution is a solution that is already under way, there is already a strategy at play and it might not be a solution which is protective of the public interest.

So the independent expert group, as noted by the CNSC, their report was flawed in several respects. The general themes of this report are unsupported statements, generalizations and assumptions.

Section 2 of the report relied almost entirely on OPG's depiction, as we understand it, of the management options.

The report contained a number of statements that seem quite categorical beyond reason. For example, containers must be replaced after 50 years.

The expert report was not aware

of any information about enhanced or on-site -- enhanced on-site storage, despite the international discussions about extended on-site storage. When we did a search using a couple of word combos just to test out their own statements, we found there was ample information, including information provided by the Nuclear Regulatory Commission, other national organizations.

The IEG -- I will say that one aspect of the IEG report that we enjoyed was breaking away from the anthem since 1977 in support of burial in the Canadian Shield. That is a welcome shift, but would have maybe been better if it had been supported by their actually looking at any of the literature that is available, of which there is ample, Atomic Energy of Canada Limited and the Nuclear Waste Management Organization. We don't vouch for its quality, but it's there.

If the paper is helpful in any way it's in confirming that dilution is built into the DGR design, at least by the independent expert group's assessment.

And I must say, I will just add,

the question of independence I think needs to be raised. At least two of the consultants are repeat contractors to the Nuclear Waste Management Organization. I think at least two of them have produced more papers for the Nuclear Waste Management Organization than perhaps any other of the many consultants NWMO hires. So independence, not so sure.

The revisions to the waste inventory. I think we will hear from others on this from Northwatch's team today, but a couple of things to note. The CNSC -- and I didn't find this in the OPG documents, but in the CNSC panel member document they talk about with the revisions to the waste inventory occupancy time would be reduced from 210 to 53 hours. I think it was 53 hours, I have just lost my -- yes, to 53 hours per year.

We didn't find this in the OPG material and we think it is a pretty large statement and it raises all kinds of other questions about things that we had heard about last year about workforce and so on.

You know, there is the unstated question about what happens when those

exceedances, those limits are exceeded.

We also heard yesterday, I think it was yesterday or maybe it was earlier, about the five-minute exposure in the case of a severe or high-energy breach and OPG said, well, that was calculated on the basis of how long it would take to get to the refuge station.

We went back through the environmental impact statement, the preliminary safety report and, once again, found very little on the refuge statement. Their location, they are located in the island, services are islanded, the only occupancy estimate we found was 24 workers in total, sometimes the refuge station is described as being combined with the lunchroom, sometimes not.

I don't think that's enough to say, well, they can walk to the refuge station in five minutes. What then, particularly given the island arrangements? What then, if there's a high-energy breach in the shaft? What then, once those workers have -- those 24 workers have taken refuge in the lunchroom?

So applicability of recent incidents at the Waste Isolation Pilot Plant.

You did hear from Mr. Hancock earlier in this review about those events themselves, and I want to speak just briefly about the applicability of those events to OPG's proposal.

WIPP was the one. OPG stated their project was based -- the selection of burial was based on international experience and WIPP was the one. Of the list they presented, WIPP was the only one that was operating and was at depth.

And it's interesting when you look at OPG's response to your Information Request, they don't mention that. And their defence I think is simply to say OPG's means of distancing themselves from the WIPP events is simply to say two things. One is, we have policy, plans and programs in place. Two is -- that is in response to the fire incident, we have policy, plans and programs in place.

And we have in our written submission a review of both the CNSC safety assessments and the S99 reports and I think that it's pretty clear that that is not a defence. The S99 reports, looking at them over three years, 594 incidents reported, approximately half

of them directly related to the causal effects at WIPP for the truck fire -- for the fire.

The defence around the radiological release is it is a safety culture. Well, we have looked at their safety culture and, in fact, OPG says decades of safety culture. So if it's decades of safety culture, we need to look at decades of operation.

And when you look at what's in the public realm, parliamentary committees, independent reports commissioned by the government in the 1990s and up through to 2004, it's not consistent with the claim of safety culture through the decades.

The 2001 Interim Report by the Standing Senate Committee on Energy, Environment and Natural Resources, they provide a summary of Ontario Hydro safety culture in the 1980s and 1990s. Utilities that planned and built nuclear power stations three decades ago expected that they would operate for 40 years -- safely for 40 years or more, however, in 1997 Ontario Hydro, the forerunner to Ontario Power Generation, shut down its seven oldest reactors at an estimated cost of \$5-\$8 billion.



And the report goes on in much more detail and for the sake of time I won't share those with you orally, but some are provided in our written report.

In 2005 the Honourable John Manley confirmed -- and this is at the request of the Government of Ontario, conducted a review and he confirmed that the culture of OPG is still at odds with safety.

In sum:

"OPG looks to people on the inside and outside like a company that is neither well-rounded nor well-governed..."

(As read)

And he goes on.

So some additional issues, and for the sake of time I will leave these now, they are worth noting, the annotated chapter -- version of Chapter 4 is incomplete, there are additional registry postings which warrant discussion, and there are questions about the assessment standard that you apply.

In 2013 Laura Bowman presented to you and provided an outline of international

standards. I think CNSC now is urging you to apply with a different standard and that standard would be, let somebody else decide the outstanding issues at a later date. And I would encourage you to not go with that standard.

So in conclusion, Ontario Power Generation has not provided the Joint Review Panel with the basis for approving the environmental assessment, the application to license a site or the application to construct a site and on the basis of what they have provided you and have not provided you, I would restate our request of 2013 and; that is, to reject the application.

Thank you. I believe we may be joined on the phone now by Pete Roche and Dr. Haszeldine.

**THE CHAIRPERSON:** Thank you, Ms Lloyd. I would just like to point out that my timer here doesn't allow me to -- we didn't program it for the 40 minutes rather than the 30 minutes, so don't be alarmed when the five-minute light comes on. That means you actually have 15 minutes left for total.

And just so you know, you have

about 18 minutes left for the two presenters.

Dr. Haszeldine, are you on the line?

**MS LLOYD:** Excuse me. We were going to actually ask to hear from Mr. Roche first, if we could.

**THE CHAIRPERSON:** Mr. Roche first, okay. Thank you.

Mr. Roche, please proceed.

**MR. ROCHE:** Hello. Good afternoon. I will be really quick.

We have learned from IR 12-512 that OPG wants the option to increase the waste volume capacity of the DGR from 200,000 cubic metres to 400,000 cubic metres and that waste could come from new operational reactors, refurbishment activities or decommissioning activities, but we are not able to see what the detailed waste volumes and characteristics of that extra 200,000 metres will be.

Assuming, according to OPG, the waste types arising from decommissioning activities are fundamentally the same as those arising from operations and refurbishment, if we take a detailed look at Attachment "A" in OPG's

response to IR 12-512, that reveals some quite significant differences and my slide presentation has a table of some of those differences.

The correspondence between Dr. Frank Greening and NWMO has raised some important questions about the accuracy of the existing operation and the refurbishment waste inventory, but these wastes have been subject to a relatively thorough environmental impact statement and yet the extra 200,000 cubic metres has not.

We are expected to accept OPG's back-of-the-envelope estimate that adding the decommissioning waste will double the dose calculated.

One particular concern is -- are you still there?

**THE CHAIRPERSON:** Yes, we are.

**MR. ROCHE:** Hello?

**THE CHAIRPERSON:** Yes, we are.

Thank you.

**MR. ROCHE:** Yes, all right. I had a bleep.

One particular area of concern is the increased potential for gas generation from

the decommissioned waste. With a large proportion of metals, this is likely to result in more gas generated from anaerobic metal corrosion.

The proposition that gas generation will keep the repository dry depends on an accurate and precise understanding of the rates of gas generation and the rates of water ingress.

So my view is that adding the decommissioning wastes at this late stage throws the development of the safety case into disarray.

I will leave it there and let Stuart take over. Thank you.

**DR. HASZELDINE:** Hello. Hello.

**THE CHAIRPERSON:** Hello, Dr. Haszeldine, we hear you loud and clear. Thank you.

**DR. HASZELDINE:** Okay. I only just got online because we had a bit of problem with the phone. All right.

So, Brennain, are you going to -- do we have time to run through this presentation?

**MS LLOYD:** Yes, we do. And I have slide No. 1 up, your opening slide.

**DR. HASZELDINE:** Okay. So I have about 16 slides and I would like to run through those, if that is okay with the Chair.

**THE CHAIRPERSON:** Yes, go ahead.

**DR. HASZELDINE:** So I will start? Right.

**THE CHAIRPERSON:** Yes, go ahead.

**DR. HASZELDINE:** Okay. My name is Professor Stuart Haszeldine, I am from the University of Edinburgh in Scotland and I have worked on radioactive waste in the U.K. for a number of years, at the time an academic, not a professional waste developer.

The second slide. In this presentation I would like to summarize some evidence that is derived from that provided by OPG and then CNSC, and really this is talking about the long-term and short-term performance of the repository because of the gas generation and the pressure which is generated underground as a consequence of that gas generation and the interaction with other underground uses.

And what I am suggesting is we have insufficient information about the generation of faults and fractures because of

that natural geological process.

Slide 3. Just to focus in on what we are talking about, these are block diagrams of a rock. Usually a rock is in confining stress at the top, it is a net compression and rock is very strong with that, but if we are pulling a rock, if it is in extension, then rock is very, very weak and if we put pressure inside a rock and pump that up, we can blow that rock apart by pushing and pushing that rock into extension. That's a general principle.

Slide 4. If we look at slide 4, this is a diagram of the stress in the rock. So that is more compression to the right and the amount of sheer which is slippage in the rock vertically. And you can see on the right there is a circle, and if Brennain presses the button we should see a red circle come there.

And then we will see, if we push the button again, we have a yellow bar saying that increased pore pressure can fracture the rock. And as the rock increases in pressure, that changes, that moves that circle across the left in the middle (audio cuts out) fracture on

the (audio cuts out) in terms of engineering of the rock and that's when the rock cracks.

So the general principle of this, which is well understood in terms of rock mechanics, is that by increasing the pressure in a rock, in the pore spaces, in the tiny pores of the rock you can induce the fracturing of the rock, and that is a very similar principle to the fracking or shale gas which you may be familiar with.

If we move on to slide 5 we can see the vertical layering of the rocks around this repository site and, of course, what we are interested in is the part with the white arrow on the right.

The repository depth is about 650-670 metres and that is just a natural pressure just now of a hydrostatic pressure, it falls on the water pressure line which is absolutely normal. There are unusual features above that, of course, in this area you will be familiar with, they're under pressured, but the bit we are interested in is below the repository we fall on the normal hydrostatic, the water pressure line going down to the aquifer 850



metres on the scale on (audio cuts out) which is the Cambrian aquifer, which is a very large supply of water which could feed into this zone.

So at the moment the repository itself is clearly not connected to any large aquifer, but what I'm concerned with is what happens after we have disturbed that, excavated a vacant space and then what happens if we put in waste which has the possibility of generating gas, as I think Brennain Lloyd was talking around in her evidence.

We will move to slide 6. Here is modelling which was presented in summary by Dr. Bredehoeft last year for Northwatch and this modelling was derived from reports, formal reports submitted into the repository evidence space and the bottom line on this is that the numbers along the bottom, the 19, the 14.2, the 9, the 7.9, those are the net resultant pressure from the different pieces shown vertically on the vertical graph.

The general principle of that is all of those pressures are extremely large increases of pressure. So those are all 7.9 megapascals increased up to maybe 19 megapascals

increase. Those are very, very large pressures indeed, which are equivalent to the depth of the hydrostatic pressure at the repository just now. And so the potential there, if gas is generated in the repository, is to increase pressure by an absolutely enormous amount geologically.

So this gas generation of course will be additional to the normal water pressure. So you can imagine (indiscernible) the repository, close that up, water gradually seeps back in at some unknown rate, we are not clear on that rate of recharge of water, and this water pressure, this gas pressure is generated from the materials in the repository in addition.

So I will show you a slide here. It increases the pressure in the pore space and can easily fracture the rock.

So I will move to slide 7. What we have been assured of is that the gas will leak from the repository, but mysteriously at the same generation -- at the rate the gases generated. So the claim is that the gas is generated slowly and leaks slowly out of the repository.

That seems rather difficult to substantiate from my perspective at the moment

because that depends on the gas which is generated in the repository moving through the clay, the bentonite backfill which is designed to stop gas moving through it, and so that is very hard to believe that the gas seeps out very easily.

We also know that for this to work the rate, the speed at which the gas generation volume occurs has to be slower than the rates of leakage, which is again hard to believe because once water is buried with the repository -- with the materials in the repository, they are damp, once water starts to seep in gas generation will occur and simulations and experimental studies of that show that is very, very rapid, that is over decades rather than hundreds or thousands of years.

So we compare the times in the box at the bottom there, the resaturation of the bentonite clay is calculated frequently to about 100 years in repositories of this type, the waste is still warm in this type of case, so that will speed reaction rates to produce gas even faster in the repository. And we know that the corrosion of the metals in the repository takes

hundreds to thousands of years and there is plenty of metal available in the repository to provide lots and lots of gas.

We are interested to obtain a secure and safe long-term disposal, we have to know extremely precisely the balance of the rate, the gas generation and the gas leaking, and I don't see how that is very easy to obtain.

The next slide is slide 8 and this is a schematic slide published in the open literature reference at the bottom and what this is showing is as the modelling of the repository resaturates and produces gas, B, C, E and then moving to D and fractures, that bubble of gas inside the rock breaks up. And if you remember the slide with the red circle, gas breaks apart and fractures in the repository.

And the critique -- so that's a general point for the waste emplaced initially in the repository and that is particularly important if decommissioning waste is placed in the repository because the extra iron content, the iron metal content of that decommissioning waste will produce even more gas and so we have a very negative spiral and negative feedback which means

the repository gas generation basically gets out of control.

And I don't see any design mechanism yet for monitoring the gas and for mitigating the gas if that gas generates and we need to be sure that that can happen for decades, or maybe even hundreds of years into the future.

So in summary, on slide 8 at the bottom, more iron equals more gas equals more fractures. That is the design floor I think we can focus on.

Onto slide 9. I now talk about how rock fractures. This is a general graph of increase in pressure with depth, so pressure is along the bottom. And remember, we are talking about gas pressures being generated at maybe 7 to 20 megapascals, so a significant amount of space on that graph along the bottom and elevation into vertical lines effectively with depth.

So we can see the general principle in rock and fluids is that water pressure, hydrostatic pressure increases downwards, just like when you go down to the bottom of the swimming pool, the hydrostatic pressure increases and, of course, lithostatic

pressure, the column of rock above it, increases even faster because rock is more dense, the column of rock weighs more above you at a certain depth. When you are 700 metres down the rock the column has greater weight than the water column.

And rock fractures when you are about 70 per cent of the (audio cuts out) being hydrostatic and lithostatic. And that is sort of again a very well-established geological principle.

I will come back to this type of graph in a minute in order to focus on the particular Bruce site.

