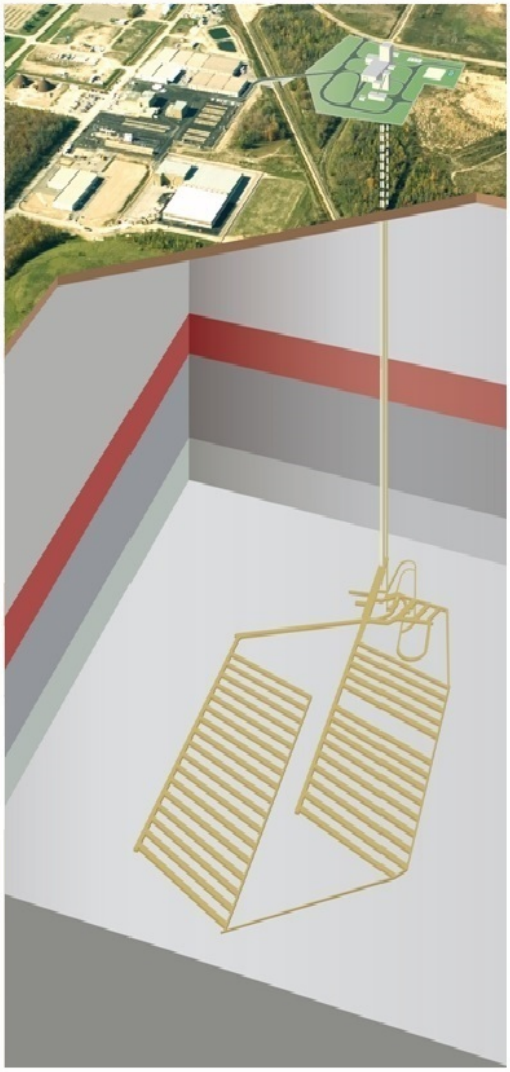
OPG'S DEEP GEOLOGIC REPOSITORY PROJECT

For Low & Intermediate Level Waste

December 2016



Mitigation Measures Report

00216-REP-07701-00019

Document History

Title:	Mitigation Measures Report		
Report Number:	00216-REP-07701-00019		
Revision:	R000	**Date:**	December 2016
Prepared by:	Mihaela Ion (NWMO)		
Reviewed by:	Paul Gierszewski (NWMO)		
Approved by:	Jerry Keto (OPG)		

[PAGE LEFT INTENTIONALLY BLANK]

EXECUTIVE SUMMARY

Ontario Power Generation Inc. (OPG) is currently seeking a licence to prepare the site and construct a Deep Geologic Repository (DGR) for its low and intermediate level radioactive waste (L&ILW) at the Bruce Nuclear site in the Municipality of Kincardine (the DGR Project at the Bruce Nuclear site).

This report provides an updated list of mitigation and monitoring commitments for each identified adverse effect for the DGR Project at the Bruce Nuclear site. They are presented in ten tables, one for each Environmental Component (e.g., Geology, Aquatic, etc.). Within each table the commitments are presented according to Valued Component and topic (e.g., Soil Quality, Stormwater Management). Each commitment is numbered and the table includes all references to similar or duplicate commitments.

The methodology for consolidating the commitments is described, and completed and updated commitments are presented in a separate table. The full list of unconsolidated commitments including redundancies is also included as an appendix for traceability and cross-referencing. A concordance table between OPG's commitments and the Canadian Environmental Assessment Agency's 2015 potential conditions is also provided.

All commitments will be tracked and managed through approved processes and procedures. Reporting to the CNSC and other regulatory agencies will be in accordance with the regulatory requirements.

Completion of the commitments made by OPG including the proposed mitigations and monitoring measures as well as the additional conditions, will assure that that the DGR project will not cause significant adverse environmental effects.

[PAGE LEFT INTENTIONALLY BLANK]

TABLE OF CONTENTS

LIST OF TABLES

Page

1. INTRODUCTION

In February 2016 the federal Minister of Environment and Climate Change requested Ontario Power Generation (OPG) to provide additional information prior to making a decision on the environmental assessment (EA) of OPG's Low and Intermediate Level Waste (L&ILW) Deep Geologic Repository (DGR) Project. In particular the Minister requested:

a) A study that details the environmental effects of technically and economically feasible alternate locations for the Project, with specific reference to actual locations that would meet OPG's criteria for technical and economic feasibility. In conducting this study, OPG is to detail the thresholds for what is considered to be technically and economically feasible. In addition, OPG is to indicate what the incremental costs and risks would be for additional off-site transportation of the nuclear waste.
b) An updated analysis of the cumulative environmental effects of the Project in light of the results of the Phase 1 Preliminary Assessments undertaken by the Nuclear Waste Management Organization, which identified three potential host communities that fall within the traditional territory of the Saugeen Ojibway Nation (SON).
c) An updated list of mitigation commitments for each identified adverse effect under CEAA 2012. OPG shall identify out-dated or redundant commitments that were previously brought forward to the Panel.

This report is OPG's response to item c) an updated list of mitigation commitments.

The structure of this report is as follows:

- Section 2 presents the methodology used to update the list of mitigation commitments, as well as to identify the outdated or redundant commitments that were previously brought forward to the Joint Review Panel (Panel).
- Section 3 presents the table with updated list of mitigation (including monitoring) commitments.
- Section 4 presents the table with outdated (completed or updated) mitigation and monitoring commitments.
- Section 5 provides the list of references.
- Section 6 includes the list of abbreviations and acronyms.
- Appendix A provides the detailed commitments supporting each mitigation and monitoring commitment listed in the tables of Section 3.
- Appendix B provides the cross-references between the mitigation and monitoring commitments in this report and the Canadian Environmental Assessment Agency's (the Agency's) potential conditions listed in CEAA [2015].

2. APPROACH

2.1 BACKGROUND

OPG made a number of commitments[1] with respect to the DGR Project through its original submissions and during the public review and panel hearings. These commitments were listed in the following documents:

- Consolidated Commitment Lists Report [NWMO 2014a], submitted with OPG letter dated August 25, 2014 [OPG 2014a], which includes all commitments made by OPG until June 2014. These are commitments made by OPG in its application for a Site Preparation and Construction Licence, and commitments made during the JRP public review process, including OPG's responses to information requests and undertakings during the 2012-2013 JRP technical information sessions, and during the 2013 JRP public hearing.

- An OPG letter dated October 17, 2014 [OPG 2014b] with an additional list of commitments made by OPG during the 2014 JRP public hearing.

- OPG's acceptance letter of the Agency's proposed conditions as written or with modifications in the case of four potential conditions [OPG 2015].

These three documents in the list above included a total of about 929[2] regulatory and community[3] commitments[4] in OPG's submissions, and 74 conditions proposed by the Agency and accepted by OPG as written or with modifications. The total of about 1003 statements included mitigation measures and monitoring activities to be undertaken by OPG for the DGR Project to minimize or reduce adverse environmental effects, as well as other actions to be undertaken as part of the normal evolution of the project (such as clarifications regarding the detailed description of the design, engineering or construction actions), activities/actions to address the requirements of applicable laws and regulations (e.g., financial guarantees), or compliance statements to OPG/NWMO governance, and others.

[1] Commitments captured in OPG's submissions [NWMO 2014a, OPG 2014b] were typically stated as future actions using the verb "will" or "shall".

[2] This number was already the result of an initial consolidation of the original lists of commitments made by the OPG in its submissions and during the public review, at the request of the Panel. About 1360 commitment statements were included in the original lists, before reducing redundancies.

[3] Regulatory commitments describe actions committed to a regulatory body or accepted by an OPG authorized representative. Regulatory commitments relate to the provisions in the enabling statutes or regulations under which OPG would be granted a licence, permit or other approval to implement the DGR Project. For completeness and transparency, non-regulatory commitments to the communities, including the Indigenous groups, were also included.

