

PMD 14-P1.17A

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**Presentation from
Northwatch**

In the Matter of

Ontario Power Generation Inc.

OPG's Deep Geological Repository (DGR)
Project for Low and Intermediate Level
Radioactive Waste

Joint Review Panel

September 2014

**Présentation de
Northwatch**

In the Matter of

Ontario Power Generation Inc.

Installation de stockage de déchets radioactifs à
faible et moyenne activité dans des couches
géologiques profondes

Commission d'examen conjoint

septembre 2014

Uncertainty Expanded

Northwatch's General Submission

Presentation by Brennain Lloyd

Presentation to the Joint Review Panel – September 2014

Review of Ontario Power Generation's Proposed Deep Geologic Repository for Low and Intermediate Level Nuclear Wastes

Northwatch's Interests



Summary of Key Findings

- OPG's group of "independent experts" have confirmed that the DGR design will ultimately rely on dilution, using a combination ground water, rain water and surface waters, including the water of Lake Huron
- The uncertainties with respect to the waste inventory appear to have increased rather than decreased
- There are increased uncertainties associated with a generally held expectation that the addition of decommissioning wastes will increase the amount of gas generated within the repository, which in turn can be expected to have serious repercussions for the safe operations of the facility
- Issues persist with respect to the Geoscience Verification Plan and the functioning of the barriers, particularly the shaft seal
- OPG's claim of successful operation having been demonstrated through international experience is unfounded

Review of OPG and CNSC PMDs

Deep Geologic Repository Joint Review Panel
Commission d'examen conjoint du projet de stockage
dans des couches géologiques profondes

PMD 14-P1.1
File / dossier : 8.01.07
Date: 2014-07-07
Edocs: 4467519

Written Submission from
Ontario Power Generation Inc.

Mémoire de
Ontario Power Generation Inc.

In the Matter of
Ontario Power Generation Inc.

À l'égard de
Ontario Power Generation Inc.

OPG's Deep Geological Repository (DGR)
Project for Low and Intermediate Level
Radioactive Waste

Installation de stockage de déchets radioactifs à
faible et moyenne activité dans des couches
géologiques profondes

Commission d'examen conjoint

Joint Review Panel

septembre 2014

September 2014

Canada

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

UNPROTECTED/NON PROTÉGÉ

ORIGINAL/ORIGINAL
PMD: 14-P1.2

Reference PMD(s)/PMD(s) de référence : 13-P1.2, 13-P1.3, 13-P1.3A

Date signed/Signé le : JULY 7, 2014

Technical Briefing
Ontario Power Generation Inc.

Exposé technique
Ontario Power Generation Inc.

Proposed Environmental Impact Statement for OPG's Deep Geological Repository (DGR) Project for Low- and Intermediate-Level Radioactive Waste

Étude proposée pour l'énoncé des incidences environnementales pour l'installation de stockage de déchets radioactifs à faible et moyenne activité dans des couches géologiques profondes

Public Hearing

Audience publique

Scheduled for:
September 2014

Submitted by:
CNSC Staff

Prévue pour :
septembre 2014

Soumise par :
le personnel de la CCSN

e-Doc 4448918 (WORD)
e-Doc 4461706 (PDF)

Canada

Review of OPG Additional Information

- Methodology used to determine the significance of adverse environmental effects
- Updates to the geoscientific verification plan
- Expansion plans for the DGR project
- Relative risk analysis of alternative means of carrying out the project
- Implications of revisions to the reference waste inventory
- Applicability of Recent Incidents at the Waste Isolation Pilot Plant (WIPP) to the Safety Case for the DGR Project