If I press again I get a yellow box, and what we are saying is here we have hydrostatic pressure, we have an open connection through fractures and that's what the repository depth is just now, it is hydrostatic pressure. If the column is completely closed, isolated from all connections to the surface or to the aquifer below in the Cambrian, then we have hydrostatic pressure, which is not what we have in the repository depth at the moment.

So I will move to slide 10, which is a graphic I have constructed to try and

understand this particular site and those are the two lines again, hydrostatic pressure and lithostatic pressure and I have put on the fracture pressure line, which is again a general principle about 70 per cent between hydrostatic and lithostatic.

Today, before excavation the repository is at the hydrostatic pressure I showed you in that general stratigraphic (audio cuts out).

During excavation the pressure will be decreased, so the pressure will decrease to atmospheric as we let people in there to excavate and emplace the waste, and then after the waste is emplaced, we backfill that with waste and then with bentonite and the pressure will gradually of course recover to hydrostatic pressure and we need to know the rate of that very precisely and we need to know how long that's going to take, and it will undoubtedly of course recover so water will get in and water is emplaced with the waste, so gas generation will start at a very, very early stage.

So the repository recovers to its original hydrostatic pressure at circle one and

then the gas generation on the table I talked about earlier on is extra to that. So the gas generation extra to the hydrostatic pressure moves from one across to three horizontally at the same depth, increases the gas pressure and goes well across, well through, well past the fracture generation zone.

So it's very clear that if gas generation occurs and it cannot be controlled very, very accurately, then the rock can fracture and gas will leak pervasively out of the repository and water will also leak faster and faster into the repository.

So press the key again, we have a white box saying a fine balance of pressures is what we are faced with here. We have hydrostatic pressure plus extra gas pressure and, as Dr. Bredehoeft showed in his evidence last year, there is also additional hydrocarbon generation pressure in this region of Canada to match the existing pressures (audio cuts out) potential to break the clay seal emplaced around the waste and to break the rock. So we need to know.

Again, press the key. We have a yellow box asking the question: how does the



developer intend to monitor the pressure through hundreds of years of time and how does the developer intend to control the pressure through hundreds of years of time to prevent this rock fracturing?

If I press the button again and I have a yellow box saying that the containment, therefore, of this waste depends on keeping absolutely no water in the waste repository. If there is any water, we start gas generation and we start the negative feedback, which will inevitably result in greater and greater pressure and inevitably result in fracturing rock.

I move to slide 11. I want to change the topic slightly. This is a slide showing the natural earthquakes around the northeastern part of North America and many of those earthquakes are natural, produced by stress in the rock, natural crustal processes, but the ones I have arrowed in red are earthquakes which are reactivated by building dams for example, dams of water to make reservoirs at the surface and that dam of water puts behind it maybe 50 or 100 metres of water and it's clear that in all those cases with the red arrows, those have

generated earthquakes.

So that tells us that the extra pressure with that column of water at the surface of the earth, that small amount of extra pressure, just .9 of a megapascal, 0.9 of a megapascal, bottom left-hand box, can produce an earthquake.

Then we go back to the fact here that we have lots and lots of experience of taking oil and gas out of the ground, but we have very little experience of putting pressure back into the ground. And what we are doing here with this geological disposal site is putting not 0.9 megapascals into the ground, but putting nine or 19 megapascals in the ground. So it's extraordinarily probable that extra earthquakes will be generated as a consequence of the gas generation in the repository.

Normally in these repository sites some work is done to try and understand the impact of natural earthquakes onto the repository. What I'm posing to you here is the impact on the repository to cause additional earthquakes which could cause obviously damage to surrounding property, damages to other activities

and also jeopardize the integrity of the repository itself.

Press again, slide --

**THE CHAIRPERSON:** Dr.

Haszeldine --

**DR. HASZELDINE:** Yes?

**THE CHAIRPERSON:** -- we have now reached the time limit. If you could try and wrap up within two minutes, please?

**DR. HASZELDINE:** Certainly, okay.

I will go to slide 12 then. This shows the impact of injecting fluid into the ground. This is a simulation for injecting carbon dioxide and this is the Illinois basin.

What I want you to look at there is the extent that additional pressure generation has an impact through a 200 or 300-kilometre radius.

So I want to go then to slide 14, Brennain. (Audio cuts out) within the zone in gas and salt resources looking at the intense drilling activity of boreholes in this region.

When I press again there should be a yellow box saying that there are also shale gas resources in this region. Press again there

should be an overlay of the Collingwood shale over that map showing us that we have shale gas resources through the exact location of the Bruce repositories.

If I press again, here is the stratigraphy of the shale gas resources with the Bruce Mountain and Collingwood and the box -- you can see there is a red box there labelled. I show the repository stratigraphy at exactly the same scale. That shale gas is exactly above the repository site.

So I press -- there is a red box saying shale gas. I press again, here is the deep geology repository in purple.

So we have to ask ourselves how are we going to ignore the exclusion of resource extraction from this region?

And so press again, slides 15 and 16, we probably don't have time to talk about, but if we linger, press the last time on slide 16, the yellow box summarizes what I have said.

The yellow box says that the pressure increase is a major problem, likely to fracture the bentonite clay and the rock producing leaks. How do we control that pressure

buildup? There will be more pressure buildup with decommissioning metal waste. The effects of that extend for hundreds of kilometres causing the impact to the repository to have a much, much larger footprint and that can cause earthquakes.

Thank you.

**THE CHAIRPERSON:** Thank you very much.

--- Applause / Applaudissements

**THE CHAIRPERSON:** So we will proceed to questions from the Panel.

Dr. Muecke...?

**MEMBER MUECKE:** Dr. Haszeldine, you state that gas pressure is needed to initiate new fractures at the repository level would be in the order of 70 to 80 percent lithostatic. As a result of excavation activities, these rocks adjacent to the repository chambers and tunnels would already be fractured.

How much gas pressure would be needed to propagate these fractures?

**DR. HASZELDINE:** Okay, thank you for your question. I think that's a good question and I agree with your assessment that there will already be fractures caused by the

excavation process.

My answer to that is that there are experiments at the Mont Terri site in Switzerland where this type of effect has been investigated experimentally and the articles are published, I can send you some of those links, if that's useful later.

And the answer to your question is only one or two megapascals overpressure can initiate extra fracturing and slippage.

So what I portrayed to you is a case -- a conservative case and it's likely that there will be slippage and fracturing in activity at much, much lower pressures.

**MEMBER MUECKE:** How much does the pressure needed for fracture initiation vary with rock type? You give a figure of 70 to 80 per cent lithostatic, does that -- what rock types does this encompass?

**DR. HASZELDINE:** I'm going to avoid giving you a very precise answer because I don't know that off the top of my head, but that is a -- I will give you an analogue answer that that is a general ratio which applies to all sedimentary basins which I have worked in

worldwide where we are designing injection for carbon dioxide, that's our safe limit. So that applies to carbonate rock, that applies to sandstone rock and any rock which is cemented to be a hard, brittle rock.

So as far as I am aware that extra -- the 70 per cent limit applies to all types of sedimentary rock.

**MEMBER MUECKE:** I believe we have somebody from NRCan available.

**THE CHAIRPERSON:** Can we confirm that the NRCan person is on the phone?

Hello?

--- Pause

**THE CHAIRPERSON:** Perhaps, Dr. Muecke, we will wait to make sure that that person is on the phone and maybe move on to other questions while we wait.

**MEMBER MUECKE:** Perhaps I can move on to OPG and draw their attention to slide No. 6 presented by Dr. Haszeldine.

Could OPG comment on the gas generation scenarios one and two which produces very high gas pressures which, according to slide No. 10, would initiate fractures in the proposed

repository?

So if I could have OPG comment particularly on those two very high gas scenarios?

**DR. GIERSZEWSKI:** Paul Gierszewski, for the record.

So a couple of points. So this particular table is from the 2009 report, there is an update of that in the final report. The numbers are lower than this, but they still are high, so your point would still be fair. I think the peak number was 17 rather than 19.

But if you want to look at it, please go to the latest report.

Again, what these were, were simple calculations. As you know, we did the modelling of the gas, the water is actually done with a more sophisticated tool that we have been working to compare with a variety of experiments in a variety of cases, but these were simple calculations to try to understand the nature of the gas and its contribution and the importance of some assumptions.

In these particular cases we assumed we had the void volume, we had the gas



being generated, we had enough water to fully generate to gas and, as in all these cases we assume that the waste completely degrade into gases and in this case there is no loss of gases from the system.

So the case one here assumes everything degrades into gas. You get full corrosion and full microbial activity that degrades everything into the CO<sub>2</sub>, H<sub>2</sub> methane form. No credit is taken for any other reactions.

Case two, because you have iron in the system you will get some formation of siderite. So this is just testing the importance of that particular reaction.

Case 3 includes a methanogenic reaction and I think it's important, the first case 1 assumes that you have complete microbial reactions occurring, but it doesn't allow the methanogenic reaction to occur, which is energetically favoured.

Case 3 puts that back in and you can see its contribution.

Case 4 also goes back and it includes the possibility of siderite. So it just

shows you the importance of the various assumptions.

So then of course in the full model we do those calculations with the actual geometry with the allowance for gas to leave through the shaft or into the rock based on the permeability and the capillary pressures. And we also account for the fact the water can also come in as well as gas can leave.

That gives us our predictions, as you see, for a range of scenarios of 7 to 9 mpa gas pressure. And contrary to what's stated here that is the absolute pressure. That is the gas pressure basically in balance with the hydrostatic pressure. It is not in addition to the hydrostatic pressure.

**MEMBER MUECKE:** Thank you for that clarification.

So do we have NRCan on?

**MS CAVALLERO:** Yes, hello. This is Kate Cavallero with Natural Resources Canada.

Sorry for the last time. We got disconnected.

I have with me here today Dr. John Adams who is a seismologist with Geological

Surveys of Canada and Dr. Alec Desbarats who is a hydrogeologist.

**MEMBER MUECKE:** So this is a seismic question.

Dr. Haszeldine has stated that far-field effects of gas pressure extend hundreds of kilometres causing minor earthquakes and faults. Could you comment on how this relates to and what would be the context of this in terms of the DGR?

**DR. ADAMS:** Okay. It is Dr. John Adams, NRCan.

Specifically, if there are pressure increases there are the chance of earthquakes. But the modelling in question, I would like to pass to my colleague as to whether the modelling is appropriate or not.

**DR. DESBARATS:** Alexander Desbarats, Natural Resources Canada, for the record.

The modelling study referred to in the presentation by Dr. Haszeldine in the Illinois basin has been conducted for the Mount Simon Aquifer unit and the distance at which pressure propagates in an aquifer unit is a

function of the diffusivity which is a ratio of the permeability to the storativity, essentially.

And so you would expect a greater pressure propagation in an aquifer than you would in a low permeability unit such as the Cobourg. So I'm not sure that the distance of pressure propagation would be the same in the case of the DGR.

**MEMBER MUECKE:** Thank you for that clarification.

This is back to Dr. Haszeldine. The way the statement reads is that:

"The far-field effects of gas pressure can cause minor earthquakes and faults."

Is that supposed to mean cause new faulting or reactivation of faults?

**DR. HASZELDINE:** Okay, thank you for your question.

The increasing pressure will cause reactivation of existing faults first because in the crust of the earth there are a huge number of legacy faults from the entire geologic history of the brittle crust and those faults are in different orientations, compass

orientations, if you like, around the compass and they also have a different friction on them depending if the fault is lined with hard rock or if it's lined with more lower friction material.

And so faults reactivate at different times and different orientations, but as you increase the pressure more and more faults will become activated and eventually you'll generate entirely new faults.

We can see this effect very commonly at the moment in the United States with the injection of wastewater from shale gas fracking, but that is reactivated faults which were not previously known to be active with earthquakes of up to magnitude 4 or 5 from injection of relatively small amounts of water which increase the pressure in the subsurface.

So my contention is that the pressure increase affecting a very large radius is an effect which is extraordinarily difficult to predict because we're only just discovering this endeavor of geological science, as I have noted in slide 11. But it's very clear that that will extend for many tens and hundreds of kilometres.

And we didn't have time in my presentation to focus on slide 13, but that's a very detailed modelling by one of the world's best groups looking at faults slip, reactivating faults in the St. Lawrence area of Canada by injecting CO pressure which shows that faults can be reactivated underground as well as breaking the surface by that same type of effect of increasing the underground pressure.

So I'm contending that this pressure increase effect has not been sufficiently understood and is very, very hard to control. We have no proposals from the developer about how they intend to control and mitigate that effect.

**MEMBER MUECKE:** Thank you, Dr. Haszeldine.

**THE CHAIRPERSON:** NRCan, I was wondering if you would also comment on the slide number 13 regarding what we've just heard from Dr. Haszeldine, in particular with respect to the relevance to the Cobourg Formation of the DGR site.

**MS CAVALLERO:** If you could just give us one moment to discuss this? Thanks.

**THE CHAIRPERSON:** Certainly. In the meantime while you're discussing it, I think we'll proceed with some additional questions and then we'll come back to you, NRCan.

Dr. Archibald...?

**MEMBER ARCHIBALD:** I have two questions, both to OPG.

On page 13 of Dr. Haszeldine's written presentation the comment was made that:

"A conservative DGR mine operation would consider installation of monitoring equipment and procedures to detect and quantify the pressure evolution caused by gas generation with the DGR."

My question is will laboratory or field scale experiments be or are being conducted to assess gas generation effects under conditions as have been postulated slide 6 of this presentation.

**DR. GIERSZEWSKI:** Paul Gierszewski, for the record.

So I understand the question is: Are experiments being planned to look into the

gas generation processes that will be relevant to the repository? And the answer is yes. In particular we are -- of course there are some international work going on. We monitor those projects and we use that to help validate our model. We've also participated in some benchmark modelling experiments.

We envisage as we get underground in the repository in the geoscience niche that there be some opportunity for tests there because we'll be able to have the in-situ conditions and also that the repository itself particularly we will have to put up a closure wall. I think there was an IR on this that we would monitor the behaviour behind the closure wall and so give us again several decades of experimental evidence before we get to a point of deciding on closure.

**MEMBER ARCHIBALD:** Thank you very much.

I would like to also follow up on a comment by Ms Lloyd. She had commented on the lack of information with respect to refuge station requirements and the design for ensuring worker safety in the event of accidents.

In the particular case of shaft



transport and breaching, could OPG please provide the Panel with a brief description of the lunchroom refuge station scenario and its capacity and features for maintaining worker safety?

**MR. WILSON:** Derek Wilson, for the record.

With respect to the main refuge station, that in the shaft station area, the refuge station is being designed to accommodate 50 persons. That's based on the construction personnel requirements for the construction phase. The 24-persons that Ms Lloyd mentioned is actually the operational phase. We have a reduced workforce and we also have consideration for visitors at the site which we expect will be frequent. So there is a requirement that actually drops down for the operational phase but the refuge station for those 50 are being accommodated.