[4] The DGR Project Consolidated Commitments List Report [NWMO 2014a] referred to six OPG documents or sections of documents submitted to the JRP as being essentially commitments, such as the Geoscientific Verification Plan [NWMO 2014c], Preliminary Decommissioning Plan [NWMO and CANDESCO 2011], Attachment to OPG Letter dated September 12, 2013 [OPG 2013b], and others. Those were included as single items in the tables of NWMO [2014a], however they included multiple commitments.

This report includes the following:

- commitments related to mitigation and monitoring identified in NWMO [2014a], and OPG [2014b], and
- the Agency's conditions as accepted by OPG, addressing adverse environmental effects.

There are about 178 commitments that are not related to adverse environmental effects, which are included in the Consolidated Commitment Lists Report [NWMO 2014a], and seven of the Agency's conditions not related to adverse environmental effects (2.1, 2.4, 2.5, 2.7, 15.1, 15.2, and 16.1), which are included in CEAA [2015].

All commitments will be tracked and managed through approved processes and procedures. (Section 2.5).

2.2 METHODOLOGY

This report consolidates and updates the mitigation and monitoring commitments[5]. The decision process methodology used is as follows:

- Initially they were grouped into ten tables, one for each Environmental Component (e.g., Geology, Aquatic, etc.). Within each table the commitments were organized according to Valued Component and topic (e.g., Soil Quality, Stormwater Management). Each table included the applicable mitigation measures and monitoring activities identified in NWMO [2014a] and OPG [2014b], as well as the Agency's conditions as accepted by OPG (Appendix A).
- Redundancies were removed by grouping all commitments that describe the same action/activity (i.e., duplicates) into a representative statement (Section 2.3.1).
- Detailed commitments were further grouped based on a common topic into more general statements. (Section 2.3.2)
- Where necessary, commitment statements were updated (Section 4).
- Completed commitments were identified (Section 2.3.4 and Section 4).
- The results are presented in Section 3.
- The cross-references between the results in Section 3 and the Agency's potential conditions in CEAA [2015] are included in Appendix B.

[5] This report still refers to two OPG submissions to the JRP (Geoscientific Verification Plan, Waste Inventory Verification Plan) as being essentially commitments. They are included as single items in this report, however they include multiple commitments. The commitments from the other four documents previously also referred as being essentially commitments, have been extracted and included in this report to the extent practicable.

2.3 CONSOLIDATION AND REMOVAL OF REDUNDANCIES

2.3.1 Duplicate or Redundant Commitments

When multiple commitments describe the same action/activity with different wording, one commitment statement has been selected as representative for describing that particular action/activity.

Duplicate commitments are identified by their numbers, which are listed after the commitment statement. The underlined number represents the commitment number providing the source reference of the wording. The other numbers represent the duplicate commitments.

An example of consolidating is provided below for mitigation commitment MIT-A-02 (from Table 3-6):

> "On-site vehicles and equipment will be equipped with appropriate silencers *[to control noise]* and maintained in good working order. [EA-123, EA-198, H-09-08, IRC-EIS-09.19, IRC-EIS-09.20, TIS-03-09, H-09-03]"

The first underlined number represents the commitment-reference providing the wording (in this instance EA-123). The original source reference for EA-123, which was Table 7.8.2-1 of the Environmental Impact Statement (EIS) [OPG 2011a], is documented in NWMO [2014a] and NWMO [2013].

All other numbers shown in the list above, starting with EA-198, identify the duplicate commitments: "EA" represents the commitments made in the original EIS submission; "H" represents commitment statements made during the public hearing process; "IRC" represents the information requests received during the public review process; "TIS" represents commitment statements made during the technical information sessions; and CEAA indicates a commitment identified in the Agency's draft terms and conditions. Their wording and source references are documented in NWMO [2013] or [OPG 2015]. This example illustrates how seven commitment statements were consolidated to reduce duplications.

2.3.2 Common Topic Commitments

At times there are different commitments that are associated with a common topic. General statements describing the topic have been used when different detailed commitments are grouped together based on common topics.

An example of grouping mitigation commitments based on a common topic is provided below with respect to mitigation commitment MIT-H-12, listed in Table 3-2:

> "The DGR Project will not discharge to the North and South Railway Ditches, Stream C or Baie du Doré. [IRC-EIS-07.12, EA-115, EA-262, IRC-EIS-01.11, IRC-EIS-07.10, IRC-EIS-07.11, IRC-EIS-07.15, IRC-EIS-07.17, IRC-EIS-07.20, IRC-EIS-07.21, IRC-EIS-07.24, IRC-EIS-07.26, IRC-EIS-12.16, and in EIS, Table 13-1 (OPG 2011a)]"

This summary statement is based on more detailed commitments, listed in Table A2 of this report under the Surface Water Quality Valued Component, which are reproduced below:

- As there will be no surface water discharges from the project to Stream C, and only a slight decrease (0.8%) in runoff, changes in surface water should have no measurable effect in temperature. [IRC-EIS-07.15, EA-115, EA-262, IRC-EIS-01.11, IRC-EIS-07.10, IRC-EIS-07.11, IRC-EIS-07.12, IRC-EIS-07.17, IRC-EIS-07.20, IRC-EIS-07.21, IRC-EIS-07.24, IRC-EIS-07.26, IRC-EIS-12.16]
- A diversion of site surface water runoff from the Stream C catchment will be implemented to avoid the discharge of any stormwater from the DGR Project site into the more sensitive coldwater habitat of the Stream C watershed and to ensure the treatment of all the drainage from the DGR Project in a stormwater management pond, prior to discharge to ditches that lead to MacPherson Bay. No releases from the site will be directed to the Stream C watershed. [IRC-EIS-01.11, EA-115, EA-262, IRC-EIS-07.10, IRC-EIS-07.11, IRC-EIS-07.12, IRC-EIS-07.15, IRC-EIS-07.17, IRC-EIS-07.20, IRC-EIS-07.21, IRC-EIS-07.24, IRC-EIS-07.26, IRC-EIS-12.16]

This example illustrates how 13 commitments were consolidated by grouping.

In summary, by grouping the commitments to remove the duplications and using common topics, redundancies have been reduced.

2.3.4 Completed Commitments

All commitments completed to date have been identified, including those identified as completed in the Consolidated Commitment Lists Report [NWMO 2014a], as well as those completed since then. There are eight completed commitments, and they are listed in Table 4-1 of this report.

2.3.5 Summary

As a result, 164 distinct mitigation and monitoring commitment statements (106 mitigation commitments and 58 monitoring commitments) have been identified, and are presented in the tables of Section 3.[6]

Details supporting the 164 statements, presented in about 690 detailed commitments, are provided in Appendix A.

2.4 IDENTIFICATION OF OUTDATED COMMITMENTS

Outdated commitments are defined in this report as either completed (see Section 2.3.4) or updated commitments.

Updated commitments are identified as wording changes that are not editorial in nature (for example, where OPG has updated its governance and replaced the Land Assessment and Remediation Policy with a new Procedure under the Environment Policy, this has been noted as

[6] Note that some commitments are applicable to, and therefore repeated in, multiple VCs.

an update). The updated commitments along with clarifications describing the changes, are provided in Table 4-1 of this report. For each commitment, the following is provided:

- the relevant Valued Component associated with the commitment,
- the detailed description of the commitment,
- current status of the commitment, and
- relevant follow-up commitments, if applicable.

2.5 COMMITMENT MANAGEMENT

Completion of the commitments made by OPG including the proposed mitigations and monitoring measures, as well as the additional conditions will assure that that the DGR project will not cause significant adverse environmental effects.