Review of OPG Additional Information

OPG Responses to Joint Review Panel EIS Information Request Packages 12, 12a, 12b, and 13		
IR#	EIS Guidelines Section	Information Request and Response
EIS 12-510	<ul style="list-style-type: none"> Section 11.3 Significance of Residual Effects Section 2.6 Study Strategy and Methodology 	<p>Information Request: Significance Determination for Residual Adverse Effects</p> <p><i>Provide a detailed narrative to explain how the significance of each residual adverse effect on the biophysical environment (Geology, Hydrogeology and Surface Water, Terrestrial Environment, Aquatic Environment, Radiological Conditions, Air Quality, Noise and Vibrations) and on Aboriginal Interests was determined. Provide a separate narrative for each residual adverse effect.</i></p> <p><i>The narrative must explain the logic behind the significance determinations and is to use context-based reasoning. Arbitrary category limits for criteria such as magnitude are not required. Rather, the context for the predicted measurable change should be explained in sufficient detail that the reader may understand the relative significance of that change in terms of the magnitude, geographic extent, timing and duration, frequency and degree of irreversibility criteria. If the social/ecological context of the adverse effect was also assessed, the rationale for this criterion must be explained. Defensibility is to be provided by references to the literature (peer-reviewed and "grey" literature). Sufficient information must be provided to allow a third party reviewer to understand how the conclusion was reached.</i></p> <p><i>The narratives provided in the Socio-Economic Assessment are sufficiently clear and do not require further elaboration.</i></p> <p>Context:</p> <p><i>In Dr. Duinker's hearing submission (PMD 13-P1.175), he expresses concerns about the lack of transparency of the decision trees and the apparent arbitrariness in professional judgement used to determine significance (pages 5-7 of the PMD). The determination of significance of adverse impacts is fundamental to the environmental assessment. Therefore, the rationale for the determination of significance must be credible, defensible, clear, reliable, and appropriate.</i></p> <p>Narrative Requirements:</p> <ul style="list-style-type: none"> <i>Clear explanation of the "measurable change" leading to identification of adverse effect in terms of comparison pre and post-impact, and the assumed measurement error. Would the change be detectable using standard monitoring methods? Have similar changes occurred in the study area and would these changes be described as "measurable"?</i> <i>Avoidance of arbitrary low/medium/high categorization in favour of narrative reasoning that is well supported by literature citations and examples from comparable projects. For example, the context for magnitude may include references to the toxicological literature, risk quotients, or population and community monitoring and modelling from comparable projects which have similar effects on the biophysical environment or upon Aboriginal interests.</i> <i>Avoidance of the "may not be significant" determination. Instead, explain the level of confidence in each of the</i>

ATTACHMENT A TO OPG RESPONSE TO IR-EIS-12-510

NARRATIVE EXPLAINING SIGNIFICANCE ASSESSMENTS FOR OPG'S DEEP GEOLOGICAL REPOSITORY PROJECT FOR LOW & INTERMEDIATE LEVEL WASTE

IR 12-510

Review of OPG Additional Information

OPG Responses to Joint Review Panel EIS Information Request Packages 12, 12a, 12b, and 13		
IR#	EIS Guidelines Section	Information Request and Response
		<p><i>significance conclusions. The level of confidence must be explained in terms of the precautionary principle, i.e. the application of risk avoidance, adaptive management and preparation for surprise requirements associated with each significance determination. For example, if the assessment team judges that the consequences of being wrong about the significance of a particular effect are such that explicit monitoring, contingency planning, or further risk reduction measures are required, then these measures must be described in association with the significance result.</i></p> <p>OPG Response: Attachment A presents a detailed narrative explaining how the significance of each residual adverse effect on the biophysical environment was determined in the Environmental Impact Statement (EIS) (OPG 2011). The narrative provides an explanation of the logic used in the significance assessments and further clarifies the significance assessments presented in Sections 7.2.3, 7.3.3, 7.4.3, 7.5.3, 7.6.3, 7.7.3, 7.8.3, and 7.9.3 of the Environmental Impact Statement (OPG 2011). For components of the environment for which no residual adverse effects were identified (i.e., radiation and radioactivity, geology, and surface water quality), information on what would have been required for identification of a significant adverse effect and a discussion of the potential effects of the DGR Project are provided for completeness. The response includes an explanation of "measurable change" leading to the identification of adverse effects for each residual adverse effect.</p> <p>References: OPG. 2011. OPG's Deep Geologic Repository for Low and Intermediate Level Waste - Environmental Impact Statement. Ontario Power Generation report 00216-REP-07701-00001-R000. Toronto, Canada. (CEAA Registry Doc# 298)</p>
EIS 12-511	<ul style="list-style-type: none"> Section 16, Follow-Up Program 	<p>Information Request: Geoscientific Verification Plan Provide an updated Geoscientific Verification Plan (GVP) that includes more details concerning specific methods, timing, and the sequencing of sampling as well as how Ontario Power Generation will develop triggers for changes to engineering design and benchmarks for verification of the safety case. Verification activities that are outlined in NWMO DGR-TR-2011-08 are generally defined and lack substantive detail as to the procedures that would be used, spatial locations of testing and timing of testing. An example deficiency is provided in the following paragraph, with more details being provided in the Context section of this IR request.</p>