With respect to a shaft -- a shaft incident, again, we have the portable refuge stations. We have the main refuge station. And during all phases should there be a need the refuge station is there. It has sufficient

capacity for compressed air as well as the -- it has a week's worth of air on its own because of the size of it and the consideration for 50 persons.

So it is set to be able to house individuals in the case of an emergency for extended periods of time until such a time as when rescue comes and releases them from that facility.

**MEMBER ARCHIBALD:** Thank you very much.

**THE CHAIRPERSON:** NRCan, are you ready to get back to the question?

**MS CAVALLERO:** Yes, this is Kate Cavallero with Natural Resources Canada.

We're ready.

**THE CHAIRPERSON:** Please proceed.

**DR. ADAMS:** John Adams.

We looked at the slide 13 and it does not represent the geological situation at the DGR. The gas is, in this case, the CO<sub>2</sub> that has been put into an aquifer rather than a low-permeability unit which is the DGR.

And secondly, this particular section is in the St. Lawrence lowlands which is

heavily faulted. You can see that there are kilometers of faults in the section and we know those do not exist within the DGR.

Thank you.

**THE CHAIRPERSON:** Thank you.

Dr. Muecke...?

**MEMBER MUECKE:** One more question to NRCan.

I'm jumping ahead slightly to your upcoming presentation in which you recommend new-field microseismic monitoring for the DGR site. Will information from that monitoring be of assistance in predicting the amount of seismicity upon closure of the site and as the gas pressure increases?

**DR. ADAMS:** Dr. John Adams, for the record.

We are jumping ahead to the presentation on Thursday. The idea of the microseismic monitoring would be only if there were perceived issues due to cracking or other stresses. And so I don't think you consider that as a permanent modelling tool to see how the gas pressures would have evolved.

**MEMBER MUECKE:** Thank you.

**THE CHAIRPERSON:** I have one much more general question to direct both to OPG and CNSC. It's a bit of a repetition from a question I asked this morning but it now focuses on some of the issues raised by Dr. Hazeldean.

So the question is would OPG and CNSC confirm for the Panel whether the conceptual model for the post-closure assessment bounds gas generation scenarios and fault creation scenarios such as those described by Dr. Hazeldean such that the doses received by receptors at the surface have not been underestimated?

**DR. GIERSZEWSKI:** Paul Gierszewski, for the record.

Again, I'd like just to be clear that the design basis for the repository and the calculations that we have, have gas pressures in the range of 7 to 9 megapascals. They are on the order of the lithostatic. They are well below the 70 to 80 percent value that's been commented on in the presentation and we agree the literature would support that. So we're not so well below the threshold at what you would expect to get the crack propagation.

And our intent is that the design

for the decommissioning case would also -- again, whatever material you put in there, you have the volume to match that such that if it's converted into gas. You again keep the overall system pressure. It's not additive. You have added volume such that the total pressure remains on the order of the 7 to 9 mpa so that you remain essentially around the lithostatic -- sorry -- the hydrostatic-type pressures.

That's the basis for the design and that's the basis by which we think that the models that we have appropriately bound the scenarios.

**THE CHAIRPERSON:** Thank you.

CNSC...?

**DR. THOMPSON:** Patsy Thompson, for the record.

Dr. Nguyen will speak to the assessment and the consideration of gas and uncertainties.

**DR. NGUYEN:** Son Nguyen, for the record.

The answer to the question of gas is that staff assessed the situation and have found that the assessment by OPG has bound the

scenario of gas transport. The question of hydraulic fracturing due to gas pressure, it is already possible as Dr. Haszeldine has said, when the gas pressure has obtained a degree which would exceed the minimum principal stress. In this particular case the minimum principal stress would be the overburden stress which has also caused lithostatic pressure which is in the order of 16 to 18 megapascals for the depth of 680-700 metres of the repository.

The maximum gas pressure that could be generated in the repository according to OPG's calculation, and verified by CNSC staff as well, would be in the range of 7 to 9 megapascals. So it's very low, very much lower than the lithostatic pressure of 18 megapascals.

Now, staff also concur with the statement from OPG that the two pressures; the hydrostatic pressure from the water and the pressure from the gas, they don't add up to contribute to hydrofracturing of the rock. The gas in order to penetrate the pores of the host rock has to be higher than the existing water pressure and when it penetrates there it's an instant average. It's a weighted average between

the two pressures which would be the equivalent for pressure which would determine the fracking or not fracking of the rock -- the fracturing or not fracturing of the rock.

The other thing too is that there would be an excavation damage zone around the openings and Dr. Haszeldine said that -- citing the open space situation that an additional 1 to 3 megapascals, 2 megapascals would increase that fracturing. This is not completely exact because the staff has been involved with this particular experiment that Dr. Haszeldine has been referring to, and the 1 and 2 megapascal pressure that fractured the rock in this particular situation is due to the fact that the minor principle stress -- the lowest of the compressor stress in that situation is of the order of 1 and 2 megapascals. So it's related to the magnitude of the minimum principal stress that prevailed during that particular situation.

**THE CHAIRPERSON:** Thank you.

Dr. Archibald, Dr. Muecke, did you have any further questions? Good.

Thank you very much, Ms Lloyd and Dr. Haszeldine and Mr. Roche.

We will now be taking a break and reconvening at quarter to four with the first of the 10-minute presentations. Thank you.

--- Upon recessing at 3:30 p.m. /

Suspension à 15 h 30

--- Upon resuming at 3:49 p.m. /

Reprise à 15 h 49

**THE CHAIRPERSON:** Welcome back.

Next on our schedule today are five 10-minute oral presentations. The Panel will direct its questions to each presenter following groups of two or three presenters.

The first presentation is by the Coalition for a Nuclear Free Great Lakes who are with us by telephone. Their presentation is based on PMD 14-P1.57.

Mr. Keegan, are you on the line?

**MR. KEEGAN:** Yes, I am.

**THE CHAIRPERSON:** Thank you.

Please proceed.



**PRESENTATION BY / PRESENTATION PAR  
COALITION FOR A NUCLEAR FREE GREAT LAKES,  
MICHAEL KEEGAN**

**MR. KEEGAN:** Thank you, Madam Chair and Joint Panel Review Members and staff in all places. Thank you to Marie-Claude Blais once again. And I would like to say that my experience with the staff over the years has been quite pleasant.

Could I please confirm that you can hear me?

**THE CHAIRPERSON:** We can hear you although we would ask that you speak fairly slowly.

**MR. KEEGAN:** Okay, very good.

I do not anticipate my presentation will approach the 10 minutes. I will attempt not to be too repetitive, acknowledging that there are several others waiting to present.

Previously I presented in September 2013 on the cumulative impacts of the proposed Deep Geologic Repository project on the social fabric of communities immediate, adjacent

and surrounding the Great Lakes Basin. That was based on a literature review.

My background is in sociology but I also have been for 34 years tracking nuclear power in the Great Lakes Basin and since Chernobyl, in the wake of Chernobyl, the Coalition for a Nuclear Free Great Lakes came together, and I serve as that Chair.

Previously, the Coalition for a Nuclear Free Great Lakes provided testimony October 2013 -- I'm sorry -- on the "crisis of legitimacy" that permeates the proposed Deep Geologic Repository. The concept of legitimacy is most often challenged when transparency is lacking in the process. Transparency provides the daylight which allows for factually-based social and scientific inquiry, which will ultimately lead towards decision making. Without transparency the trust in the process is tainted, resulting in distrust.

Currently there is mistrust and distrust of the existing Bruce nuclear complex after decades of real life experiences. This mistrust is cumulative and the mere announcement of a proposed Deep Geologic Repository put forth

by Ontario Power Generation compounds this mistrust. All discourse and processes going forward have a potential of cumulative mistrust.

In the United States the shore of Lake Huron and Lake Erie, we are seeing municipalities and governing bodies pass resolution after resolution in opposition to this proposal.

The divisive impact potential on all communities at all levels has not been fleshed out. The literature review suggests that the DGR proposal has the potential of ripping communities apart family by family, friendship by friendship and doing so for generations.

I have presented on the crisis of legitimacy which results from lack of transparency in this proposed deep geologic burial. Poor research design based on false and partial disclosures establishes methodologies which lack quality assurance. This same quality assurance or lack of quality assurance, I believe to be at the root cause of the WIPP failure.

Proceeding without full transparency from the project conception has resulted in compromises that have potential of

great harm to the Great Lakes basin. Since my testimony in October of 2013 revelations have come forward that the proposed Deep Geologic Repository is to now be modified to include decommissioning waste, essentially doubling the project volume. This was not presented upfront at the onset of the proposal and should have been.

The post-hearing revelations made public by Dr. Frank Greening implicate that the level of radioactivity to be placed in the DGR is far greater than what was being acknowledged. In short, this has been a classic "bait and switch"; a falsehood. The volume and elevated radiation levels were all known from the onset by the proponent but this was not disclosed until that disclosure was forced into view.

While the Coalition for a Nuclear Free Great Lakes appreciates the fact that the Joint Panel Review members have held additional hearings in part because of these revelations, the sincerity of the Panel Review will be suspect if the proposed DGR is allowed to proceed in phases to dig first and ask questions later.

In the United States the National

Environmental Policy Act Regulations prevent a project from going forward and breaking ground until the unresolved questions are addressed and/or mitigated. To begin this project with so many unknowns of volume and toxicity is to bias what would be a final approval and certainly taints this process beyond reconciliation.

I was upset to learn this morning about the steam generators going into the Deep Geologic Repository. It was alluded to large metal objects. These steam generators weigh 100 tonnes each and there are 64 of them across the system. These are laced with transuranics. Cutting into these is a very messy proposition. At the Bruce and, I believe, it's the Pickering plant, hundreds of workers were contaminated with alpha radiation because of work that they did around these steam generators.

Moving forward with unresolved questions suggests that what is more important to the project proponents is that there is the illusion of a solution" rather than a sound scientific basis supporting this now morphing Deep Geologic Repository.

The hole that is being proposed is far greater

than meets the eye. Transparency is lacking from the onset and what is becoming increasingly clear is that this is a confidence game just as it is throughout the world.

his promise of a solution provides the green light to generate more of which no one knows what to do with. This is an illusion and it is a falsehood. Stop digging the proverbial hole. The alternative must be considered. Please employ a mechanism of full cost accounting so that the true cost of going forward will be known. This con game should not be allowed to go forward.

When I say "full cost accounting" it comes to my knowledge that Bruce Power is dumping power at night. It's an economic boondoggle being subsidized in so many different ways. The power is not needed. To give them the green light on the DGR is to give them the opportunity to generate more nuclear waste with which no one knows what to do with.

In the wings is quite a -- Hydro-Québec which has a tremendous amount of hydro power to be sold to Ontario at a very reasonable rate. These projects need to be taken offline.

This reminds me of a song from Blue Oyster Cult, the song Godzilla. The refrain is "History shows again and again how nature points out the folly of men". So whatever is the ultimate solution is going to be a lesser of evils. Limit the problem now. Turn off the spigot. Stop the production and then we can put our heads together to figure out what is the lesser of the evils. What is the solution going forward? But to generate more of this waste is foolhardy.

And that is my presentation. I will stay on the line. Thank you.

I'm Michael J. Keegan with the Coalition for a Nuclear Free Great Lakes.

**THE CHAIRPERSON:** Thank you, Mr. Keegan.

--- Applause / Applaudisements

**THE CHAIRPERSON:** We will proceed directly to the next 10-minute presentation which is by Beyond Nuclear which is PMD 14-P1.19 and 19A.

Mr. Kamps, please proceed.

**PRESENTATION BY / PRESENTATION PAR  
BEYOND NUCLEAR, KEVIN KAMPS**

**MR. KAMPS:** Thank you, Chair Swanson and Panel Members, for this opportunity.

And I'd like to apologize for the incorrect date on my presentation. It is September 16th today.

So most of my presentation, as you'll see, is focused on the WIPP incident from earlier this year and, as you'll see also, I am greatly indebted to Don Hancock of Southwest Research and Information Centre who has been the decades-long watchdog and public advocate on the WIPP project.

This first slide just points out how remarkably long the radioactivity release last Valentine's Day, February 14th, 2014 went on for. It went on for 15 and a half hours and an important aspect of the timing was that the peak time of the release was from 10 to 15 hours after it started. So not on the 14th, but on the 15th from 10 a.m. to 3 p.m. And a part of this I'll talk more about later is the significance of an entirely different shift of workers coming onsite



during the latter and worse part of the release and the number of those individuals receiving internal alpha radioactive contamination.

Another important aspect of the release is the great distance that the radioactivity travelled. Three thousand (3,000) feet of tunnels were passed, 2,150 feet of the exhaust shaft vertically, and then another 3,000 feet across the surface of the land, so the released travelled around two and a half kilometres all together.

And an important point is that, through sheer luck, the ventilation filtration systems had been reactivated but a few days earlier before this radioactivity release took place. They were dysfunctional for a time after the truck fire that I'll talk more about, and so that was very fortunate for surface contamination levels.

The next slide has a photograph from the Department of Energy of the suspect's guilty barrel in this radioactivity release.

And I just wanted to point out, as you'll see in future slides, that the media coverage has been not just local or state-wide,

but, in fact, national and international in scope.

And so a major article appearing in "The Los Angeles Times" last month quoted Bob Alveres, a former senior adviser to the Energy Secretary of the United States, who pointed out that the rest of a radioactivity release at WIPP was supposed to be one event every 200,000 years, not one in 15 years.

This was a cardinal violation, Mr. Alveres said.

So we're now seven months beyond the radioactivity release at WIPP. Many questions, most questions, remain unanswered. And of course, the hazardous persistence of plutonium-239 is a 240,000 year period into the future.

And I found this quote also quite revealing. It's from James Kanka, who has long been associated with the WIPP project in a leadership capacity, former Director of the New Mexico State University at Carlsbad Environmental Monitoring and Research Center.

And he said that the accident was a horrific comedy of errors. This was the

flagship of the energy department, the most successful program it had. The ramifications of this are going to be huge. Heads will roll.

The Department of Energy, of course, is a tens of billions of dollar per year federal agency.

The next slide puts together an estimate of the price tag on this accident, and "The Los Angeles Times" put that figure at a billion dollars based on the project's annual budget, the need to now decontaminate the underground, needed upgrades to safety that have already been identified, and more will likely be identified, and delays in the coming decade to the nuclear weapons program cleanup.

And of significance in a future slide as well, the Los Alamos National Lab from which this guilty barrel came felt compelled in the early days after the radioactivity release to rush shipments of also suspect barrels to another site. Not only at Los Alamos do they have those barrels, not only in the underground of WIPP do they have these suspect barrels but, in fact, they rushed shipments to the West Texas Waste Control Specialists location, which is an

aboveground surface storage facility,  
exacerbating the problem.

And I just mention that because it shows the importance of the schedule for clean-up. There are agreements between the federal government and the state governments, the potential for fines of large magnitude and you could see from their very behaviour the importance of those clean-up schedules.

So the next slide focuses on a town hall meeting that was conducted with the Energy Secretary, Ernest Moniz, last month. And Don Hancock from Southwest Research asked two very significant questions to the Energy Secretary, and didn't get a very clear answer.