Proper identification, tracking, management and completion of commitments are required to allow ensure project staff to:

- Meet the applicable regulatory requirements.
- Ensure a common understanding of the commitments that have been made with regulatory agencies, or other parties, and the criteria for their completion.
- Ensure and demonstrate that regulatory commitments made by the DGR project are honoured.
- Readily understand the basis for, rationale for, expectations of and limitations of the licensing basis.
- Manage commitments in an efficient manner and avoid unnecessary administrative burden.
- Maintain an accurate record of the completion of commitments for audit and other record keeping purposes.
- Manage/revise commitments so they remain current, accurate and applicable.

All commitments listed in tables of Section 3 and Appendix A of this report, including those listed in this report, in the Consolidated Commitment Lists Report [NWMO 2014a], and in CEAA [2015] will be tracked and managed through approved processes and procedures.

Changes to the regulatory commitments will be managed in accordance with change approvals processes to be established between OPG, the CNSC, and other regulatory agencies, in accordance with the regulatory requirements.

Changes to the non-regulatory commitments to the communities, including the Indigenous groups, are managed directly through the relationship between OPG and the other involved party. OPG expects that these commitments may be monitored by the CNSC, as the primary regulatory body, but not subject to its change approval.

Reporting to the CNSC and other regulatory agencies will be in accordance with the regulatory requirements.

3. UPDATED MITIGATION AND MONITORING COMMITMENTS

3.1 UPDATED LIST OF MITIGATION AND MONITORING COMMITMENTS

The updated list of the mitigation and monitoring commitments is presented in this section. The commitments are organized in tables for each Environmental Component and their Valued Components:

- Table 3-1: Geology Mitigation and Monitoring Commitments
- Table 3-2: Hydrology and Surface Water Quality Mitigation and Monitoring Commitments
- Table 3-3: Terrestrial Environment Mitigation and Monitoring Commitments
- Table 3-4: Aquatic Environment Mitigation and Monitoring Commitments
- Table 3-5: Radiation and Radioactivity Mitigation and Monitoring Commitments
- Table 3-6: Atmospheric Environment Mitigation and Monitoring Commitments
- Table 3-7: Indigenous Interests Mitigation and Monitoring Commitments
- Table 3-8: Socio-economic Environment Mitigation and Monitoring Commitments
- Table 3-9: Human Health Mitigation and Monitoring Commitments
- Table 3-10: Ecological Features Mitigation and Monitoring Commitments

This is the same order as they appear in Table 13-1, Summary of Likely Effects, Mitigation Measures, Residual Adverse Effects, Significance and Follow-up, of the EIS [OPG 2011a].

Additional details, supporting each commitment in the tables listed above, are provided in a similar order and manner in Appendix A of this report.

In each table, the following is provided for each Valued Component:

- A statement summarizing the likely environmental effects with mitigation measures in place (**Likely Environmental Effects with Mitigation**).
- A list of mitigation commitments including any in-design mitigation measures (**Mitigation Commitments**).
- A list of monitoring commitments to be undertaken (baseline, follow-up, and/or regulatory) relevant to that particular environmental effect and Valued Component (**Monitoring Commitments**).

3.2 DESCRIPTION OF COMMITMENTS

3.2.1 Commitment Number

A numbering system has been implemented in this report to clearly identify the mitigation and monitoring commitments associated with the DGR Project. Each commitment is numbered by identifying whether it is a mitigation (“MIT”) or a monitoring (“MON”) commitment and identifying the Environmental Component. For example, in Table 3-1, the first mitigation commitment is identified as “MIT” for mitigation, followed by “G” for Geology and “01” for the first commitment.

The descriptors used for the Environmental Components in the commitment numbers are as follows:

- G – Geology
- H – Hydrology and Surface Water Quality
- T – Terrestrial
- W – Aquatic
- R – Radiation and Radioactivity
- A – Atmospheric
- I – Indigenous
- S – Socio-economic
- P – Human Health

3.2.2 Commitment Description

The text of the commitments largely shown as it appears in the source reference, with the exception of some minor, mostly editorial type changes. Any additional information, provided as background information where necessary, is shown in italics and brackets. Commitments derived from the Agency's proposed conditions as accepted by OPG use the text included in [CEAA 2015] and [OPG 2014b], where "The Proponent shall" was replaced by "OPG will" and "Aboriginal" was replaced by "Indigenous".

For consolidated commitments, cross-references to the commitments from which the consolidated commitment originated are provided, as described in Section 2.1. Cross-references represent either reference to commitments as worded in prior documents or submissions, or reference to commitments, indicated by the phrase "based on", which include minor editorial changes to the original wording. In addition, a number of high-level statements were developed for this report to summarize common topics, as described in Section 2.3.2; such statements do not represent new commitments, as they do not describe any new mitigation measures or monitoring activities. They therefore do not have references.

Cross-referenced commitment numbers are consistent with the numbering system used in prior reports and submissions [NWMO 2013, NWMO 2014a, NWMO 2014b, OPG 2014b]. Similar to NWMO [2014a], when multiple numbers are provided for a commitment statement, the underlined number represents the number of the commitment providing the source reference of the wording. Other numbers represent duplicate commitments.

A few examples are provided below.

- An example of direct reference is shown for the mitigation commitment MIT-A-02, listed in Table 3-6, which is described as:

  > "On-site vehicles and equipment will be equipped with appropriate silencers *[to control noise]* and maintained in good working order. [EA-123, EA-198, H-09-08, IRC-EIS-09.19, IRC-EIS-09.20, TIS-03-09, H-09-03]"

- An example of indirect reference (using “based on” as an indicator) is shown for the monitoring commitment MON-G-04, listed in Table 3-1, which is described as:

  > “The shallow bedrock groundwater and solute transport will be monitored to confirm predictions of the Geosynthesis program. [based on EA-219, EA-162, EA-217]”

3.2.3 Applicability to DGR Project Phases

The mitigation and monitoring commitments listed in this report apply to the DGR Project phases as follows:

- Where likely adverse effects are identified with mitigation measures in place for specific project phase(s), the commitments apply to the respective DGR project phase(s).

- Where no likely adverse effects are identified with mitigation measures in place, the commitments apply as a minimum to the Design & Construction phase, unless specified otherwise. A number of these commitments apply to multiple phases of the DGR Project, as indicated in NWMO [2014a] and OPG [2014b]. OPG’s commitment management process will ensure that appropriate tracking mechanisms are in place to ensure that they are addressed, as appropriate and as required, throughout the DGR project phases (see Section 2.5).

Table 3-1: Geology Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
(Additional details for each commitment below are provided in Table A1.)		
Soil Quality	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-G-01	OPG will, during site preparation and construction and to the satisfaction of the CNSC, place a liner under the waste rock management areas to direct leachate to a treatment facility or the stormwater management pond. [based on CEAA 11.2]
	MIT-H-02	OPG will, during site preparation and construction and to the satisfaction of the CNSC, place a liner under the stormwater management pond. [based on CEAA 11.1]
	MIT-G-02	Waste rock management will be implemented.
	MIT-G-03	Prior to the deposition of waste rock in the WRMA, silt curtains will be installed between the drainage ditches and the toe of the waste rock pile (i.e. the permanent stockpile of limestone). These will be maintained for the development of the waste rock pile during of the construction phase until it is observed that silty material is no longer being released from the waste rock pile. In addition, vegetation will be re-established in the area between the silt curtain and the waste rock pile to assist in limiting the migration of sediment to the silt curtains and the drainage ditches. [IRC-EIS-05.32, EA-039, EA-267, IRC-EIS-08.13, IRC-EIS-08.16, IRC-EIS-09.36]
	MIT-G-04	OPG will not, during any phase of the project, dispose of waste rock outside the boundaries of the stormwater management system without the permission of the CNSC. [based on CEAA 11.3, LIC-165 (Rec #31)]
	MIT-G-05	In the event of such *[malfunction or accident]*, follow-up monitoring *[of soil quality]* may include a number of activities, including surficial soil sampling, subsurface soil investigations (i.e., borehole drilling with soil sampling for analysis), and potentially, soil remediation. The purpose of these activities would be to ensure compliance with the prevailing regulatory standards, which are currently the MOE Table 3 SCS *[Site Condition Standards]*. If non-compliant, determine additional mitigation required to be compliant, as required under Ontario Environmental Protection Act. [EA-212, EA-160, H-23-12]
	MIT-H-18	OPG will, prior to site preparation and to the satisfaction of the CNSC, develop and implement a detailed spill response plan throughout all Designated Project phases. Containment methods, locations and strategies set out in the plan shall be designed and implemented in a manner that will enable spill mitigation to be deployed in time to prevent downstream effects. [based on CEAA 13.3, LIC-165 (Rec #27)]
	MIT-H-19	Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]
	Monitoring Commitments:	
	MON-G-01	Soil sampling will be undertaken prior to the site preparation and construction phase in order to establish a baseline with which future soil investigation results can be compared. [EAFMP-023]
	MON-R-03	OPG will, in order to confirm the environmental assessment prediction of no adverse effects for members of the public and Indigenous communities from exposure to radiation, add the collection of soil samples within the Site Study Area and Local Study Area during construction to the Radiological Environmental Monitoring Program. [based on CEAA 8.3]
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction

Table 3-1: Geology Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
		and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]
Overburden Groundwater Quality **Overburden Groundwater Transport**	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-G-01	OPG will, during site preparation and construction and to the satisfaction of the CNSC, place a liner under the waste rock management areas to direct leachate to a treatment facility or the stormwater management pond. [based on CEAA 11.2]
	MIT-H-02	OPG will, during site preparation and construction and to the satisfaction of the CNSC, place a liner under the stormwater management pond. [based on CEAA 11.1]
	MIT-H-08	The shaft liner is designed with the objective to operate as a dry facility, with little to no seepage through the shaft lining *[to avoid the groundwater inflow following construction]*, and therefore less water to manage in the stormwater management system. [based on EIS, Table 13-1 (OPG 2011a)]
	MIT-G-06	Prior to establishing the shaft collars and the start of shaft sinking, the upper 180 m of bedrock around each shaft will be treated by either ground freezing or grouting (refer to *[OPG's response to]* IR-LPSC-01-31 *[OPG 2012a]*). [IRC-EIS-01.03]
	MIT-G-07	In the event of such *[a malfunction or accident]*, follow-up monitoring *[related to overburden groundwater quality]* may include a number of activities, including monitoring well installation, periodic groundwater quality monitoring, and, if necessary, groundwater remediation. The purpose of these activities would be to ensure compliance with the prevailing regulatory standards, which are currently the MOE Table 3 SCS *[Site Condition Standards]*. If non-compliant, determine additional mitigation required to be compliant, as required under Ontario Environmental Protection Act. [EA-213, H-23-12]
	MIT-H-19	Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]
	Monitoring Commitments:	
	MON-G-02	Groundwater quality and flow monitoring will be conducted prior to and during site preparation and construction and operations to establish a baseline*, [to confirm the assumptions made in the EA, and to confirm that there are no adverse effects during the site preparation and construction, and operations phases as a result of the Waste Rock Management Area (WRMA), the Stormwater Management Pond (SWMP) and shaft excavation and dewatering]*. [EAFMP-012 and Section 3 of NWMO (2011a)]
	MON-G-03	The overburden groundwater transport will be monitored to confirm EA predictions of no measurable change in groundwater levels beyond the Site Study Area. [based on EA-218, EA-161, also in EIS, Table 13-1 (OPG 2011a)]
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]
Shallow	**Likely Environmental Effects with Mitigation:**	

Table 3-1: Geology Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
Bedrock Groundwater Quality **Shallow Bedrock Groundwater and Solute Transport**	• No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-G-01	OPG will, during site preparation and construction and to the satisfaction of the CNSC, place a liner under the waste rock management areas to direct leachate to a treatment facility or the stormwater management pond. [based on CEAA 11.2]
	MIT-H-02	OPG will, during site preparation and construction and to the satisfaction of the CNSC, place a liner under the stormwater management pond. [based on CEAA 11.1]
	MIT-H-08	The shaft liner is designed with the objective to operate as a dry facility, with little to no seepage through the shaft lining *[to avoid the groundwater inflow following construction]*, and therefore less water to manage in the stormwater management system. [based on EIS, Table 13-1 (OPG 2011a)]
	MIT-G-06	Prior to establishing the shaft collars and the start of shaft sinking, the upper 180 m of bedrock around each shaft will be treated by either ground freezing or grouting (refer to *[OPG's response to]* IR-LPSC-01-31 *[OPG 2012a]*). [IRC-EIS-01.03]
	MIT-G-08	OPG will, prior to site preparation and to the satisfaction of the CNSC, use information from existing and planned groundwater monitoring wells to verify the zone of influence from dewatering during excavation and construction. OPG will use the results to inform the final design of shaft excavation procedures and infrastructure, including mitigation of groundwater inflow from surficial and shallow bedrock groundwater zones. [based on CEAA 11.4, LIC-165 (Rec #10)]
	MIT-G-09	OPG will, to the satisfaction of the CNSC, implement a follow-up program for groundwater quality and groundwater inflow rates into the shafts and repository. If groundwater inflows exceed predicted values or if the zone of influence is larger than expected, OPG will implement mitigation measures to either reduce groundwater inflow or the zone of influence. If groundwater loadings and/or concentrations of contaminants of concern exceed environmental assessment predictions, OPG will implement mitigation measures to avoid adverse effects to surface water quality, to the satisfaction of the CNSC. [based on CEAA 11.5]
	MIT-H-19	Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]
	Monitoring Commitments:	
	MON-G-04	The shallow bedrock groundwater and solute transport will be monitored to confirm predictions of the Geosynthesis program. [based on EA-219, EA-162, EA-217]
	MON-G-05	The shallow bedrock groundwater quality will be monitored to confirm predictions of the Geosynthesis program. [based on EA-219, EA-162, EA-217; also in EIS, Table 13-1 (OPG 2011a)]
	MON-G-06	OPG will, prior to site preparation and to the satisfaction of the CNSC, update the hydrogeologic properties of the till cover in the water balance and surface water/groundwater interaction numerical models and undertake further updates to the models as more data become available. [based on CEAA 11.6]
	MON-G-07	Monitoring wells have been established as part of the Geoscientific Site Characterization Program and monitoring will continue during construction and operation of the DGR. [EA-011]
	MON-R-04	OPG will, prior to shaft sinking and to the satisfaction of the CNSC, enhance its capability to detect and monitor the movement of the tritium plume originating from the Western Waste Management Facility by adding an adequate number of

Table 3-1: Geology Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
		monitoring wells up-gradient of the DGR shafts. [based on CEAA 11.7]
	MON-R-05	OPG will, to the satisfaction of the CNSC, conduct a comprehensive assessment of the migration of the tritium plume originating from the Western Waste Management Facility site. The assessment shall include updated modelling of the tritium plume migration. If groundwater modelling or monitoring indicates that the tritium plume may reach the shaft before the shaft collars are installed, OPG will prepare a contingency plan, to the satisfaction of the CNSC, and implement that plan as required. [based on CEAA 11.8]
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]
Intermediate Bedrock Water Quality **Intermediate Bedrock Solute Transport** **Deep Bedrock Water Quality** **Deep Bedrock Solute Transport**	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-H-08	The shaft liner is designed with the objective to operate as a dry facility, with little to no seepage through the shaft lining *[to avoid the groundwater inflow following construction]*, and therefore less water to manage in the stormwater management system. [based on EIS, Table 13-1 (OPG 2011a)]
	MIT-H-19	Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]
	Monitoring Commitments:	
	MON-G-08	The following will be monitored to confirm predictions of the Geosynthesis program [based on EA-219, EA-162, EA-217; also in EIS, Table 13-1 (OPG 2011a)]: • Intermediate bedrock quality • Intermediate bedrock solute transport • Deep bedrock water quality • Deep bedrock solute transport
	MON-G-09	Details of the testing and investigations commitments, confirming that the geologic/hydrogeologic setting underneath the Bruce nuclear site, are provided in the Geoscientific Verification Plan (GVP).
	MON-G-10	OPG will, prior to operations and to the satisfaction of the CNSC, augment the Geoscientific Verification Plan to provide additional gas generation modelling for the decommissioned DGR and to include modelling of gas generation from decommissioning waste in a manner that will ensure there will be timely information available for the design and implementation of the mitigation measures associated with reduction of gas generation. [based on CEAA 14.3]
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