OPG's DEEP GEOLOGIC **REPOSITORY** FOR LOW & INTERMEDIATE LEVEL WASTE

Geoscientific Verification Plan

January 2014

Prepared by: Nuclear Waste Management Organization

NWMO DGR-TR-2011-38-R001

IR 12-511

Review of OPG Additional Information

EIS-12-512: DGR Expansion Plans

This response to the Information Request presents the assessment of several components of the design, and the potential impact on the environment, of the potential expansion of the Deep Geologic Repository (DGR). The ability to support such a future expansion is identified as part of the project requirements (NWMO 2010) and is a consideration in all aspects of the design. As such, this information has not been formally documented in a stand-alone report. The information provided in this response shows that expansion could be achieved without major changes to the DGR facility infrastructure or safety case. Before the DGR facility is expanded to accept additional waste, further analysis would be completed in detail and the required regulatory approvals would be sought. Further, experience gained through the construction and operation of the proposed DGR would be incorporated into the expansion design and planning.

1. BACKGROUND

Ontario Power Generation (OPG) is currently seeking regulatory approval for site preparation and construction of a DGR with a capacity of approximately 200,000 m³ (packaged volume) for low & intermediate level waste (L&ILW) arising from operations and refurbishment activities from OPG owned or operated reactors (see Figure 1) (OPG 2012). The activity that causes the waste to come into existence however is not an important consideration. Rather, it is the characteristics of that waste from a volume, material, and radionuclide perspective that is important. The 200,000 m³ would provide sufficient capacity for disposal of the estimated L&ILW wastes to be generated through the operation and refurbishment of the OPG owned or operated reactors.

The DGR project has also assessed the feasibility of an expansion of the DGR from the current planned waste volume capacity of 200,000 m³ to a capacity of 400,000 m³. This additional capacity could account for the potential of future L&ILW waste volumes arising from either new operational and refurbishment activities or decommissioning activities.

This consideration of the expansion of the DGR also supported the requirement in the Environmental Impact Statement Guidelines to perform a cumulative effects assessment of including L&ILW arising from decommissioning. The following considerations respecting expansion of the DGR have been assessed at a conceptual level:

- Repository layout within the existing site constraints (assuming that the surface and underground footprint are not constrained within the lands currently designated as OPG retained lands at the Bruce nuclear site);
- Constructability of the expanded repository;
- Impacts to waste operations;
- Environmental impacts of expanded repository; and
- Safety implications of decommissioning waste inventory.

Section 2 describes the proposed design impacts (to both underground and surface facilities) and operational impacts of expanding the repository. Section 3 describes additional considerations specific to L&ILW arising from decommissioning activities, and Section 4 discusses timing of the potential expansion.

2. REPOSITORY EXPANSION

A general layout of the expanded underground repository has been prepared to assess the feasibility of this planning assumption. For this layout, the DGR was conservatively assumed to be expanded to double in size (i.e., 400,000 m³ packaged waste volume). Figure 2 shows the expansion layout and Figure 3 shows the proposed and expanded repository footprint on the Bruce nuclear site. The underground layout and required number of emplacement rooms would be updated when the volume of additional waste is better defined. The expansion assumes that the emplaced waste is isolated by closure walls prior to initiation of expansion (i.e., no waste emplacement during construction activities).