Don asked, "To what level are you going to decontaminate the underground?" and also, "To what level of exposure to workers will you allow?"

And it's important to point out that this year's annual budget for fiscal year 2015, the request from the Obama administration DOE was for \$129 million. And Congress will not give them that much. We'll see how much they get.

But either way, this amount of money is woefully inadequate to the DOE's stated goals of recovery.

So the next slide is about institutional control, and a few quotes from recent media coverage.

The Federal Mine Safety and Health Administration issued 52 citations at WIPP. And referring to the fire, this truck that caught on fire was 29 years old.

Another important point to make is it's not just the federal agencies to blame for these management failures, but the state government also, so air testing lapse at the WIPP site blamed on a staff vacancy at the state agency of New Mexico.

And again, another quote from the "LA Times":

"30 safety lapses at WIPP, technical shortcomings, failures in the overall approach to safety."

And I just wanted to point out that the Nuclear Regulatory Commission Chairman, Alison McFarlane, who is a geologist, she's

author of the book, "Uncertainty Undergrounds, A Technical Review of the Yucca Mountain Proposal". And she was also a member of the Blue Ribbon Commission on America's Nuclear Future.

Just recently, on August 26<sup>th</sup>, warned of the loss of institutional control over time in her vote on the nuclear waste confidence proceeding at the Nuclear Regulatory Commission.

So this is a very significant issue over time, but I point out that WIPP, institutional control was lost in the present, in real time.

The next slide is about inhaled alpha emitters, the accident that took place at the Bruce nuclear generating station in late 2009, and now this incident at WIPP.

This is a photograph by Robert Del Tredici of a particle of plutonium, alpha radioactivity in the lung tissue of an ape, and it makes the damage visible. What can't be shown is the initiation of a cancer, and that's the real concern with inhaling alpha radioactivity, is lung cancer over years or perhaps decades.

So injuries at WIPP. There were smoke inhalation injuries from the fire; 13

workers were sent to the hospital. One of them has now sued the operator, and I'll read his quote. His name is William Udder:

"I get tired. I start coughing real hard, I start vomiting. It's like this all the time."

So there have been injuries.

The CNSC in document number 1915 stated that:

"Several workers, six in total, were treated for smoke inhalation during the event, but no injuries occurred."

So I'll point out that it was actually 13 workers, and there were injuries.

Regarding radiological injuries, I should have written the number 22. That's being reported now for the total of WIPP workers who tested positive for internal alpha particle contamination, including a number of workers who came on shift many hours after the beginning of the 15.5 hour long radioactivity release.

Again, this was sheer luck that there were no workers underground. The only

reason for that was a suspension of operations due to the truck fire just days earlier.

And I do want to point out the environmental and public health impacts.

The radioactive contamination won't simply go away or disappear. It's still there.

I mentioned before that drums are not only in WIPP's underground; they've been put on the surface in the state of Texas and they're still on the surface in the state of New Mexico at Los Alamos.

Great concern about the combustibility, the ignitability of zirconium, not just from attacks, as Dr. Greening points out in this quote, but also from accidents.

Here's an image of a zirconium fire.

So what are the options at WIPP? A partial clean-up, declared safe enough, expose workers to worse radioactivity, lock off sections not to be used again, or permanently shut it down.

And I will just close by saying that the ever-moving target of how much



radioactive waste will be buried at the DGR represents a shell game and, as Mr. Keegan said, the transparency, the accountability in that regard is objectionable.

Thank you.

**THE CHAIRPERSON:** Thank you, Mr. Kamps.

We are now going to proceed directly to the next 10-minute presentation, which will be by James and Brenda Preston, which is PMD 14-P1.39.

And for the previous two presenters, we may have questions for you as well.

--- Pause

**PRESENTATION BY / PRÉSENTATION PAR:**

**JAMES AND BRENDA PRESTON**

**MR. PRESTON:** First of all, for the record, my name is Jim Preston, and I'm accompanied by my wife, Brenda.

Dr. Swanson, Dr. Archibald, Dr. Muecke, Madam Chair, thank you for the opportunity to again present our thoughts. We

would like to address the relative uncertainty of risk and risk accessibility from a non-expert perspective, including trust and consequences.

Risk is associated with uncertainty, danger and detrimental occurrences often beyond one's personal control. It is also subjective and often based on personal experience.

We understand that risk involves probabilities or likelihood and consequences or outcomes.

The IEG points out that experts focus more on probabilities and attempts to quantify the likelihood of the probability, while non-experts focus on actual consequences without considering the probability of the consequence occurring, a qualitative view.

Our opinion is that the review process should offer a balance of the quantitative and qualitative input by experts and non-experts. We do not believe the IEG report and analysis has been balanced.

There was no attempt by the IEG to reach out to the non-expert participants beyond a simple word search of their

interventions to more fully understand their thoughts and perspectives.

Risk will also vary based on the alternatives offered by the proponent. We believe that OPG offered no alternatives to the public, and CNSC did not challenge them.

In our past intervention, we stated:

"No huge corporation would approve a multi-billion dollar project without looking at all of the alternatives."

It took a JRP request to the IEG for a risk analysis comparison of four alternative methods for nuclear waste management and storage to be reviewed.

The IEG report clearly favoured the Bruce site in declining to undertake a rigorous analysis of the other options.

We submit that the JRP's work is not complete until a thorough quantitative and qualitative analysis and public discussion is held to review all alternatives.

Solutions for separating low-

level waste and intermediate-level waste must also be included in that discussion.

The IEG noted in their final report that tolerance of nuclear waste facility will require that management facilitate public scrutiny of the facility and its management through being open with stakeholder participation, provision of relevant information and reliable notification of any problems that occur.

Entering the DGR process with the JRP we believe the government body that protected the interest of the public was the CNSC. We have been deeply disturbed by their apparent lack of independence and critical oversight of the project.

As stated previously, they did not force the critical review of storage alternatives. Secondly, their response to Dr. Greening's first letter stated the inaccuracies in much of the classification, volumes and radioactive life of the waste inventory was dismissive and unprofessional.

The CNSC should be receptive to outside professional quantitative input.

Thirdly, the analysis of the fire incident and storage container leakage at WIPP was similarly dismissive, that it could never happen under OPG management.

They had reviewed the policies and procedures of OPG and deemed them appropriate. The words "safety culture" have been attached to OPG. Yet, we would contend that both organizations suffer from a defensive culture rather than a positive culture due to the lack of openness, willingness to share information about alternatives and receptivity to being critically challenged by others.

From the perspective of the public that is looking to the nuclear watchdog regulator to perform a critical review of the information and facts, these examples illustrate how trust in the CNSC continues to be eroded.

Our current local municipal council seems to be ill-informed with little interest in updates or understanding public concerns regarding the proposed DGR project.

OPG and the mayors met illegally in secret meetings. A member of the council stated, "The DGR is a done deal." Kincardine

cannot change its decision even if they decided, they no longer wanted to be the host.

The project today bears little resemblance to the one discussed in the Golder report. Again, our trust has been lost and our perception of risk has been elevated exponentially.

We live at ground zero, our community will be the first affected by nuclear consequence. The risks are 100 per cent that we will suffer from noise pollution, airborne particulate pollution, health and financial risk.

Our municipality has no expertise in monitoring and mitigating these areas. Burms, calcium chloride and surface vegetation will not work on a rock pile that is going to be 35 metres high.

The real estate expert who intervened at the last session failed to provide the JRP with an analysis of the proposed property protection plan and that provided in other locations.

Financial risk has not been adequately addressed and is ignored by the IEG.

In summary, the IEG report didn't

undertake a competent analysis of alternatives or consider qualitative factors when discussing risk. CNSC discarded input from an expert that placed the accuracy of the safety model in question and negated the incidents at WIPP as non-repeatable.

Mayors and councillors aggregated their responsibility to protect their constituents. In the past 12 months risks have increased and trust decreased.

Our question is simple, who will advocate for us going forward? That is risk.

We request that the Joint Review Panel reject the application of OPG to construct a DGR on Lake Huron or anywhere within the Great Lakes basin.

We thank the Joint Review Panel for the opportunity to offer our opinions.

--- Applause

**THE CHAIRPERSON:** Thank you.

Panel members, did we have any questions based on the previous three presentations?

Dr. Muecke? No?

Dr. Archibald? No?

We had one question for clarification or comment from OPG, which is with respect to I believe it was Mr. Keegan's reference to steam generator waste and decommissioning.

So would OPG comment on the inclusion of steam generator waste within decommissioning waste with respect to health and safety of nuclear workers as well as the general public?

**MR. KETO:** Jerry Keto, for the record.

Steam generators don't particularly present any particularly unique or unusual hazard that we can't deal with, you know, with normal radiation protection processes. They are not unlike other components that we may deal with at the station, they just happen to be particularly large.

**THE CHAIRPERSON:** Thank you, Mr. Keto.

I have one question for Mr. Kamps.

You mentioned that WIPP was an example of loss of institutional control at the



present time. Would you please expand upon that comment for the Panel in terms of are you referring to the control by the Department of Energy specifically?

**MR. KAMPS:** Yes, I am. I think I gave some examples in the presentation, there is others that could be given.

The truck being 29 years old and not maintained to the point where it caught on fire and caused a serious incident that was then eclipsed by a much more serious incident just nine days later. That is one example.

Another would be lack of defence and depth on the ventilation filtration system. I mentioned that close call where it was reactivated just some days before the radioactivity release. The surface releases would have been significantly worse if that reactivation had not taken place in time, which was really a chance of sheer luck that this burst of the barrel happened when it did and not some days earlier.

So those are some examples. There are others that could be given. It is not only the Federal Department of Energy, it is also

the state which left a critical monitoring position unstaffed. So there is less data to work with because the state didn't fill this role.

So these are breakdowns in institutional control in the current, present day.

**THE CHAIRPERSON:** Thank you.

I believe that concludes our questions based on the presentations. Thank you very much.

We will be proceeding to the next 10-minute presentation, which will be by ZeroWaste4ZeroBurning, which is PMD 14-P1.9.

Mr. Bertrand, Ms Gasser, please proceed.

**PRESENTATION BY / PRÉSENTATION PAR:**

**ZEROWASTE4ZEROBURNING, LOUIS BERTRAND**

**MR. BERTRAND:** Thank you, Madam Chair. Thank you very much. And Members of the Panel, good afternoon.

First, we would like to acknowledge that we are on Saugeen Ojibway

traditional lands, and we give thanks for the opportunity to share knowledge and understanding.

This afternoon we are addressing the implications of the proposed expansion of the DGR. We will focus on, firstly, the practice of waste reduction by incineration in light of the response we got to undertaking 25, and on the impacts of the expansion on the host community.

In light of the prospect of a doubling of the waste quantity and a 40-year period of operation, we feel that our review of the response to undertaking 25, which is information that was not available last year on the operation of the incinerator at the Western Waste Management Facility, is important to long-term impacts.

Quickly, the Western Waste Management Facility incinerator is a batch incinerator. In other words start-up and shutdown transient conditions which can produce spikes in emissions much higher than in normal operation, let's say the incinerator operates 24 x 7.

The incinerator has a bypass vent which allows -- you know, obviously an emergency

bypass vent -- which allows combustion gasses to bypass the air pollution control equipment completely.

Now, undertaking 25 doesn't say how often it is used or even if it is used, but that would be important information to have.

And finally, this incinerator is tested yearly, only three days per year, and even then the results are reported as averages. In other words, there is no way of monitoring any emission spikes for the rest of the year.

As undertaking 25 states, the incineration is done according to the certificate of approval obtained from the Ontario Ministry of the Environment. However, we need to examine the basis for a regulation, the paradigm of the dose makes the poison which we get from a guy by the name of Paracelsus in the 1500s.

The assumption is that below a certain threshold there are no significant harmful effects.

The other basis for air quality approvals is a low enough concentration at the point of impingement, in other words the person breathing the contamination. And this is the

principle of pollution dilution.

The first assumption is currently in doubt as new findings show pathways and harmful health and effects at low doses; body burdens of picograms per kilogram or parts per billion. These are doses that are realistically encountered in the environment, but ignored by regulations.

The pollution dilution approach assumes that contaminants disperse rapidly and cause no long-term effects.

However, the International Agency for Research on Cancer, part of the World Health Organization, has indicated in 2013 that air pollution is exposing us to carcinogens and is becoming a global worrisome health hazard.

With persistent organic pollutants having long lifetime in the environment and likely to bioaccumulate in the food chain, we can no longer support the argument that because it complies with the regulations it must be safe.

Rather than looking at the concentration, the better way of looking at emissions is to look at the total quantity of

contaminants produced. The doubling of quantities to be sent to the DGR and the doubling of the time of operation would necessarily double the burden on the environment.

Obviously, our first recommendation is to discontinue incineration at the Western Waste Management Facility.

But beyond that recommendation we have to observe that this project is unusual in its nature. And this Panel has a potential and opportunity to make precedent-setting recommendations.

In other words, to go beyond the current regulatory scheme and go towards instead requirements that are based on realistic assessment of health and environmental effects. In other words, please consider cumulative effects as well as low-dose effects.

I will now pass it on to Linda Gasser for comments on the impacts on the community.

**MS GASSER:** Good afternoon, Madam Chair, ladies and gentlemen.

I am just going to make some very brief points about the impact of the expansion of

change in scope of the DGR project on this whole host community process and the host community agreement.

When I was here last year I raised some concerns. I provided the example of what occurred in the Municipality of Clarington with the host community agreement that that municipality sign with the proponent and some of the shortcomings around that process.

So as was mentioned by some of the other proponents, what has occurred is a classic bait and switch. The HCA was signed between Kincardine and OPG in October 2004. So here we are almost 10 years later and there has been a substantial change in scope of the project.

From this, one could assume that there is also a substantial potential for increase of adverse effects. And from that you could also say that there is now a greater likelihood that there would be, in addition to all the other adverse effects, there would likely be greater impacts to property.

And when I look at the property value protection plan that is in the host

community agreement, it seems to me that it would be almost impossible for somebody to seek any kind of relief given the stringent conditions. Meaning, you could only seek relief if the impact is identified after the DGR gets -- the projects get approved and prior to the closing of the project.

Stigma is often dismissed. I have to say in the Clarington, Durham Region case the consultants outright dismissed the concept of stigma and decreased property values.

But I quote from Kiel & McClain Study from 1994. It is specific to incineration, but I think it provides a helpful sentence to help people understand as to when impacts occur.

So I quote from page 322 of that study, I can provide the reference:

"Individual housing appreciation rates are affected by the presence of an incinerator. These findings suggest that when the full cost of the siting and operation of a locally undesirable facility is



estimated both the short-run and the long-run impacts need to be considered. A drop in house values may take place as early as the first rumours of the facility and levels may again be affected as more information on the facility becomes available. The observed differences in appreciation rates experienced by houses close to the incinerator..." (As Read)

I am quoting from the study on incineration --

"...and those further away which continue to differ after the facility has gone online indicate that the local housing market has not fully adjusted to the facility even after seven years of operation." (As read)

And here is the key sentence in

my opinion.