Table 3-2: Hydrology and Surface Water Quality Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
(Additional details for each commitment below are provided in Table A2.)		
Surface Water Quantity and Flow	**Likely Environmental Effects with Mitigation:** • Residual adverse effects during site preparation and construction, operations, and decommissioning: – Reduction in surface water quantity and flow in the existing North Railway Ditch prior to the confluence with Stream C (31%) [Note: No effect on Stream C (-0.8%)] – Increase in surface water quantity and flow in the existing drainage ditch at Interconnecting Road (114% during the site preparation and construction phase and 61% during the operations phase)	
	Mitigation Commitments:	
	MIT-H-01	OPG will, during all preclosure phases and to the satisfaction of the CNSC, establish and maintain a stormwater management system, including a stormwater management pond, to collect all discharge from the waste rock management area and runoff from the Project site, and to manage water quality downstream of the Project site. [based on CEAA 3.1]
	MIT-H-02	OPG will, during site preparation and construction and to the satisfaction of the CNSC, place a liner under the stormwater management pond. [based on CEAA 11.1]
	MIT-H-03	OPG will, over the life of the project and to the satisfaction of the CNSC and in order to support the design of the stormwater management system, calibrate and verify hydrological and water quality models with new information as it becomes available, including but not limited to, leachate geochemistry and flow rates. The models should be calibrated and verified prior to site preparation, at the end of construction, and periodically during operations and decommissioning and be used to support the design and operation of the stormwater management system. [based on CEAA 3.5]
	MIT-H-04	OPG will, to the satisfaction of the CNSC, review and, if necessary, revise the design of the stormwater management system, based on an assessment of the likelihood of significant changes in the return period and magnitude of major storm events. [based on CEAA 3.6, H-14-02, IRC-EIS-04.09, LIC-165 (Rec #14)]
	MIT-H-05	OPG will, prior to construction, develop and regularly update, to the satisfaction of the CNSC, a climate change strategy that [based on CEAA 14.1]: *[CEAA]* 14.1.1. incorporates the results of up-to-date climate change models; *[CEAA]* 14.1.2. analyses how the environment may affect the Designated Project; and *[CEAA]* 14.1.3. identifies any changes to project implementation or mitigation required in light of those analyses.
	MIT-H-06	OPG will, to the satisfaction of the CNSC, use the results of the climate change strategy to inform the understanding of probable maximum precipitation events and, if required, adjust design elements including the storm water management system. [based on CEAA 14.2, LIC-138, LIC-165 (Rec #28)]
	MIT-H-07	OPG will, prior to construction and to the satisfaction of the CNSC, submit a management plan that provides a detailed description of the options available to increase the capacity of the drainage ditch at Interconnecting Road in the event the flow exceeds the capacity of the ditch, in order to avoid adverse effects on nearshore habitat in MacPherson Bay. The plan shall identify the relative potential effects of each of the options on the ecology of MacPherson Bay, and consider the relative effects when selecting and implementing the preferred option. [based on CEAA 4.5]

Table 3-2: Hydrology and Surface Water Quality Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
	MIT-H-08	The shaft liner is designed with the objective to operate as a dry facility, with little to no seepage through the shaft lining *[to avoid the groundwater inflow following construction]*, and therefore less water to manage in the stormwater management system. [based on EIS, Table 13-1 (OPG 2011a)]
	MIT-H-09	OPG will, before the stormwater management system is fully functional and to the satisfaction of the CNSC, prepare a contingency plan to mitigate effects of severe storm-related uncontrolled overland flow to Stream C, Baie de Doré, and MacPherson Bay during site preparation. [based on CEAA 3.7]
	MIT-H-10	OPG will, during site preparation and to the satisfaction of the CNSC, develop and implement a follow-up program for flow reduction rates in the North Railway Ditch and Stream C that includes the identification of mitigation measures that shall be implemented, if necessary, to address adverse effects on surface water quantity. [based on CEAA 4.3, LIC-165 (Rec #9)]
	MIT-H-11	OPG will, prior to beginning construction of the stormwater management system and to the satisfaction of the CNSC, verify that the overburden stratigraphy at the site is the same as predicted in the EIS. If unexpected, higher permeability, stratigraphy is encountered, OPG will assess the potential effect on water levels in the northeast marsh and evaluate and implement mitigation options to the satisfaction of the CNSC. [based on CEAA 9.6, LIC-165 (Rec #35)]
	MIT-H-19	Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]
	Monitoring Commitments:	
	MON-H-01	The stormwater management pond discharge volume will be measured weekly, averaged monthly and recorded as part of the conventional regulatory monitoring program. The flow rates will be recorded and compared with the predicted increase in flow in the drainage ditch at Interconnecting Road calculated in the Hydrology and Surface Water Quality TSD. [EAFMP-009]
	MON-H-02	Quarterly (seasonal) flow monitoring of the North Railway Ditch will be conducted at the south eastern Project Area boundary *[to ensure that there are no significant changes to stream flow at Stream C as a result of the project]*. Flow will also be measured during or immediately following two major storm events each year to confirm that the effect of reduced flow in the North Railway Ditch is not significant. *[Baseline]* flow data will be collected for one year prior to the start of site preparation and construction, and *[follow-up monitoring data will be collected]* for a minimum of three years after the start of site preparation and construction *[to confirm the assumptions made in the EA]*. [based on EAFMP-011, IRC-EIS-07.16, IRC-EIS-09.46, LIC-165 (Rec #9)]
	MON-H-03	OPG will, to the satisfaction of the CNSC, implement a follow-up program to monitor water levels in the northeast marsh: *[CEAA]* 9.5.1. monthly for a period of one year prior to site preparation and construction to establish baseline levels; and *[CEAA]* 9.5.2. weekly during the site preparation and construction phase. [based on CEAA 9.5, IRC-EIS-09.17, IRC-EIS-10.11, LIC-165 (Rec #37.1)]
	MON-H-04	Groundwater levels will be monitored in the shallow groundwater well closest to the marsh to determine water table fluctuations. [EAFMP-030]
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