IR 12-512

OPG Responses to Joint Review Panel EIS Information Request Packages 12, 12a, 12b, and 13		
IR#	EIS Guideline Section	Information Request and Response
EIS 12-512	• Section 14, Cumulative Effects	<p>Information Request:</p> <p>DGR Expansion Plans</p> <p>Provide the existing Technical Assessment and all associated support documents for the expansion of the proposed DGR to accommodate the disposal of decommissioning waste, LLW and ILW, from the Pickering, Darlington and Bruce nuclear generating stations. The response must include plans for anticipated changes to both the physical layout of the subsurface (shafts, emplacement rooms, etc.) and surface (WRMA, SWMP, etc.) facilities and structures and their operational parameters.</p> <p>The anticipated timing of any expansion activities relative to currently proposed DGR phases must be included in this response.</p> <p>Context:</p> <p>The cumulative effects analysis presented in the EIS lists the emplacement of decommissioning waste from the OPG-owned and operated nuclear generating stations (Pickering, Darlington and Bruce) into the DGR as a reasonably foreseeable activity. The Hosting Agreement with Kincardine includes provision for accepting decommissioning waste into an expanded DGR (EIS, Table 10.4-3, Item 31). An approximate doubling of the underground capacity was envisioned from ~200,000 m³ to ~400,000 m³ (IR EIS-04-145).</p> <p>Since the finalization of the EIS in 2011, the earlier than anticipated planned decommissioning of the Pickering Nuclear Facility has triggered the expectation from OPG that the L&ILW from that site would be placed into the proposed DGR. During the hearing OPG referenced the existence of an expansion Technical Assessment (Hearing Transcript Volume 23: October 28, 2013, p.121, l. 21) which details initial plans for the expansion and its impact on the proposed DGR.</p> <p>OPG Response:</p> <p>The ability of the DGR Project to support the potential for future expansion is identified in the project requirements and was assessed as part of the design process. As such, a formal Technical Assessment report had not been prepared. However, the requested information is provided in Attachment A.</p> <p>This response includes the expansion layout referenced by OPG in the hearings as the expansion GA, or general arrangement drawing (Hearing Transcript Volume 23: October 28, 2013, p.121, l.21).</p>

Review of OPG Additional Information

Consolidated OPG Response List - IR Packages 12, 12a, 12b, and 13
Page 200 of 491

**Report of the Independent Expert Group
on
Qualitative Risk Comparisons among
Four Alternative Means for Managing the
Storage and Disposal of Low and
Intermediate-Level Radioactive Waste
in Ontario**

Consolidated OPG Response List - IR Packages 12, 12a, 12b, and 13
Page 214 of 491

**Report of the Independent Expert Group
on
Risk Perceptions of the Four Alternative
Means for Managing the Storage and
Disposal of Low and Intermediate-Level
Radioactive Waste in Ontario**

Consolidated OPG Response List - IR Packages 12, 12a, 12b, and 13
Page 42 of 491

OPG Responses to Joint Review Panel EIS Information Request Packages 12, 12a, 12b, and 13		
IR#	EIS Guidelines Section	Information Request and Response
EIG 12-513	<ul style="list-style-type: none"> Section 7.3, Alternative Means of Carrying out the Project 	<p>Information Request:</p> <p>Alternative Means Risk Analysis</p> <p>Provide a renewed and updated analysis of the relative risks of siting alternatives under alternative means requirements of the EIS Guidelines. This analysis should be undertaken by independent risk assessment experts. The analysis is to be qualitative, transparent, defensible, and repeatable.</p> <p>Options to be analyzed:</p> <ol style="list-style-type: none"> 1. "As is" facility at the WWMF (the status quo) 2. Enhanced surface storage at the WWMF ("hardened" storage) 3. Proposed DGR in the Cobourg Formation at the Bruce Power site 4. A conceptual DGR in granitic bedrock of the Precambrian Canadian Shield. Information required for the qualitative analysis of a conceptual DGR in granitic bedrock should be based primarily upon the extensive data and analyses available within the environmental assessment performed by Atomic Energy of Canada Limited (AECL) for the Environmental Assessment Panel for Nuclear Fuel Waste Management and Disposal Concept (known as the Shearwater Panel). <p>Analysis of risks to socio-economic factors (such as physical, social and financial assets) is not required because the conceptual DGR in granite is not located in a specific geographic location.</p> <p>The relative risk of each alternative should be assessed for normal operations and for selected accidents, malfunctions and major events. The accidents, malfunctions and major events that were assessed in the EIG can be used for the risk analysis.</p> <p>Effects of the environment on relative risk must also be included; specifically, the relative risk associated with severe weather events – particularly under climate change scenarios.</p> <p>The relative risk analysis should include the following:</p> <ul style="list-style-type: none"> • Worker Health and Safety: construction, operation and decommissioning • Public Health and Safety: construction, operation, decommissioning and post-closure • Risks to Safety Case: <ul style="list-style-type: none"> ○ Advective water flow around and through the facility ○ gas generation ○ physical obstruction