"If the designers of compensation programs want to correctly measure the decline in property values experienced by those located close to such a facility, measurement of the changes in levels must be taken at each of the stages as well as after the facility has gone into operation." (As Read)

So the current host community agreement, in my opinion, should just be ripped up by Kincardine. It is all to the benefit of OPG, very little benefit to Kincardine.

The property value protection plan, which Dr. Leise touts as a possible remedy, I am not sure it is going to be a remedy to many of the people that would be affected.

This project has gone on for what, 10, 12 years? It might take a few more years. There are people in limbo for an awful long period of time.

And when I was here the last time

I urged the Panel not to place too much importance on this whole host community process and these agreements.

Proponents often pressure the municipalities involved to sign early, way too early, before they have sufficient project information, before they have information on the potential adverse impacts, before mitigation measures are known, long before any kind of conditions of approval associated with any kind of approval are known.

And very often, in the case of Clarington, they asked for relief that was far less than was actually provided in the conditions of approval with many other issues unaddressed.

So I urge this Panel not to place too much importance on the whole host community process. Because as it has played out here, appears to be very different from what Dr. Leise contemplated.

Thank you.

--- Applause

**THE CHAIRPERSON:** Thank you very much.

We will now proceed directly to

the final 10-minute presentation, which is by the Provincial Council of Women of Ontario who are with us by telephone.

Ms Janes, are you on the line?

**MS JANES:** I think I am.

**THE CHAIRPERSON:** Yes, we can hear you loud and clear.

You have 10 minutes, so you now may proceed.

**PRESENTATION BY / PRÉSENTATION PAR:**

**THE PROVINCIAL COUNCIL OF WOMEN OF ONTARIO,  
GRACIA JANES**

**MS JANES:** Thank you. Good afternoon, Dr. Swanson and Panel Members, Dr. Muecke and Dr. Archibald.

Thank you for the opportunity on behalf of Provincial Council Women of Ontario to deal with this very important issue.

I have truncated my brief, because it was pretty lengthy with lots of references, so I hope I get a little bit of leeway at the end if I am not rushed too much.

At any rate, I think the overview

of our position is that we are really shocked by the method that is being used by the Ontario Power Generation, and that is the verification as you go along in building, using the observational method.

And all the other issues are contingent on the safety and the certainty of this long-term geologic stability, and so they all connect with the method that is being used and with the geology particularly.

We remain of the opinion, despite the voluminous amount of information before this panel, that OPG has not proven its case. There are still far too many unknowns, flaws, contradictions, and assumptions all based on the poor methodology.

And as we say, the most damaging flaw in OPG's plan is its use of the observational method whereby OPG expects that a great deal of key information will be found and the steps that must be taken to counteract potentially significant problems as identified by its own research and that of others what will happen after the Panel recommends and the government approves, if they do.

Only then will OPG proceed to follow their geoscientific verification safety plan as they construct the repository.

And as Mr. Gibbons noted this morning, any warning signals will be heeded and studied, plans for change made and perhaps changed again if they don't work as they go along.

There is no mention of the possibility of halting the project for any reason, as all potential problems are considered solvable using this method.

It is puzzling that there are very few details about the method or of any discussion as to the appropriateness of using it. Rather, there is just a short general descriptive statement, and it just leaps out of this statement that the objective is to optimize designs without compromising safety.

And so they also say that they use this because the geotechnical behaviour is often difficult and it is sometimes appropriate to adopt this approach. But they don't give us a real argument about why they really should use it or how it is used otherwise.

So throughout this thorough and lengthy documentation the proponents acknowledge that important facts and geological requirements to ensure a safe repository, verification plans and other cautionary information are essential for OPG's plans to succeed.

For example, they talk about the detailed geological mapping that is required to verify the bedrock stratigraphy, stratigraphic continuity and predictability, methodology, discontinuities and structure to refine the knowledge on rock characteristics, including jointing, bedding, claim thickness, spacing and presence of weak seams and verify the --

**THE CHAIRPERSON:** Ms Janes?

**MS JANES:** Yes?

**THE CHAIRPERSON:** May I interrupt you a bit?

**MS JANES:** Yes.

**THE CHAIRPERSON:** I am having great sympathy for the translators at this point.

**MS JANES:** Sorry.

**THE CHAIRPERSON:** I know that you are anxious to stay within the 10-minute limit, but please try to slow down just a tad.

**MS JANES:** I shall, I shall.

**THE CHAIRPERSON:** Thank.

**MS JANES:** I will try.

-- verify the assumed rock mass classification reading used in the design.

The mapping will be conducted following each excavation or cycle.

PCWO therefore believes that a Panel recommendation to the government for approval of the licensing of this first-of-a-kind deep geological nuclear barrel repository in Canada, based on the use of the observational method, is asking the public to take a potentially very dangerous leap of faith.

Further to the above basic most serious underlying methodology problem, information in the Panel EIS's and several of the OPG and RFI responses bolster arguments raised against the project and have verified the many uncertainties and flaws pointed out by PCWO and others.

For instance, in response to Information No. 22, OPG has stated that:

"Based on Dr. Sykes'  
modelling analyses in support



of the DGR project, there will be no changes in the moisture content of the Ordovician shales. The shales have exceptionally low permeability, they are under pressured and moisture movement through them is negligible. The Ordovician shales of the Bruce site have undergone considerable stress due to glaciation, and yet they have maintained their permeability as measured by the DGR borehole test. Examination of the shale cores confirms that changes in the stress in the nine cycles over the last million years have not had an impact on the shale." (As read)

However, this has been countered by the EIS No. 12 where -- the Panel EIS, where they say:

"Site characterization

studies to date have relied on examination of only a limited number of core sample tests from a few boreholes, only one of which has been sited within the special boundary and depth of the proposed repository.

Geomechanical characterization of the actual repository site conditions is thus extremely limited."

"Further...", they say, "faults are known throughout the RSA at the level of the proposed DGR excavation. The pervasive dolomitization of Cambrian and Silurian rock throughout the RSA implies that Upper Ordovician seal-rock facies had been breached in the past and that hot fluids have moved through parts of the stratigraphic

section within the RSA in the past, possibly along as yet unmapped deep-rooted faults and fractures which cut across the Ordovician section." (As read)

And we have further evidence from Wilf Ruland, who testified in the last hearing, where they say:

"But what surprised Dr. Smart and myself was down below the DGR host horizon in the Cambridge sandstone we do find hydraulic potential and it is a rather dramatic one. The overpressures are such that the hydraulic heads of 165 metres above the ground surface are present down there and that means if you were to drill a well into these units below the DGR host horizon they would be artesian wells." (As read)

From there, these references

challenge OPG's undertaking 22 information re: the possibility of moisture and irreversible changes to the sedimentary formations, as well as pointing to the faults and fractures, all of which OPG states will be investigated as the project proceeds.

Furthermore, in a letter to the Joint Panel of June the 6th, OPG was providing further clarification that it would provide greater detail of the proposed sub-surface activities which will be included in individual test plans associated with each activity. These test plans acknowledge that the issues of rock core strength, on-site humidity, excavation deformation and critical fractures are extremely important.

We really feel that a lot of the language within the evidence, all through it actually, are a lot of suppositions and "may" and "could". I'm not sure if they took some out, I think they were sort of instructed to keep it down to a minimum at least.

But they do state, for instance, that:

"The uncertainties relating

to the causes and future evolution of anomalous pressures have been conservatively bound in the safety assessment provided by OPG." (As read)

And in other places "it might be possible", "it could be", and there are uncertainties.

So to conclude, we ask the Panel to consider the following questions. Given the many thousands of years some of this nuclear waste must be kept isolated and the possible dangers if it is not and the uncertainties raised by the presenters at these hearings and in some of the materials of OPG, NWMO and CNSC, is the observational method the appropriate one?

Two: What kind of effective changes can OPG or others possibly make should problems arise after the proposal is approved and the construction has begun, after it is sealed off?

What remedial help can be advised immediately, a few years on, thousands of years in future should OPG's plans fail?

Is there a chance that once OPG gets the licences and begins to construct a repository, OPG would cease work and decide to abandon the plant for the repository if major flaws are discovered in the execution of the observational process?

So you can see that that is the main thing. For the sake of the person who is transcribing, they could hopefully look at our brief and if there are some of the things that could be filled in that I did use, they have a clue to, with some of the wording they might get the clue.

So that's our presentation and we thank you for letting us present it.

--- Applause / Applaudissements

**THE CHAIRPERSON:** Thank you, Ms Janes.

Panel Members, did we have any questions for the previous two presentations? No?

Okay, thank you very much.

We now have time for questions from registered participants. I understand from Secretariat staff that we have eight people who

have asked for leave to present a proposed question.

Participants are reminded that questions must be brief, directly related to today's presentations and that the microphone may not be used to make a statement.

Let's begin with Mr. Monem.

**MR. MONEM:** Alex Monem, for the record. Thank you, Madam Chair.

I would like to return to a question posed by Dr. Muecke regarding the potential for a liner under the waste rock pile and how this would be addressed in the case of an expanded waste rock pile made necessary by DGR expansion?

I thought I understood the response provided yesterday, but I don't think I do. Mr. Wilson stated that an assessment of the performance of the till will be performed ahead of rock placement and consequently the need for any liner.

Could we just haven't explained how this is going to be done and whether this is going to be done on the assumption of a 15 metre rock pile or a 35 metre rock pile and whether or

not there is experience we can rely on to do this with confidence?

**THE CHAIRPERSON:** OPG...?

**MR. WILSON:** Derek Wilson, for the record.

There has already been extensive investigation of the surface geotechnical capability at the site as we discussed in last year's, I believe it was October 1 session around the stormwater management pond and waste rock management pile.

So again, we have confidence through that investigation that there is continuity of the till through the areas that we're planning for both the stormwater management pond in terms of its extent as well as its depth and the waste rock management area.

During construction as we finalize our grading plans and go in and begin grading for construction, we would use standard construction techniques to verify that the conditions of the sub-surface are as we expect them to be and then we would build the waste rock management pile accordingly.

If through that verification as



we are in the field suggests that there is -- we don't have the continuity in the till that we expected in certain areas, we would then apply a liner, as we discussed previously.

**THE CHAIRPERSON:** So, Mr. Wilson, can you give the Panel a more specific and explicit description of what you refer to as "standard construction procedures" to identify whether or not the till is as you expected?

**MR. WILSON:** Derek Wilson, for the record.

We would be looking for the -- we could use either x-ray type technology to ensure that the sub-surfaces of a condition that we expected to be in terms of its permeability and that would be done.

We would also look at doing test pitting in certain areas again as we are going through to verify that we have the continuity of the till in those areas, supplementing the information that we already have without to the extent of the potential to damage and get too far below.

**THE CHAIRPERSON:** Another supplementary, with your indulgence, Mr. Monem.

Would the test pitting and other techniques such as the x-ray examination be part of your standard environmental management system as you proceed?

**MR. WILSON:** Derek Wilson, for the record.

The environmental monitoring system is not what I'm considering here, I'm just talking about the integrity of the ground underneath for the constructability purposes.

The monitoring system is over and above that in our well system to be able to monitor the groundwater conditions around those areas in order to be able to ensure that we are not -- and that would be a longer-term issue.

I can come back to the Panel with the typical test methods and standards that would be applied for a certain activity like that, I just don't have it at hand.

**THE CHAIRPERSON:** We would appreciate that, Mr. Wilson. Perhaps tomorrow morning.

**THE CHAIRPERSON:** Mr. Monem...?

**MR. MONEM:** Just as a follow-up, a clarification. Could we also maybe tomorrow

hear if the assumption is correct that the testing will be done on the basis of a 35 metre rock pile and whether or not there are different expectations of the characteristics of the till that we would look for, for a 15 versus 35 metre rock pile?

**THE CHAIRPERSON:** OPG...?

**MR. WILSON:** Derek Wilson, for the record.

We can, yes.

**THE CHAIRPERSON:** Thank you.

Mr. Monem...?

**MR. MONEM:** Thank you.

In slides 14 and 15 of OPG's presentation today, it's very small, but there is an assumption made that Darlington and Bruce will be decommissioned in 2082 and the assumption -- again, the assumption is that means an out-of-service date of those reactors in 2050.

My question is for OPG. Is this a reasonable assumption that these reactors will be out of commission in 2050?

**THE CHAIRPERSON:** OPG...?

**MS SWAMI:** Laurie Swami, for the record.

I would say that is a reasonable assumption.

**THE CHAIRPERSON:** Mr. Monem...?

**MR. MONEM:** Could we expect sort of an ongoing need for nuclear power generation past the 2050 mark?

**THE CHAIRPERSON:** OPG...?

**MS SWAMI:** Laurie's Swami, for the record.

If Mr. Monem's question is about nuclear power in the province, the design of the existing fleet of reactors requires a mid-term refurbishment to continue to operate the reactors for approximately 25 to 30 years post-refurbishment. That program would then reach the end of life for those facilities as we understand them today. So the existing fleet of nuclear plants would come out-of-service after their -- what I guess I would call second phase of their operation post-refurbishment.

If there was a need for additional generation from nuclear power as we go through the planning phase that the government has underway, that would be determined by the government and there may be new nuclear plants in

future in the province, but that would be speculation on my part.

**THE CHAIRPERSON:** Thank you.

Mr. Monem...?

**MR. MONEM:** And I didn't mean to say there's energy planners in the room or didn't make any of those kinds of questions, but has OPG done any calculation of total volumes of low and intermediate level nuclear waste, both from operations, refurbishment and decommissioning in the event that there are nuclear powered generators past the 2050 mark? Has there been any calculation like that done at all?

**THE CHAIRPERSON:** OPG...?

--- Pause

**MS SWAMI:** Laurie Swami, for the record.

The project that we proposed is for the existing fleet of reactors. We have done preliminary review for the proposed new nuclear plant at the Darlington facility a number of years ago now.

That project, as I'm sure most here would understand, is awaiting a decision from the province should we need to proceed with

it, so it's not a consideration at this point in time.

**THE CHAIRPERSON:** Mr. Monem...?

**MR. MONEM:** Just one more question along this line.

We know that the project being applied for now is for 200,000 cubic metres, the expansion 200,000 cubic metres is not an application and I'm just trying to see if that's a reasonable assumption that it's only 200,000 additional cubic metres.

So again, I wonder if OPG has done any calculation to determine whether or not the combined 400,000 cubic metres would be sufficient to manage all of the low and intermediate waste generated even if a new build at Darlington, for instance, were to come online.

**THE CHAIRPERSON:** So, OPG, I believe Mr. Monem's question relates not only to the current fleet, but should there be a new build at Darlington and whether you had done those calculations.

Is that correct, Mr. Monem?