Table 3-2: Hydrology and Surface Water Quality Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
Surface Water Quality	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-H-12	The DGR Project will not discharge to the North and South Railway Ditches, Stream C or Baie du Doré. [IRC-EIS-07.12, EA-115, EA-262, IRC-EIS-01.11, IRC-EIS-07.10, IRC-EIS-07.11, IRC-EIS-07.15, IRC-EIS-07.17, IRC-EIS-07.20, IRC-EIS-07.21, IRC-EIS-07.24, IRC-EIS-07.26, IRC-EIS-12.16, and in EIS, Table 13-1 (OPG 2011a)]
	MIT-H-13	All stormwater runoff from the DGR Project site, including the WRMA, will be collected in drainage ditches that flow into the stormwater management pond. The key design features to control contaminant concentrations in the stormwater discharge include: • all surface water (including the shaft sump discharge) from the site will drain to the SWMP via a perimeter ditch system for a single point of discharge from the site; • vegetated perimeter ditches for the DGR site to control sediment loading; • SWMP design will control sediment and suspended solids; • an oil/water separator (e.g., stormceptor) will control hydrocarbon releases, Total Suspended Solids (TSS), and metals associated with TSS; • SWMP discharge is conveyed through approximately 1 km of vegetated drainage ditch prior to discharge to MacPherson Bay. [based on EIS, Table 13-1 (OPG 2011a) and IRC-EIS-05.09, EA-112, H-24-36, IRC-EIS-04.17, IRC-EIS-05.07, IRC-EIS-05.34, IRC-EIS-07.13, IRC-EIS-08.39, IRC-EIS-12.17, IRC-EIS-12.15]
	MIT-H-14	OPG will, prior to construction, submit to the CNSC a plan for treatment of all water destined for discharge from the stormwater management pond. OPG will, throughout construction, operations and decommissioning and to the satisfaction of the CNSC, treat stormwater management pond releases to ensure compliance with section 36 of the *Fisheries Act*. [based on CEAA 3.2, LIC-165 (Rec #25)]
	MIT-H-15	Water sampling and testing is proposed to confirm that all water released from the DGR Project site via the stormwater management pond has concentration levels below certificate of approval discharge criteria. [EIS, Table 13-1 (OPG 2011a), EA-097, IRC-LPSC-04.40]
	MIT-H-16	Flow from the SWMP can be stopped if criteria are not met. [EIS, Table 13-1 (OPG 2011a)]
	MIT-H-17	OPG will maintain the drainage network and the SWMP on the DGR site and the drainage system downstream on the Bruce nuclear site. [based on IRC-EIS-04.19]
	MIT-H-18	OPG will, prior to site preparation and to the satisfaction of the CNSC, develop and implement a detailed spill response plan throughout all Designated Project phases. Containment methods, locations and strategies set out in the plan shall be designed and implemented in a manner that will enable spill mitigation to be deployed in time to prevent downstream effects. [based on CEAA 13.3, LIC-165 (Rec #27)]
	MIT-H-19	Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]
	Monitoring Commitments:	
	MON-H-05	OPG will, prior to construction and to the satisfaction of the CNSC, improve the characterization of the leachate that will be generated by the waste rock piles, by

Table 3-2: Hydrology and Surface Water Quality Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
		performing kinetic leach tests on existing dolostone, shale and limestone core samples. During shaft excavation OPG will conduct field cell studies on the material being deposited in the dolostone, shale and limestone waste rock piles to verify leachate compositions and the acid generation potential under prevailing conditions. [based on CEAA 12.1, LIC-165 (Rec #33, Rec #64)]
	MON-H-06	OPG will, prior to construction and to the satisfaction of the CNSC, submit a waste rock characterization program for the duration of construction that will include sampling of full-strength leachates to examine contaminants of concern other than those linked to acid generating potential (including, but not limited to metals and metalloids released under alkaline conditions, total dissolved solids and hydrocarbons). [based on CEAA 12.2, LIC-165 (Rec #24, Rec #32, Rec #33)]
	MON-H-07	OPG will, prior to construction and to the satisfaction of the CNSC, develop a waste rock follow-up program which shall be implemented throughout all preclosure phases of the Designated Project and will, based on sampling of full strength leachates, include monitoring the quantity and quality of leachate and surface runoff directed to the stormwater management system. [based on CEAA 12.3]
	MON-H-08	OPG will, during all preclosure phases and to the satisfaction of the CNSC, monitor concentrations of contaminants and conduct acute and chronic toxicity tests on the discharge from the stormwater management pond. During the initial period of operation, the monitoring and testing shall be undertaken prior to any release of water from the pond. Once there is an established baseline, and with the concurrence of the CNSC, OPG will establish action levels and monitoring frequencies that would allow the pond to operate in a normal continuous discharge mode as long as the relevant parameters remained below the action levels. [based on OPG proposed revised wording to CEAA 3.3]
	MON-H-09	OPG will, during all preclosure phases and to the satisfaction of the CNSC, implement a follow-up program to monitor a broad spectrum of parameters (e.g., metals, phosphate, total petroleum hydrocarbons) quarterly at the point of discharge of the storm water management pond. [based on CEAA 3.4, LIC-165 (Rec #30)]
	MON-H-10	Regular scheduled monitoring (weekly inspection during construction of rail bed crossing) of the both the silt management fence and temporary construction fencing is planned to prevent fence failure through the identification of damage and direct repairs or replacement. [based on IRC-EIS-08.16, EA-039, EA-267, IRC-EIS-05.32, IRC-EIS-08.13, IRC-EIS-09.36]
	MON-H-11	OPG will, prior to site preparation and to the satisfaction of the CNSC, develop and implement a follow-up program for aquatic life in the stormwater management system and the ditch at Interconnecting Road. The program shall include the collection of water quality and sediment quality data and the conduct of a risk assessment for fish, fish habitat and aquatic birds based on those data. [based on CEAA 4.4]
	MON-H-12	OPG will, to the satisfaction of the CNSC, implement a follow-up monitoring program during site preparation and construction and operations to determine the effectiveness of the stormwater management system in mitigating water quality impacts in MacPherson Bay. The follow-up program shall include: *[CEAA]* 4.6.1 conducting an effluent dispersion study in MacPherson Bay after commissioning of the stormwater management pond as support for the design for the follow-up monitoring program; *[CEAA]* 4.6.2 collecting baseline data for all follow-up monitoring indicators prior to site preparation, including the collection of additional baseline sediment quality data in MacPherson Bay; and *[CEAA]* 4.6.3 examining water quality, sediment quality, benthic invertebrate

Table 3-2: Hydrology and Surface Water Quality Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
		community indicators, and caged bivalve studies at determined sampling locations and frequencies. [based on CEAA 4.6, LIC-165 (Rec #8, Rec #13)]
	MON-H-13	OPG will, during construction and operations and to the satisfaction of the CNSC, conduct a sediment quality follow-up program in MacPherson Bay. Prior to construction, OPG will collect additional baseline sediment quality data at the ditch at Interconnecting Road and MacPherson Bay. [based on CEAA 4.7, LIC-165 (Rec #8)]
	MON-H-14	Certificates of Approval *[water]* will be obtained as required for the DGR. OPG will monitor environmental releases in accordance with these Certificates of Approval and report the results as required. [EA-097, IRC-LPSC-04.30]
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