41

SUBMITTED BY:
TOM ISAACS, WILLIAM LEISS (CH)

SUBMITTED TO:
THE JOINT REVIEW PANEL FOR THE DEEP GEOLOGIC REPOSITORIES FOR LOW AND INTERMEDIATE LEVEL RADIOACTIVE WASTE (DGR)

March 25, 2014

Consolidated OPG Response List - IR Packages 12, 12a, 12b, and 13
Page 241 of 491

REPORT


**Risk Perception of Nuclear Waste Disposal
A background study**

Submitted by:
Anne Wiles

Submitted to:
The Independent Expert Group

April 23 2014

Consolidated OPG Response List - IR Packages 12, 12a, 12b, and 13
Page 241 of 491



REPORT

**Risk Perception of Nuclear Waste Disposal
A background study**

Submitted by:
Anne Wiles

Submitted to:
The Independent Expert Group

April 23 2014

IR 12-513

Review of OPG Additional Information

OPG Responses to J		
IR#	EIS Guidelines Section	
		<p>position of c... "Much more... indicated scab... b) The report in OPG... for the near term (-... Included. Summary ta... of the four identified op... response addressing the</p> <p>OPG Response: The Independent Expen Group's re... enclosed report (IEG 2014a). The co... 2014b).</p> <p>References: IEG. 2014a. Report of the Independent Expe... Risk Comparisons among Four Alternative Mea... Radioactive Waste in Ontario. Submitted by M. L... Panel for the Deep Geologic Repository Project fo... 2014. (enlosed) IEG. 2014b. IEG letter from Dr. W. Leiss to Laurie Sw...</p>
EIS 13-514	Section 8.1, General Information and Design Description	<p>Information Request: Provide the following:</p> <ul style="list-style-type: none"> The results and evaluations of the re-runs of postclosure safe... as a similar level of detail and clarity as that provided in NWMO DGR-TR-2011-25 "Postclosure..."; An assessment of how the revised inventories will affect the pre-c... evaluation of the DGR, with special emphasis on the occupational health and safety of the workforce, as... as radiation protection requirements. This assessment should also address the impact of the revised inventories on the possible future expansion of the DGR; An assessment of how the revised inventories would affect the environmental effects of accidents, malfunctions and malevolent acts, with emphasis on the pre-closure phase;

Consolidated OPG Response List - IR Packages 12, 12a, 12b, and 13
Page 474 of 491

POSTCLOSURE SAFETY IMPLICATIONS OF REVISED PRESSURE TUBE INVENTORIES

CONTENTS

INTRODUCTION.....	1
MODIFICATIONS TO THE INVENTORY OF RADIONUCLIDES IN THE PRESSURE TUBES.....	2
MODIFICATIONS TO THE MODEL.....	3
RESULTS AND ANALYSIS.....	4
OVERVIEW OF RESULTS FOR ALL CALCULATION CASES.....	4
NORMAL EVOLUTION SCENARIO CALCULATION CASES.....	4
PERMANENT INTRUSION SCENARIO CALCULATION CASES.....	4
SEVERE SHAFT SEAL FAILURE SCENARIO CALCULATION CASES.....	4
CONCLUSIONS.....	5
REFERENCES.....	9

Consolidated OPG Response List - IR Packages 12, 12a, 12b, and 13
Page 491 of 491