**MR. MONEM:** Yes, Madam Chair.

--- Pause

**MS SWAMI:** Laurie Swami, for the record.

This is really forcing me to speculate on volumes that have or have not been the current proposed DGR, which is what we are seeking the licence for is for the existing fleet of operating or owned or operated by OPG. Starting to discuss whether new build, which may or may not go forward, is included, it becomes a very difficult conversation because we haven't got that as our planning assumption. Our planning assumption is for the current fleet of operating units.

So I think that what we have said is we are applying for the existing inventory, that is what this application is for. We have considered foreseeable projects, which is what the expansion that we have talked about and the cumulative effects is the basis of a lot of discussion today obviously and that's the analysis that we have.

**THE CHAIRPERSON:** So to clarify for the benefit of the Panel, Ms Swami, what we have is a cumulative effect assessment for the foreseeable future for your existing fleet for

decommissioning waste, but you cannot provide us with an upper bound that may include the possible Darlington new build?

**MS SWAMI:** Laurie Swami, for the record.

That is correct. The new nuclear project at this present time is not proceeding, as we understand it.

**THE CHAIRPERSON:** Mr. Monem...?

**MR. MONEM:** Last question.

Has OPG done any study or analysis or even thinking about the potential for further expansion at the Bruce site beyond the 400,000 cubic metre size?

**THE CHAIRPERSON:** OPG...?

**MS SWAMI:** Laurie Swami, for the record.

No, we have not.

**THE CHAIRPERSON:** Thank you.

Is that all your questions, Mr. Monem?

**MR. MONEM:** I think I will leave it there; thank you.

**THE CHAIRPERSON:** Mr. Mann...?

--- Pause



**MR. MANN:** Thank you, Dr.

Swanson.

If I could seek leave to ask OPG and CNSC the following: Could OPG and CNSC please explain to the citizens and taxpayers of Ontario why we in Ontario -- because Québec and New Brunswick are not going to do this -- why we in Ontario are pursuing a DGR consisting of 80 to 95 per cent clothes and rags that everyone agrees do not need a DGR and will never cause a problem and where the decommissioning waste could be substituted and be placed in the DGR instead of the rags and clothes without having to expand the DGR at all and when, within the next 30 years, while maintaining the safe and certain status quo storage aboveground, OPG could figure out what to do with all nuclear waste, including decommissioning nuclear waste and high-level spent fuel nuclear waste instead of pursuing this absolutely piecemeal and speculative and wasteful DGR -- number of DGR processes and applications, especially since high-level spent fuel will ultimately be included in the OPG DGR in Kincardine when Kincardine Council merrily changes its position and allows high-level spent

fuel in the OPG DGR for low and intermediate waste in Kincardine?

**THE CHAIRPERSON:** Mr. Mann, I will reword your question a little bit to encompass the information that would be new to the Panel and I will direct the question primarily to CNSC, which is: Is it in staff's view that given the state of our knowledge with respect to particularly the low-level waste, and the current technology available to reduce the volume of that waste and/or store that waste for a long enough period that the activity declines, is it staff's opinion that it is an appropriate period in time to proceed with a DGR that indeed includes low-level waste?

--- Pause

**DR. THOMPSON:** Patsy Thompson, for the record.

I would like to provide perhaps two aspects in response to the question you have asked.

First, the mandate of the CNSC is to ensure that applications for licences, in this case to manage low and intermediate level radioactive waste, meet the requirements of the

*Nuclear Safety and Control Act* and Regulations.

So the review of the licence application, the environmental assessment, all of the information for both of those processes are intended to provide the information necessary to determine whether the proponent's project would meet the requirements of both legislation. That's a requirement and I believe legally we would not be able to not review an application from a proponent that meets all the legal requirements. So that's sort of a legalistic answer to your question.

The second aspect is, my understanding from the information that we have reviewed over the last year or so in terms of recommendations, suggestions that had been made by various interveners in terms of finding ways of reducing, separating the existing waste streams that OPG has in the Western Waste Management Facility, for example, that the technology does not exist to separate some of the long-lived radioactive nuclides from the existing waste. So that would put a constraint in itself.

The other aspect is, moving forward OPG has recognized the need to minimize

waste. It's certainly an expectation of the CNSC. We have, in one of our safety and control areas, the requirement to essentially reduce, minimize and recycle to the extent that it's practical, so that as a good practice, good environmental protection and sustainable development that we minimize the amount of waste generated. So that is the perspective we can provide.

**THE CHAIRPERSON:** Dr. Thompson, just for complete clarity for the benefit of the Panel, if we were to look at the short-lived low-level waste versus longer-lived low-level waste, is the Panel to understand that notwithstanding how small a proportion a longer-lived low-level waste may be, under regulation it would still be required to be properly stored and/or disposed of?

**DR. THOMPSON:** Patsy Thompson, for the record.

That's correct. The CNSC requirements would be for the long-term safety of that waste.

**THE CHAIRPERSON:** Thank you.

Mr. Mann...?

**MR. MANN:** Well, does the clothes and rags that the workers wore, does that require a DGR?

**THE CHAIRPERSON:** I think we just got the answer. Do you have another question, Mr. Mann?

**MR. MANN:** Okay. In light of Kevin Kamp's brief presentation about the WIPP catastrophe, I wonder if OPG and CNSC, they have described the WIPP catastrophe as not a disaster, both OPG and CNSC are of the opinion that it is not a disaster.

In light of Kevin Kamp's presentation, how can they come to that conclusion and, if they do still hold to that conclusion, would they believe that a WIPP disaster in our community, in an OPG DGR, if a WIPP disaster happened here, would they still consider that not to be a disaster, because I can guarantee every citizen in our community would consider that to be more than a disaster.

**THE CHAIRPERSON:** OPG...?

**MS SWAMI:** Laurie Swami, for the record.

Yesterday I did suggest disaster

was the wrong word, I would also agree catastrophe is the wrong word when describing the WIPP event.

I also mentioned yesterday that it was a serious event, that it needed to be considered obviously and that we would look to that for the operating experience that that would generate.

I also believe that we have talked a great deal during the hearing, both this time and last year, about the accidents and malfunctions and the consideration of what that would look like, and so that is part of the environmental assessment discussion and I think that's clear that when we do that analysis the results are presented and there is a conclusion that it is not likely to result in a significant environmental effect.

**THE CHAIRPERSON:** CNSC...?

**DR. THOMPSON:** Patsy Thompson,  
for the record.

The pre-closure safety assessment. So for the environmental assessment for OPG's proposed DGR looked at both pre-closure and post-closure assessment.

The WIPP incident would be considered within the proposed -- OPG's proposed project as being within the pre-closure, so the operational period.

The environmental assessment looked at accidents and malfunctions, including the fires and the breach of a waste container. The environmental assessment demonstrated that during the operational period for that type of accident that the consequences on members of the public and workers would be essentially acceptable providing the likelihood in the mitigation measures.

So there are two ways to look at the WIPP incident. One consideration is that the WIPP -- the two incidents at WIPP essentially correspond to both types of accidents and malfunctions that were considered in DGR and in the WIPP event, both the workers and the members of the public were exposed to very low levels. Some members of the public, the doses are estimated to be 0.001 and doses to the exposed workers have been calculated to be 0.1 mSv per year.

So from that point of view

essentially it indicates that the DGR pre-closure assessment appropriately considered the types of events that have happened at WIPP.

Also, that if the project -- OPG's proposed DGR receives a licence and this type of event would occur, the expectation is that we would certainly take regulatory action, there would certainly be a need to report, investigate, find the root causes and correct the situation.

**THE CHAIRPERSON:** Thank you.

Very quickly, Mr. Mann, please.

**MR. MANN:** Just one more question.

Today we heard things, it will happen 30 years from now this decommissioning waste, and so on, and it just sounds like there is no rush to judgment in my opinion.

And I'm just wondering, why not make Bruce County the center of energy, a university where you find out how to promote energy and get energy for the world forever and how to figure out how to deal with and recycle nuclear waste in the next 30 years, and do that and keep the status quo as is, because there is



nowhere on the planet that buries clothes and rags.

And I'm just asking OPG and then CNSC, why not -- why can't our Bruce County be the universe and the university of how to figure out how to deal with this? We got to the moon, we can certainly figure out how to recycle nuclear waste. It might take a while, but since the nuclear industry is evaporating in 100 to 150 years all over, we are going to be a ghost town and the university to seek out how to recycle this stuff and make it beneficial to all instead of burying it would be a very great benefit to our community.

**THE CHAIRPERSON:** Thank you, Mr. Mann.

I think OPG has already explained to us some of their initiatives with respect to reducing and recycling.

We also heard last fall regarding OPG's commitment to support higher education with respect to the nuclear industry. Your remarks are noted by the Panel.

**MR. MANN:** Thank you.

**THE CHAIRPERSON:** Ms Lloyd...?

--- Pause

**MS LLOYD:** Thank you, Dr. Swanson.

I have three questions. The first is for CNSC and also perhaps some comment from OPG on this and it relates to slide 13 from CNSC's presentation.

It's not on the slide, but this morning during the presentation it's talking about possible effects of post-closure safety, increased gas generation, and one of the alternatives that was identified this morning by CNSC was the use of concrete instead of metal containers.

I'm wondering what CNSC has done in terms of looking at the changed chemistry as a result of this substitution. That's my first part.

My second question I guess is to OPG as to whether they have a similar interest or expectation with respect to this kind of substitution?

**THE CHAIRPERSON:** I think the first thing we need is the slide up on the screen, if we could, please. Thank you.

The Panel would ask CNSC to perhaps clarify the context for the statement that Ms Lloyd is referring to.

**DR. THOMPSON:** Patsy Thompson, for the record.

I will ask Ms Kay Klassen to respond to the question in the context for the information on the slide.

**MS KLASSEN:** Kay Klassen, for the record.

The context was in relation to the information provided by OPG in our review. OPG identified that should there be some issues in the longer haul with respect to the quantities of metal in a future assessment of the detailed information that would come forward on actual decommissioning waste, that they expected that some of the management practice that they could employ at the time, if required, would be reduction of metal by decontaminating some of the lower-level contaminated metals and the other one was the possibility of reducing metal in some of the waste containers and using the possibility of concrete.

Those were management structures

that were being put forward as a possible way if it was required in the future.

**THE CHAIRPERSON:** Thank you for that context.

So, Ms Lloyd, what was your question again?

**MS LLOYD:** I had understood the remarks by CNSC this morning to be a putting forward this, that this was CNSC's view. I hadn't seen the option of -- but there are many pages, I missed many I'm sure -- I didn't recall the substitution to concrete containers in the OPG materials. Perhaps that's why I took this to be an idea that CNSC was endorsing.

So my question to CNSC was: Given my understanding they were endorsing the substitution, had they looked at the chemistry that I expect would change as a result of this substitution. That was my question.

And I also had a question for OPG, whether they also considered this to be a viable alternative, or substitution rather?

**THE CHAIRPERSON:** Okay. So let's start with CNSC.

**DR. THOMPSON:** Patsy Thompson,

for the record.

At this time, given the state of the project, we did not do that analysis, but there is a process in place for -- it's a safety assessment that is done to validate the robustness of waste containers so that we find them appropriate for their intended purpose.

**THE CHAIRPERSON:** OPG...?

**MS SWAMI:** Laurie Swami, for the record.

I am looking at page 7 of EIS 12-512 and there is a discussion in the middle of the page that, for example, there could be a change in reduction of metal content by changing the containers to concrete containers. This is a "for example" and is an early explanation of things that could be done to reduce the metal content being placed in a potential expansion of the DGR.

So as we would expect to do additional analysis, et cetera, when we -- or if we came forward with that project, that would be the time that we would do that type of an analysis.

**THE CHAIRPERSON:** Ms Lloyd...?

**MS LLOYD:** Thank you.

My second question is -- and I don't recall what slide, I think it was in response to questions from Panel Members.

Derek Wilson made a statement that there was the option of adding in a wall, I think he was talking about in the emplacement room, in the room itself, and I think he said in case of a release.

So this might be a situation where without the transcript we are left guessing what exactly was said, but if my understanding is correct and Mr. Wilson said that an end wall could be added in the case of release, I'm wondering if he could discuss with you what that would mean in terms of worker exposure, worker protection, and so on.

**THE CHAIRPERSON:** OPG, I believe this was in response to a question by Dr. Archibald, so I believe Ms Lloyd is now expanding the question in terms of protection of worker health and safety if they were to have to go in and put in that wall in a particular room.

**MR. WILSON:** Derek Wilson, for the record.

If I recall correctly, the context was in relation to the WIPP incident and a release of such, how would that be handled similar to that of Room 7 or Panel 7.

In that regard, again, we had indicated that there is the potential to isolate any given emplacement room with the closure wall. We have done that for two reasons. One is, that for whatever reason, if there was a need to shield or to provide additional shielding to workers because of the arrangement of packaging of waste, and so on, we could erect a shielding wall, but in this particular instance, again if it was in relation to a release within the room, you would follow standard radiation protection measures and establish a working condition, a safe work plan and a mitigation strategy to be able to go in and construct such a wall.

And again, it is at the front of the room so there is always potential to have some initial shielding put in place to do that.

So again, there are many different radiation protection measures that OPG is well-versed in and perhaps somebody from OPG would be willing to add additional information.

**MS SWAMI:** Laurie Swami, for the record.

I believe that Mr. Wilson has covered that quite well, but we could use things like temporary shielding walls, other equipment that we would put in place to essentially shield workers from receiving a dose.

Of course there would be the ability for monitoring individual dose, if there was any, whether through personal alarming, dosimeters, whether through thermal luminescent devices, whether through urinalysis afterwards, et cetera.

So we have a very comprehensive radiation protection program that looks at shielding workers, ensuring they are protected during their work execution and then ensuring that we are monitoring very carefully to make sure they don't exceed any dose targets within OPG, and particularly dose limits.

**THE CHAIRPERSON:** Ms Lloyd...?

**MS LLOYD:** Thank you.

It's a bit abstract for me, but if I can just test if I understand it. So one of the strategies they might use is something like a



rotating workforce, so when a worker hit dose they would pull out, another go in. Is that that kind of -- is that what the safe work plan is?

I'm not quite clear on what both Mr. Wilson and Ms Swami are meaning.

**THE CHAIRPERSON:** OPG...?

**MS SWAMI:** Laurie Swami, for the record.

I believe Mr. Wilson and I both referred to shielding walls. These are walls which could be bags of material that would shield from source of radiation. We use those throughout our plants today, so this is not unknown to us and is certainly something we would implement, should that be required.

**THE CHAIRPERSON:** Thank you.

**MS LLOYD:** I will leave that for now.

My third question, I thought it was a simple question until I heard Mr. Monem asking a similar question and it became less simple. So my question for OPG was: Looking at the early and late scenarios, slides 14 and 15 of their presentation, where does new build fit into that?

And then we heard a lot about provincial decisions and so on, but I am assuming a certain level of intentionality on the part of OPG given their appeal of the court case which quashed the approval.

So I'm wondering if I could just ask my question, knowing that Mr. Monem had an attempt. Where does new build fit into the early and late scenario timing wise?