Table 3-3: Terrestrial Environment Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
(Additional details for each commitment below are provided in Table A3.)		
Eastern White Cedar **Other Plants (Heal-all, Common Cattail)**	**Likely Environmental Effects with Mitigation:** • Residual adverse effect during site preparation and construction: – Loss of eastern white cedar caused by the removal of 8.9 ha of mixed woods • No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-T-01	The DGR Project will avoid disturbance of the marsh area, and no vegetation within the marsh area will be cleared. [IRC-EIS-01.12]
	MIT-T-02	Exclusionary fencing to prevent additional loss *[beyond that which cannot be avoided]* during construction surrounding the DGR Project site will be installed. Temporary construction fencing to protect vegetation will help prevent incidental damage and soil compaction within driplines and along vegetation community edges caused by equipment and workers encroaching into areas proposed for protection within the Site Study Area. [based on IRC-EIS-08.15, IRC-EIS-01.13, IRC-EIS-01.15, IRC-EIS-12.07, EA-266, H-17-16, H-24-33, H-24-40]
	MIT-T-03	The project will minimize the disturbance to the natural vegetation on the site in the areas not identified for buildings, access, equipment/materials storage and waste rock storage. [based on IRC-EIS-09.39]
	MIT-T-04	Where required, trees will be felled, skidded and piled in the cut area, and if salvageable, chipped and reused for landscaping on the DGR Project site or elsewhere on the Bruce nuclear site. [EA-033]
	MIT-T-05	Rehabilitation and re-vegetation plans will be considered as part of OPG's biodiversity program. [based on EIS, Table 13-1 (OPG 2011a), and H-32-01]
	MIT-H-19	Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]
	Monitoring Commitments:	
	MON-T-01	OPG will, prior to site preparation and to the satisfaction of the CNSC, develop a follow-up program to monitor any changes to cattail and other aquatic plant habitat within the stormwater system, including the stormwater management pond. Baseline conditions shall be established prior to habitat disturbance, and follow-up monitoring shall take place following the disturbance of habitat during all preclosure phases. OPG will address any adverse change in these plant communities that, in turn, may adversely affect significant species, such as amphibians and reptiles, in accordance with the *Species at Risk Act*. [based on CEAA 10.1]
	MON-T-02	OPG will, prior to construction and to the satisfaction of the CNSC, develop a follow-up program to monitor the naturalization of disturbed areas during construction and operations. If monitoring indicates the presence of invasive plant species and noxious weeds, OPG will implement appropriate mitigation measures. [based on CEAA 10.3]
	MON-T-03	OPG will, during site preparation and construction and to the satisfaction of the CNSC, monitor for indications of potential effects on plants as a result of changes in air quality caused by the Designated Project in the Project Area and the Site Study Area. [based on CEAA 10.4]
	MON-T-04	OPG will, prior to site preparation and to the satisfaction of the CNSC, confirm the absence of significant plant species in the Project Area. If significant species are located, OPG will, following consultation with appropriate regulatory agencies and the CNSC, take action to avoid or mitigate the potential loss. [based on CEAA 10.5]

Table 3-3: Terrestrial Environment Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
	MON-T-05	The plant species and communities adjacent to areas which have been cleared during site preparation and construction will be monitored. [based on EIS, Table 13-1 (OPG 2011a)]
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]
Northern Short-tailed Shrew **Muskrat** **White-tailed Deer**	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified	
	Mitigation Commitments:	
	N/A	None identified [EIS, Table 13-1 (OPG 2011a)]
	Monitoring Commitments:	
	MON-T-06	The wildlife habitat use in adjacent areas to those that are cleared during the site preparation and construction phase will be monitored. [based on EIS, Table 13-1 (OPG 2011a)]
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]
Midland Painted Turtle **Northern Leopard Frog**	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-T-01	The DGR Project will avoid disturbance of the marsh area, and no vegetation within the marsh area will be cleared. [IRC-EIS-01.12]
	MIT-T-06	OPG will, prior to site preparation and to the satisfaction of the CNSC, install barriers to prevent turtles and snakes from entering the DGR Project site. The barriers will include, at minimum, the installation of exclusion fencing along the southern and eastern edges of the Project site and shall be maintained throughout site preparation and construction. [based on CEAA 9.1, LIC-165 (OPG's response to Rec #52)]
	MIT-T-07	OPG will, to the satisfaction of the CNSC, implement measures to avoid adverse effects to snapping turtles and other turtle species at risk, including: *[CEAA]* 9.2.1 conducting turtle surveys of "Wetland 3" throughout the years prior to its infilling. A qualified individual experienced in turtle surveys should conduct a minimum of three surveys per year on sunny days, beginning as soon as the ice cover has melted. The third survey should occur no later than mid-June. [based on OPG proposed revised wording to CEAA 9.2, LIC-165 (OPG's response to Rec #46, OPG's response to #48)] *[CEAA]* 9.2.2. relocating snapping turtles from "Wetland 3" to the northeast marsh prior to the infilling of "Wetland 3. [based on OPG proposed revised wording to CEAA 9.2, LIC-165 (Rec #49)]
	MIT-T-08	OPG will, during and after the re-routing of the drainage ditch and to the satisfaction of the CNSC, maintain water levels in the northeast marsh at appropriate levels to protect snapping turtle habitat. [based on CEAA 9.4, LIC-165 (OPG's response to Rec #47)]

Table 3-3: Terrestrial Environment Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
	MIT-T-09	OPG will develop and implement a management plan to the satisfaction of the CNSC, to ensure its activities do not disrupt eastern ribbonsnake or eastern milksnake individuals, their eggs, gestation sites, hibernacula or habitat during site preparation and construction. [based on CEAA 9.3, LIC-165 (Rec #51)]
	MIT-T-10	Should a rare or endangered species or its critical habitat be encountered during site preparation and construction, appropriate measures will be implemented to avoid destruction, injury or interference with the species, its residence and/or its habitat (e.g., through siting, timing or design changes). If the foregoing cannot be avoided, work will cease and the local Ontario Ministry of Natural Resources and Forestry (MNRF) office will be contacted for advice regarding mitigation measures. [EAFMP-057]
	MIT-T-11	OPG will maintain an awareness of newly listed at-risk species that may potentially use the site, and include them in management programs. [H-10-01, H-24-14]
	MIT-H-19	Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]
	Monitoring Commitments:	
	MON-T-07	OPG will, prior to construction and to the satisfaction of the CNSC, submit a follow-up program to monitor the use of the SWMP and drainage ditch system by amphibians, birds, invertebrates and small-bodied fish. The program shall contain mitigation measures to be taken, should concentrations of total dissolved solids in the storm water management system be observed at levels with the potential to affect sensitive plant or animal species. [based on OPG proposed revised wording to CEAA 10.2]
	MON-T-08	Regular inspections will be scheduled to monitor for the effectiveness of the exclusion fencing.
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]
Mallard **Red-eyed Vireo** **Wild Turkey** **Yellow Warbler** **Bald Eagle**	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-T-10	Should a rare or endangered species or its critical habitat be encountered during site preparation and construction, appropriate measures will be implemented to avoid destruction, injury or interference with the species, its residence and/or its habitat (e.g., through siting, timing or design changes). If the foregoing cannot be avoided, work will cease and the local Ontario Ministry of Natural Resources and Forestry (MNRF) office will be contacted for advice regarding mitigation measures. [EAFMP-057]
	MIT-T-11	OPG will maintain an awareness of newly listed at-risk species that may potentially use the site, and include them in management programs. [H-10-01, H-24-14]
	MIT-T-12	OPG will carry out all preclosure phases of the Project in a manner that protects and avoids harming, killing or disturbing migratory birds or destroying or taking their nests or eggs. In this regard, OPG will take into account Environment Canada's Avoidance Guidelines. OPG's actions in applying the Avoidance Guidelines, will be in compliance with the Migratory Birds Convention Act, 1994 and with the Species at Risk Act. [based on CEAA 5.1]
	MIT-H-19	Operational programs and procedures are developed to protect the environment,

Table 3-3: Terrestrial Environment Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
		and health and safety of the public and the workers. [based on EA-056, H-16-02]
	Monitoring Commitments:	
	MON-T-07	OPG will, prior to construction and to the satisfaction of the CNSC, submit a follow-up program to monitor the use of the SWMP and drainage ditch system by amphibians, birds, invertebrates and small-bodied fish. The program shall contain mitigation measures to be taken, should concentrations of total dissolved solids in the storm water management system be observed at levels with the potential to affect sensitive plant or animal species. [based on OPG proposed revised wording to CEAA 10.2]
	MON-T-09	OPG will, prior to site preparation and to the satisfaction of the CNSC, develop and implement a follow-up program to monitor and assess the effectiveness of the mitigation measures used to avoid harm to migratory birds, their eggs and nests. This monitoring will be conducted throughout all preclosure phases. [based on CEAA 5.2]