PRECLOSURE SAFETY IMPLICATIONS OF REVISED PRESSURE TUBE INVENTORIES

CONTENTS

1. INTRODUCTION.....	Page 1
2. MODIFICATIONS TO THE RADIONUCLIDE CONCENTRATIONS IN THE PRESSURE TUBES.....	2
3. PRECLOSURE SAFETY ASSESSMENT METHODOLOGY.....	4
4. RESULTS.....	5
4.1 RADIOLOGICAL SAFETY DURING NORMAL OPERATIONS.....	5
4.2 ACCIDENT ASSESSMENT.....	6
4.3 MALEVOLENT ACTS.....	6
5. CONCLUSIONS.....	9
REFERENCES.....	9

Preclosure Safety Implications - 1 -

IR 13-514

Consolidated OPG Response List - IR Packages 12, 12a, 12b, and 13
Page 474 of 491

WASTE INVENTORY VERIFICATION PLAN

CONTENTS

1. PURPOSE.....	Page 1
2. OBJECTIVE.....	1
3. BACKGROUND.....	3
4. REFERENCE INVENTORY.....	4
5. METHODS.....	4
5.1 DIRECT MEASUREMENT.....	4
5.2 SCALING FACTORS.....	4
5.3 ACTIVATION CALCULATIONS.....	4
6. OPERATIONAL LLW.....	7
7. REFURBISHMENT LLW.....	9
8. PLAN.....	11
8.1 WORK PROGRAM DEFINITION.....	13
8.2 DATA QUALITY.....	13
8.3 VERIFICATION.....	14
8.4 ANALYSIS AND INTEGRATION.....	14
8.5 TIMEFRAME.....	16
REFERENCES.....	16

Waste Inventory Verification Plan - 1 -
April 2014

Review of OPG Additional Information

OPG Responses to Joint Review Panel EIS Information Request Packages 12, 12a, 12b, and 13		
IR#	EIS Guidelines Section	Information Request and Response
		<p>be closed off, and therefore isolated from the expansion activities. And, as discussed in the Postclosure Safety section above, these revised inventories have no effect on the postclosure safety assessment so do not constrain the ability of the DGR to accept additional wastes.</p> <p><u>Inventory Verification</u></p> <p>Attachment C provides the requested Waste Inventory Verification Plan. The purpose of this document is to summarize the activities underway and planned at OPG to continue to measure and verify the properties of the L&ILW arising from operations and refurbishment of OPG-owned or operated nuclear generating facilities and intended for disposal in the proposed DGR. This document has been prepared in response to Information Request EIS-12-514. The work is implemented by more specific work programs and plans within the OPG management system.</p> <p>The plan includes an external third party review of the waste characterization program.</p> <p>The plan includes a description of the main methods used for waste characterization, including measurement of radiolabels on ion exchange resins.</p>
EIS 13-515	<ul style="list-style-type: none"> Section 12, Accidents, Malfunctions and Malevolent Acts 	<p>Information Request:</p> <p><i>Provide a brief description of the recent incidents at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. Include an explanation of the relevance of these incidents to worker and public health and safety (both occupational health and safety and radiation protection requirements) at the proposed DGR under normal and accident conditions. Describe how the consequences of such incidents might or might not fall within what OPG modeled for its analysis of accidents, malfunctions, and malevolent acts.</i></p> <p>Context:</p> <p><i>Recent events at the WIPP have received media attention and raised concerns with interested parties. The requested information will provide context for the Panel's review of the proposed DGR.</i></p> <hr/> <p>OPG Response:</p> <p>There have been two recent incidents at the United States Department of Energy (US DOE) Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico: 1) the February 5, 2014, mine fire, and 2) the February 14, 2014, radiological release. The events are considered by the US DOE to be independent as they occurred in different sections of the facility. OPG and NWMO are carefully reviewing the information that the US DOE is publishing with respect to these two events on their website (http://www.wipp.energy.gov/wiporecovery/recovery.html).</p>

Additional Issues / Areas of Comment

- Annotated version of Chapter 4 of EIS
- Additional Registry Postings
- Assessment Standard



Conclusions

Key Finding

Ontario Power Generation has not provided the Joint Review Panel with a basis for approving the Environmental Assessment, the Application for a License to Prepare the Site, or the Application for a Licence to Construct the proposed Deep Geologic Repository for low and intermediate level radioactive wastes at and below the Bruce Nuclear Site