**THE CHAIRPERSON:** Ms Lloyd, I believe the Panel has heard everything that OPG was able to provide us with respect to that question. I'm not sure we are going to gain anything unless, Ms Swami, you have anything specific to add regarding the early and late scenarios and where new build may fit in within that?

I'm seeing flipping of pages so we will see if we can get a little bit more information there.

--- Pause

**MS SWAMI:** If you don't mind, I will take a minute to find it because I certainly can't read it on the screen.

--- Laughter / Rires

**THE CHAIRPERSON:** I totally sympathize and certainly you can take a bit of time.

--- Pause

**MS SWAMI:** Laurie Swami, for the record.

So as Ms Lloyd is very familiar that the current site preparation licence has been suspended pending a review of the judicial review that is underway through the courts, so I don't want to comment on that, but should a decision come back that that proceeds in whatever manner that would proceed in, the expectation would be that the licence could last -- the site preparation licence could last perhaps 10 years based on what we know today.

So I am really speculating here. That would take us to 2024 as a potential when we could start the site preparation. The estimate is that is a 10-year period -- and I'm going ballpark -- for site preparation and construction of new nuclear facility.

Then they would begin operations. So now we're looking at 2035 if they were to actually proceed. And I don't know when that

would be, I am merely speculating.

So in 2035, let's say, you could begin operation of a unit at Darlington for a new build which would potentially generate low and intermediate level waste as we would expect today and, therefore, would operate at the current understanding of the technology for 60 years, give or take.

So on this timeline it would be many years of operation compared to what we see in today's plants with the mid-cycle refurbishment, they have a longer life than the current plants.

That would go somewhere into the 2080s and then we would proceed with potentially some type of refurbishment and some type of continued operation.

So now I am really speculating, in 100 years from now we would have some sort of understanding.

So that's why it's very speculative for me to say, oh yes, that is going to go here and it's going to be this volume, because, one, we don't have a technology; two, we don't understand the new methods that we would be

able to employ in 20 or 30 years to minimize the low and intermediate level waste that could be generated from a new type of design because we wouldn't obviously be building today's technology, we would be building an advanced technology from today.

So there are many, many things that would just be speculation on our part to start to quantify what the numbers would be, what the radioactive content would be, and that's why when I say we don't have that information, we really couldn't even begin to speculate, except to say it could be similar to today, but that we know would be again speculation.

So that's why I hesitate to say it's going to be here and it's going to be now.

**THE CHAIRPERSON:** Thank you.

Ms Lloyd...?

**MS LLOYD:** Thank you, Dr.

Swanson.

**THE CHAIRPERSON:** Dr. Storck...?

--- Pause

**THE CHAIRPERSON:** Apparently Dr. Storck has left the building.

Ms McClenaghan...?

**MS McCLENAGHAN:** Thank you,  
Dr. Swanson.

My first question leaves off from the slide we just had, if we want to get it back up, that's the early -- slide 14 in the OPG presentation, early scenario.

The question is with respect to the statement on that slide that the earliest start of Pickering decommissioning would be 2044.

My question, Madam Chair, would be for OPG whether if there were a policy decision to approve decommissioning earlier such as prompt decommissioning following closure, what would be the implications for the scenario and what would be the implications for operations at the DGR?

**THE CHAIRPERSON:** OPG...?

**MS SWAMI:** Laurie Swami, for the record.

Our current planning assumptions are based on a delayed decommissioning and that is what all of our planning basis is currently.

**THE CHAIRPERSON:** Thank you.

Ms. McClenaghan...?

**MS McCLENAGHAN:** Yes, Dr.

Swanson, I do understand that's the current planning basis but I'm aware that at Gentilly-2 there is a discussion about decommissioning early and I expect that to be a discussion in the public domain at Pickering as well given that we're looking at 2018 to 2022 for that closure so it's quite imminent.

And I think unlike the previous question where Ms Swami talked about how far away it was this one is quite near and I think we have to think about the implications of that.

There are reasons for OPG to use delayed decommissioning, obviously, to allow cooling of the material, but there are reasons for the public and workforce to want prompt decommissioning for employment reasons as well.

**THE CHAIRPERSON:** So Ms McClenaghan, for the benefit of the Panel, are you suggesting that the Panel requires information regarding a possible policy change and on what basis? What's the strength of the information that would indicate a policy change in Ontario?

**MS McCLENAGHAN:** Well, we have one -- one similar facility closed last year

where this is a current discussion in the public domain. So it's not speculative. I've already heard discussion at the hearings at Pickering, for example, about the date of decommissioning.

And so if the Panel is contemplating approving a DGR and we could have such a significant policy change quite soon, I think we need to think about what the implications for the placement scenario and all of the other implications for operations that might arise.

**THE CHAIRPERSON:** OPG, has this been part of your planning process up to now?

**MS SWAMI:** Laurie Swami, for the record.

No, our current planning assumptions as I stated, is for a delayed decommissioning. A policy change of that nature is not something that I could even begin to speculate on.

**THE CHAIRPERSON:** CNSC, are you aware of any looming policy change with respect to delayed decommissioning?

**DR. THOMPSON:** Patsy Thompson, for the record.



I will provide some information and should you require more information, I would have to get information from other than Ms Klassen from back in the office from the Waste Decommissioning Division.

The current plans are supported by a decommissioning plan and a financial guarantee that outlines essentially the plan that Ms Swami has just referred to. We're aware that in the province of Quebec in relation to Gentilly-2, aware of the preliminary decommissioning plan called for decommissioning at a later date of a period of -- sorry, I'm losing my English -- after a period of safe storage that we've also heard in front of the Commission on a report from Hydro Quebec that they have had some work done by consultants on the options for earlier decommissioning. But I believe that information has not come back and their regulatory requirements in terms of preliminary decommissioning plan and financial guarantee has not reflected that information.

There is some work done, being done internationally in terms of decommissioning practices with consideration of essentially

having a knowledgeable workforce onsite that would facilitate decommissioning -- for early decommissioning. There's other considerations in terms of worker exposures in favour of, you know, later decommissioning.

So that is work that is being conducted internationally, but that's as much as I can say unless Ms Klassen has more information.

**THE CHAIRPERSON:** So Dr. Thompson, given what you have just told the Panel, would you please confirm for the Panel's benefit that it is staff's judgment at this point that the status of decommissioning and their timing, the decommissioning in the context of reasonably foreseeable as it is now before us, is still the valid one with respect to the cumulative effects assessment for this project?

**DR. THOMPSON:** Patsy Thompson, for the record.

My understanding is it is a reasonably foreseeable project in the sense that it's the most probable scenario given the work that has been done to date and the planning assumptions and the -- essentially the preliminary decommissioning plans and all the

work that has been done to support the licensees' operational plans and decommissioning.

**THE CHAIRPERSON:** Thank you.

Ms McClenaghan...?

Oops, I'm getting the high sign here. OPG...?

**MS SWAMI:** Laurie Swami, for the record.

I thought it might be helpful to add that a quick check on the Hydro Quebec website indicates that they will begin the 40-year dormancy period, as they refer to it, in 2015 as they prepare for decommissioning. So it would appear to me that they also have a policy of deferred decommissioning.

**THE CHAIRPERSON:** Thank you.

**DR. THOMPSON:** Perhaps, Dr. Swanson, if I could add just there is an application from Hydro Quebec that speaks to 2015 as the date for the start of safe storage. And so any discussions in the Province of Quebec in terms of changing the plans for decommissioning has not been reflected in an application to the CNSC.

**THE CHAIRPERSON:** Thank you.

Ms McClenaghan...?

**MS McCLENAGHAN:** Thank you, Dr. Swanson.

My next question has to do with the discussion that CNSC had earlier in response to a question of yours about the cumulative effects assessment and the disruptive scenario. And I believe I heard Dr. Thompson indicate that the consideration of a farming family established onsite and drawing water from a deep well was one disruptive scenario that had been contemplated but that the doses and the implications for that scenario had not been calculated in the cumulative effects assessment.

And I'm wondering if Dr. Thompson was offering to do that for the Panel because I was a bit unclear at that point in the transcript as to whether or not that was being offered.

**THE CHAIRPERSON:** Yes, Ms McClenaghan, that actually had specific reference to non-human biota and, yes, we will be hearing back, I believe tomorrow, from the CNSC as well as OPG on that matter.

**DR. THOMPSON:** Dr. Swanson, just for my understanding is your request went to OPG

and you did not request for us to --

**THE CHAIRPERSON:** Sorry, too many of these carryovers.

So it'll be OPG. So Ms McClenaghan, there will be some information, I believe, tomorrow.

**MS McCLENAGHAN:** Yes, I did understand that on non-human biota. My question arose because Dr. Thompson was specifically saying that there had been consideration, I believe, in terms of human health from a farm family in the previous assessment, the regular project assessment, but that it hadn't been assessed in the cumulative assessment.

And I was wondering if they were offering to provide that to the Panel.

**THE CHAIRPERSON:** No, the -- and it is apparently for Thursday. It is for non-human biota.

Ms McClenaghan, I think if you went back and checked the information response it's pretty clear. It certainly is to the Panel that there was a dose calculated for human receptors. So I don't think we need any further information in that regard.

**MS McCLENAGHAN:** All right.

Thank you.

And the last question has to do with the discussion we heard earlier with respect to recycling and reduction of waste. And my question is whether or not the plan to reduce the amount of waste coming to the DGR from the current facilities relies on quantities of the concrete, wood and steel going into the general recycling stream and whether or not the quantities of that reduction have been calculated.

**THE CHAIRPERSON:** Ms McClenaghan, I'll ask the first part of your question. The second one we already have an answer to the other day with respect to early days for the recycling initiatives and so there are no numbers as yet available.

But the first question I will ask OPG to answer. And so can you repeat the first part of your question, Ms McClenaghan?

**MS McCLENAGHAN:** Yes. It's whether the plan to reduce the amount of material coming to the DGR from the current fleet for concrete, wood and steel requires the material to

be going into the general recycling stream.

**THE CHAIRPERSON:** Thank you.

OPG...?

**MS SWAMI:** Laurie Swami, for the record.

There are many aspects of the plans to look at how to reduce the amount of waste. So the first part is to look at what is being brought into the station as part of the program. So if we were bringing in parts they typically could have been wrapped in plastic, cardboard, wood, depending on what they are.

And what we would do is we look at ways and means of preventing that material from getting into the nuclear site itself. And therefore, it would not be diverted from the site to a recycling program although it might be a recycling program before it gets to the site.

When it comes to the material that we talked about earlier with a potential to divert waste to -- after being decontaminated or confirmed not to contain contamination above regulatory guidelines, that material could be released because it would be considered non-radioactive waste at that time.

So that's part of the pilot program where we need to see what that looks like and how to do that effectively.

**THE CHAIRPERSON:** So if the Panel understands correctly, Ms Swami, is your part (a) is to reduce right at the -- before it even gets into any contact with radionuclides of any kind and then part (b) is if it does come into contact with radionuclides take measures to reduce the radioactivity such that it is cleared by the regulatory agency to then become part of a regular waste stream. Is that correct?

**MS SWAMI:** Laurie Swami, for the record.

That's correct. That's just two parts. There are many other parts but I think that's enough detail.

**THE CHAIRPERSON:** Thank you.

Ms McClenaghan...?

**MS McCLENAGHAN:** Yes, thank you. That was my question.

Thank you. Those are all my questions.

**THE CHAIRPERSON:** Dr. Greer...?

**DR. GREER:** Thank you, Madam



Chair. Dr. Sandy Greer, for the record.

I have two lines of questioning. The first relates to mathematical modelling. I would appreciate a better understanding about how mathematical modelling is used. For example, two examples today were stated in, first of all, by Derek Wilson regarding predicting ranges of total suspended solids and later in the day calculations in regard to gas generation following Stuart Haszeldine's presentation.

And just for clarification for us to understand how modelling actually is practiced, my first question is: Are there a number of choices of different types of modelling that the OPG or CNSC would be using or is there just really a very limited number and types of models that the nuclear industry can choose in terms of determining predictions and estimations?

**THE CHAIRPERSON:** Dr. Greer, the purpose of questions is for the Panel to obtain information that we feel we don't already have.

**DR. GREER:** I apologize.

**THE CHAIRPERSON:** We're quite confident regarding the information around model choices at this point. Did you have another

question?

**DR. GREER:** Well, yes. I just -- okay, I really just wanted clarification for people who would want to do research how they would look up these types of models to understand them better and would they be identified in any of the documents?

**THE CHAIRPERSON:** Okay. So, OPG, in terms of your public information, to what extent do your, for example, instruments such as your frequently asked questions, provide information that would help people like Dr. Greer understand your choice of models and the reasons for why you have made those choices? And also, an overall description of what the models do.

Is that adequate covering of your question, Dr. Greer?

**DR. GREER:** Oh. Yes, thank you.

**MS SWAMI:** Laurie Swami, for the record.

I'll ask Mr. Powers to answer that question.

**MR. POWERS:** Kevin Powers, for the record.

I'd have to look back on our Qs

and As, but I do not believe we have any answers to questions on modelling. However, if Dr. Greer would like further information on that we can deal with that through correspondence.

**THE CHAIRPERSON:** Thank you, Mr. Powers.

Dr. Greer?

**DR. GREER:** Dr. Sandy Greer, for the record. Thank you.

And for my second type of question, it's in regard to the decontamination of materials that would be made safe to go out into the marketplace. Does the CNSC require a licence to do that type of decontamination?

**THE CHAIRPERSON:** CNSC...?

**DR. THOMPSON:** Patsy Thompson, for the record.

Material needing to be decontaminated would normally have levels of radioactivity above the level, the level that requires a CNSC licence. So yes, CNSC licence is required to handle that material. We would also look at practices to make sure that the workers are appropriately protected.

There's also a program when

material is cleared from regulation, when it meets clearance levels. We have worked with landfill operators, for example, where they have archways with detection systems so that if material is to be -- before it enters the recycling or recycling facility or the landfill, if the alarm is triggered then there is a procedure in place for the shipment to be returned to where it came from and the CNSC is notified.

**THE CHAIRPERSON:** Thank you.

Dr. Greer...?

**DR. GREER:** Yes. Dr. Sandy Greer, for the record.

So there are companies in Canada who already know how to go through these processes and who have the appropriate licenses?

**THE CHAIRPERSON:** CNSC...?

**DR. THOMPSON:** Patsy Thompson, for the record.

There are some licensees who do this type of work. There's also licensees like Hydro Quebec and others who have had practice in terms of, for example, with waste oils and other material where they have a screening process

where, for example, for bulky material with screening tools they can sort of identify the contaminated parts, take those and then release the parts of the material that isn't contaminated.

So some of those programs have been in place and have been quite successful in reducing the volumes of waste.

**THE CHAIRPERSON:** Thank you.

Dr. Greer...?

**DR. GREER:** Yes, thank you. Dr. Greer, for the record.

My final question is, could you please provide just a couple of examples of these decontaminated materials, like where would they be used? Would they be used in, say, kitchen cutlery or cars or belt buckles? I mean, where would they then be used in the marketplace; what types of items?

**THE CHAIRPERSON:** CNSC, just perhaps a very quick answer.

**DR. THOMPSON:** Patsy Thompson, for the record.

I must clarify that what I was describing is not just decontamination but it's

also segregation of waste.

In terms of the information as to where that material is used, what I'm familiar with is more the material that is sent to general recycling or landfill. I know that there are procedures in place for using that material but I wouldn't be able to speak to it.

**THE CHAIRPERSON:** Thank you.

**DR. GREER:** Thank you.

**THE CHAIRPERSON:** Ms

McFadzean...?

**MS MCFADZEAN:** My apologies for keeping you at this late hour. I have two very quick and, I hope, easy questions that are really clarification.

The first one is that over the last hearing and during the last seven days of this hearing there have been many intervenors and organizations who have come in speaking positively about the DGR placement. Because they have mentioned that transportation is always dangerous and the more you have to transport the waste the more complicated and the more risk there is for accidents, but OPG has spoken with great confidence about the track record they have

for transportation, which I'm mulling over in my head and I really want to just ask if that is correct, that there is really not an issue with transportation and there is a confidence on OPG's part.

Does that mean that transportation is not really an aspect that needs to be considered in the siting of a DGR, in particular the one here?

**THE CHAIRPERSON:** Ms McFadzean, I'll actually direct that question to CNSC because it's really more of sort of discriminating between the alternatives-type question.

CNSC, would you care to comment on this, please?

**DR. THOMPSON:** Patsy Thompson, for the record.

We have not looked at that aspect in the alternative means assessment. What I could say is that with the experience, the history of transportation of radioactive packages in Canada and internationally, there has never been an event where there has been a significant breach of package and a release of material that

has contaminated members of the public or significantly contaminated the environment.

There is presentations on the CNSC website that speaks to the transportation records, the testing of packages. There is also videos. So that information is readily available on the CNSC website.

**THE CHAIRPERSON:** Thank you.

Ms McFadzean...?

**MS MCFADZEAN:** That's very helpful. Thank you.

My one other question is about the decommissioning project, the additional decommissioning waste. Last year that began to hover over the hearing and there was a gentleman who was with CNSC who sat to the left of Dr. Thompson. I believe his name was, first name was either Don or the last name was Hanford, or I'm in the right ballpark?

Okay, when the decommissioning waste issue was brought up last year this gentleman said that there would not be a need for a further environmental assessment because once the licence is granted for OPG to operate this project it would be a question of them coming



back and indicating their need for an expanded site and that they have done the required investigation and then it would just be an extension of the licence.

This time around, in fact after I spoke on Friday and mentioned that, Dr. Muecke kindly asked Dr. Thompson who said, "No, that was not the case. If the decommissioning waste does become part of this project it takes in another environmental assessment. So I need some clarification on what direction is this going with that waste.

**THE CHAIRPERSON:** So CNSC, I think actually this is more of a clarification from the transcript from last fall.

Ms McFadzean, that actually was not the Panel's recollection of Mr. Don Howard's answer to that particular question. However, I would ask perhaps CNSC to just doubly confirm that we would definitely be, as the Panel understands, going into another full process with respect to the decommissioning waste.

**DR. THOMPSON:** Patsy Thompson, for the record.

That is correct. It was actually

Mr. Don Howard who was here. But due to illness, he wasn't able to be here last week and this week.

And so the requirement would be for OPG to come forward with an application that would trigger the regulatory process for the licence review as well as an environmental assessment either under the Nuclear Safety and Control Act or the Canadian Environmental Assessment Act, whatever the regulatory requirements would be at the time.

This would also require a complete safety case, safety analysis to support that licence application.

And I would add that this is a public process with the opportunity for members of the public to be involved.

**THE CHAIRPERSON:** Thank you.

**MS MCFADZEAN:** Thank you. That is very clear.

**THE CHAIRPERSON:** Okay, thank you very much.

Mr. Bourgeois?

**MR. BOURGEOIS:** Thank you, Madam Chair.

Can you hear me? Yes.

In northern Alberta the population, as here in Inverhuron and in Bruce Township and County, are too small to be able to make use of epidemiological studies that would identify disease and morbidity associated with the tar sands in that region.

A community health survey was able to do so. Does the Panel believe that a similar survey would be helpful here to identify whether existing operations at the nuclear power plant and this proposed operation are a factor for disease and morbidity in our community since our population base here is also too small to support an epidemiological approach, a standard epidemiological approach?

**THE CHAIRPERSON:** Thank you, Mr. Bourgeois.

You are actually asking the Panel a direct question.

I will just point out that the Panel will deliberate in due course based on the information we have received from the interveners, from the proponent, from the regulatory agencies, and including from the

medical officer of health.

And really, unless we feel we needed anymore information to help us with that really I am not quite sure where you are going.

Did you have a specific question for --

**MR. BOURGEOIS:** Well, actually I was thinking not so much for you, but for you to direct to CNSC or Ontario Power Generation, whether they believe these would be approaches that would help them clarify and help all of us clarify how to identify whether or not there are impacts and will be impacts from operations proposed.

**THE CHAIRPERSON:** Thank you, Mr. Bourgeois.

With that clarification, I would like to direct the question to CNSC with respect to the utility of a community health study such as has been conducted in the oil sands region of Alberta.

I believe, Mr. Bourgeois, that might be what -- you are referring to, for example, the Fort Chipewyan study?

**MR. BOURGEOIS:** Fort Chipewyan,

yes, that would be...

**THE CHAIRPERSON:** Thank you.

**DR. THOMPSON:** Patsy Thompson,  
for the record.

I can't comment on the study you have just referred to in northern Alberta, I am not familiar with it.

What I would say is that the CNSC has conducted an epidemiological study for the Bruce area, it was part of the RADICON study that we spoke about last fall, and that work has been published in a peer review journal. It includes the study of the population around the Bruce, Pickering, and Darlington sites.

And what we had mentioned last year is that that study covers the period up to 2008 where we have looked at cancer incidence in different slices of age groups in the population, including children and adults, and looked at various types of cancer and their incidence and compared them to the provincial and different regions in the province.

**THE CHAIRPERSON:** Mr. Bourgeois?

**MR. BOURGEOIS:** Yes, thank you.  
But the studies, the community health surveys,

don't specifically refer to and isolate cancer studies. There is general population health and impacts that can happen, say heart disease, say diabetes.

There are any number of disorders and a study such as the RADICON study doesn't address because it is broadly based, it is differently based and it is not community-based.

And these projects are in communities and it is the communities that host the projects that fear and suffer the effects.

**THE CHAIRPERSON:** Noted, Mr. Bourgeois. And the panel is aware of the types of studies you are suggesting.

**MR. BOURGEOIS:** Thank you.

My second question refers to Dr. Rawlings, and he spoke yesterday as well on behalf of OPG when he talked about the inadequacy of the AERMOD models used by OPG to identify typical conditions. And also talked about the sea breeze effects. But he said nothing about the role that thermals might play in distributing site available toxins into the Inverhuron community nor about the role the rock pile will play in creating an unstable atmosphere about it

that will propel these thermals further afield.

Does the CNSC or...? I am sorry, would the Panel consider who to direct the question to? But does the -- believe that models which would identify these conditions would be useful in assessing the potential impacts on sensitive receptors offsite?

**THE CHAIRPERSON:** OPG, do you know if Mr. Rawlings is still on telephone.

**MS SWAMI:** Laurie Swami, for the record.

I believe he still on the telephone and could perhaps answer any question you direct.

**THE CHAIRPERSON:** Mr. Rawlings, are you there?

**MR. RAWLINGS:** Martin Rawlings for the record.

Yes, I am.

**THE CHAIRPERSON:** Did you hear the question?

**MR. RAWLINGS:** Yes, I did.

**THE CHAIRPERSON:** So would you please respond? Thank you.

**MR. RAWLINGS:** Madam Chair,

before responding, I hear a bit of an echo. Are you getting an echo as well today?

**THE CHAIRPERSON:** Not too bad on this side. So hopefully, you can put up with it.

**MR. RAWLINGS:** All right, fair enough.

There were a couple of points that were raised by Mr. Bourgeois in his question. I will try and step through them.

The atmosphere has -- we often describe the atmosphere in terms of stability. It is really the ability for the atmosphere to mix. When mixing is restricted, for example at night, we refer to those as stable conditions.

Unstable conditions typically occur when there is a lot of energy and sunlight and they are well-mixed. And then through overcast days or days where there is some cloud cover and periods of time there are neutral conditions.

So neutral is in the middle, unstable condition, good mixing, and stable condition very core mixing.

The AERMOD dispersion model that we used in assessing this project does assess



predictions during stable, neutral, and unstable conditions.

Unstable atmospheric conditions usually result in lower concentrations, especially when releases occur at the ground, because they create greater mixing if you want greater dispersion and spread of contaminants.

The term thermals are usually referring to situations that occur when you have very strongly unstable conditions and you can get, if you want, little updrafts occurring. Thermals are really just part of an unstable atmosphere enhancing the mixing and enhancing the transport.

So situations such as thermals and unstable conditions were incorporated as part of the modelling we did using AERMOD and meteorological data taken from the tower immediately adjacent to the DGR site.

We did talk a little bit earlier today in response to a question from Dr. Muecke about the waste rock pile with respect to its effect on dispersion. I pointed out that the waste rock pile, whether it is the 15-metre high pile likely as a result of the project or taller

pile in the event there is an expansion would result in some deflection of the winds, but should not result in a significant effect on local meteorology.

Depending on the colour of that waste rock pile, it could result in enhanced heating of the surface or retarded heating of the surface. In both cases, it would relatively be a small effect compared to large bodies such as Lake Huron, which would have an overwhelming effect on the local dispersion.

It is unlikely that the waste rock pile would have a significant effect on large scale atmospheric stability conditions around the site resulting in transport. If it did result in enhanced unstable conditions, it would likely result in greater dispersion of the emissions from the site and therefore a slightly lower concentration.

**THE CHAIRPERSON:** Thank you, Mr. Rawlings.

Mr. Bourgeois?

**MR. BOURGEOIS:** Yes, Madam Chair.

But if I understand what he was saying, they may be lower concentrations, but

further afield.

And if we are dealing with radionuclides such as radium and gasses, radioactive gasses coming from the vent, vented out, and from the incinerator, these products could then reside in the soil and plants and vegetation around the Inverhuron community and be transported further afield and affect us even more over the long-term than would be the case without the waste rock pile.

**THE CHAIRPERSON:** Was there a question in there?

**MR. BOURGEOIS:** Yes. I was asking, is that true?

**THE CHAIRPERSON:** Oh, okay. I will ask, first of all, Mr. Rawlings to comment on although it would be transported farther, there would still remain a concern regarding processes such as food chain transfer.

And I would also ask CNSC to comment on that.

So let's start with Mr. Rawlings.

**MR. RAWLINGS:** Martin Rawlings, for the record.

Unstable conditions -- the

comment was transport further during unstable conditions that results in greater mixing on lower concentrations.

So at a distance concentrations would be lower during unstable conditions than they would during more stable conditions. So in fact, the greater amount of unstable conditions the less offsite transport.

**THE CHAIRPERSON:** CNSC?

**DR. THOMPSON:** Patsy Thompson, for the record.

In relation to Mr. Bourgeois' questions or concerns about the waste rock piles and the entrainment of potentially radon or radon decay products from underground, I could use the experience of the CNSC regulating uranium mines where there are waste rock piles, including mineralized waste rock piles, tailings facilities, as well as underground mine ventilation systems.

We have essentially years of environmental monitoring data for radon, radon decay products, and radioactive dust. The monitoring information shows that very close to the source you do get an increase in radon

concentrations, but the data shows that when you are one or two kilometres away from the site the levels are down to background levels, so essentially within the range of background.

And even on the site, if you are not close to the source it is very difficult to - - you know, there is quite a bit of variability, but it is not elevated.

We are essentially in the process of finalizing a document where we have accumulated, you know, the data from 2000 to 2012 where we have all the monitoring information, all the high-volume data as well, and we have done some assessments.

And that report should be available soon and it will be put on our website, so it would be an additional source of information, at least looking at uranium mines and the impact in terms of radioactive dust and radon.

The review that we have done of atmospheric modelling done by OPG for this project was reviewed by two of our experts, Dr. Nana Kwamena and Mr. Avijit Ray. Dr. Kwamena has a PhD and post-doctoral research experience in

terms of atmospheric chemistry and atmospheric processes, including atmospheric dispersion. And Mr. Avijit Ray has essentially decades of experience using AERMOD and other models for permitting of industrial sources.

Their review indicates that that model was appropriate for use in this case. And they have done a detailed review of the concerns identified by Mr. Bourgeois in terms of the table, and their assessment indicates that this is not a phenomena that would have an impact with the surface sources of, you know, the waste rock even at the higher level.

**THE CHAIRPERSON:** Thank you.

Mr. Bourgeois?

**MR. BOURGEOIS:** Thank you. My last question deals with the incinerator.

How many days and hours did it operate in 2013 and 2014? Each of the times we went on tour it wasn't operating. And OPG has been shipping waste to be incinerated elsewhere, including liquid waste.

And I just wonder how is it operating and is it operating, and how frequently does it operate?

**THE CHAIRPERSON:** OPG?

**MS SWAMI:** Laurie Swami, for the record.

The incinerator is currently in an outage, but I will ask Ms Morton to come forward and be more specific on the operating through the last number of years.

**MS MORTON:** Lise Morton, for the record.

I will try to capture all the questions I think I heard there. And I am going by memory, I would have to pull out the actual records.

I believe last year the operating for solid waste incineration was about 38 per cent. We had several outages while we were making significant modifications and reliability issues with some of the equipment, that happens sometimes.

So we did not operate full production last year. I believe there was another question there about shipping liquid waste. We have not shipped liquid waste off site.

I don't know if there was another

question, I apologize.

**THE CHAIRPERSON:** Mr. Bourgeois, did that address your questions?

**MR. BOURGEOIS:** Yes, thank you.

**THE CHAIRPERSON:** Thank you very much.

**MR. BOURGEOIS:** Thank you.

**THE CHAIRPERSON:** I believe that brings us to a close for today.

Thank you to everyone who participated today either by being here in person or by watching the webcast.

We will resume tomorrow at 9:00 a.m. We will be hearing presentations from the Saugeen Ojibway Nations and the Historic Saugeen Métis.

We will also be discussing the Panel's questions arising from the new information presented by Dr. Greening on September 10.

We will start the session on the new information with some statements from Ontario Power Generation and the CNSC.

OPG and CNSC only, if you wish to use any presentation materials in support of your



statements, please send it to the Secretariat electronically so that it can be made available on the registry and here in hardcopy first thing tomorrow morning.

Thank you everyone and good night.

--- Whereupon the hearing adjourned at 6:05 p.m.,  
to resume on Wednesday, September 17, 2014  
at 9:00 a.m. / L'audience est ajournée  
à 18 h 05 pour reprendre le mercredi  
17 septembre 2014 à 9 h 00