Table 3-4: Aquatic Environment Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
(Additional details for each commitment below are provided in Table A4.)		
Redbelly Dace **Creek Chub** **Burrowing Crayfish** **Benthic Invertebrates** **Variable-Leaf Pondweed**	**Likely Environmental Effects with Mitigation:** • Residual adverse effect during site preparation and construction: – Removal of burrowing crayfish habitat present in the North Railway Ditch, other drainage ditches and ephemerally wet low areas during site preparation activities – A portion of non-critical habitat is removed in the South Railway Ditch during construction of the rail bed crossing	
	Mitigation Commitments:	
	MIT-W-01	OPG will, during site preparation and construction, implement measures to avoid adverse effects to fish and fish habitat associated with culvert installation at the North and South Railway Ditches, including [based on CEAA 4.1, EA-118, EA-187, and in EIS, Table 13-1 (OPG 2011a)]: *[CEAA]* 4.1.1. embedding culverts below the bed of the South Railway Ditch; *[CEAA]* 4.1.2. isolating and dewatering the culvert site; *[CEAA]* 4.1.3. deploying erosion and sediment control measures; and *[CEAA]* 4.1.4. re-vegetating banks upon completion of construction at the North and South Railway Ditches.
	MIT-W-02	OPG will ensure that in-water works do not occur between July 1 and September 30. [based on CEAA 4.2]
	MIT-W-03	The DGR Project design will avoid the marsh in the northeast portion of the Project Area where there is known crayfish habitat. [based on EIS, Table 13-1 (OPG 2011a)]
	MIT-W-04	Machinery will be operated on land and in a manner that minimizes disturbance to the banks of the South Railway Ditch. Machinery is to arrive on-site in a clean condition and is to be maintained free of fluid leaks. Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water. Keep an emergency spill kit on-site in case of fluid leaks or spills from machinery. [based on EA-120, EA-188, and in EIS Table 13-1 (OPG 2011a)]
	MIT-W-05	Measures will be used to prevent deleterious substances such as new concrete (i.e., it is precast, cured and dried before use near the watercourse), grout, paint and preservatives from entering the watercourse. [based on EA-120, EA-188]
	MIT-W-06	Department of Fisheries and Oceans Canada's Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters set out that "No explosive may be used that produces or is likely to produce, a peak particle velocity greater than 13 mm/s in a spawning bed during egg incubation". If the monitoring program detects exceedances of this peak particle velocity and spawning is observed, a mitigation plan will be prepared outlining additional procedures for protecting fish and their habitat, as described in the guidelines. [based on EA-203, and EAFMP-061]
	MIT-T-10	Should a rare or endangered species or its critical habitat be encountered during site preparation and construction, appropriate measures will be implemented to avoid destruction, injury or interference with the species, its residence and/or its habitat (e.g., through siting, timing or design changes). If the foregoing cannot be avoided, work will cease and the local Ontario Ministry of Natural Resources and Forestry (MNRF) office will be contacted for advice regarding mitigation measures. [EAFMP-057]
	MIT-H-19	Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

Table 3-4: Aquatic Environment Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
	Monitoring Commitments:	
	MON-W-01	The aquatic species EA Follow-up monitoring program will include visual inspections, surface water level monitoring, and groundwater well monitoring. Visual inspections will be conducted to: • Verify re-growth of riparian vegetation in disturbed areas (ditches); • Identify bank stability deficiencies; • Verify the presence of crayfish chimneys in the Project Area; and • Monitor the marsh for confirmation that excavation does not dewater and affect marsh habitat. [based on EAFMP-027, EA-166, EA-168, EA-184, EA-189, EA-191, H-17-15]
	MON-H-03	OPG will, to the satisfaction of the CNSC, implement a follow-up program to monitor water levels in the northeast marsh: *[CEAA]* 9.5.1. monthly for a period of one year prior to site preparation and construction to establish baseline levels; and *[CEAA]* 9.5.2. weekly during the site preparation and construction phase. [based on CEAA 9.5, IRC-EIS-09.17, IRC-EIS-10.11, LIC-165 (Rec #37.1)]
	MON-H-04	Groundwater levels will be monitored in the shallow groundwater well closest to the marsh to determine water table fluctuations. [EAFMP-030]
	MON-T-07	OPG will, prior to construction and to the satisfaction of the CNSC, submit a follow-up program to monitor the use of the SWMP and drainage ditch system by amphibians, birds, invertebrates and small-bodied fish. The program shall contain mitigation measures to be taken, should concentrations of total dissolved solids in the storm water management system be observed at levels with the potential to affect sensitive plant or animal species. [based on OPG proposed revised wording to CEAA 10.2]
Lake Whitefish **Smallmouth Bass** **Spottail Shiner** **Brook Trout**	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-H-12 through MIT-H-18	See the descriptions of the mitigation commitments for the Surface Water Quality VC in Table 3-2, Hydrology and Surface Water Quality Mitigation and Monitoring Commitments.
	MIT-T-10	Should a rare or endangered species or its critical habitat be encountered during site preparation and construction, appropriate measures will be implemented to avoid destruction, injury or interference with the species, its residence and/or its habitat (e.g., through siting, timing or design changes). If the foregoing cannot be avoided, work will cease and the local Ontario Ministry of Natural Resources and Forestry (MNRF) office will be contacted for advice regarding mitigation measures. [EAFMP-057]
	MIT-H-19	Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]
	Monitoring Commitments:	
	MON-W-02	OPG will, prior to site preparation and to the satisfaction of the CNSC, develop a lake whitefish follow-up program which includes provisions to incorporate input from interested stakeholders and the Saugeen Ojibway Nation. The follow-up program will take into consideration the increasing understanding of the role of MacPherson Bay in the ecology of the area, and identify mitigation measures that shall be implemented, if necessary, to protect lake whitefish and lake whitefish nursery

Table 3-4: Aquatic Environment Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
		areas. [based on CEAA 4.8]
	MON-W-03	One time monitoring will be undertaken after construction of drainage ditches and stormwater management pond for bank stability and re-vegetation of new ditches. [based on EIS, Table 13-1 (OPG 2011a)]

Table 3-5: Radiation and Radioactivity Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
(Additional details for each commitment below are provided in Table A5.)		
Humans	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-R-01	The DGR provides long-term isolation and containment. [PSR, Table 14-4]
	MIT-R-02	The DGR design includes mitigation measures to reduce the probability from potential human intrusion [based on OPG response to IR-EIS-06-246 *(OPG 2012h)*]: • Repository is located a nominal 680 m below ground surface below the depth of casual construction excavation or easy drilling. • Repository is placed in a location with low potential for natural resources (minerals, salt, gas). • Repository is located at a depth where there is no potable water (below 170 m from surface).
	MIT-R-03	OPG will, before a licence to operate is issued and to the satisfaction of the CNSC, perform probabilistic calculations for radiation exposures to humans and non-human biota for the Normal Evolution and Disruptive Scenarios. These calculations should supplement the deterministic calculations in the current long-term safety case assessment. [based on CEAA 13.9]
	MIT-R-04	OPG's future modelling for all variant cases of the Disruptive Scenarios shall, to the satisfaction of the CNSC, provide clear and accessible evaluations of the amounts and activities of discharges into Lake Huron via the shallow and intermediate groundwater systems. [based on on CEAA 13.10]
	MIT-R-05	Shielding is incorporated into the DGR design (waste package, Waste Package Receiving Building, Amenities Building) [based on EIS, Table 13-1 (OPG 2011a)] Note: Detailed commitments are provided in Table A5 on: • Waste Package Design • Waste Package Receiving Building Design • Amenities Building Design
	MIT-R-06	End and closure walls are designed to be installed in the underground repository when appropriate.
	MIT-R-07	Zoning is designed to prevent spread of contamination in or around the DGR. [based on EIS, Table 13-1 (OPG 2011a)]
	MIT-R-08	The ventilation system is designed for safe working conditions for the DGR personnel. (radiological hazards)
	MIT-R-09	Emission control measures will be implemented. [based on EIS, Table 13-1 (OPG 2011a)]
	MIT-R-10	Sump and stormwater will be collected and managed. [based on EIS, Table 13-1 (OPG 2011a)]
	MIT-R-11	OPG will, as soon as possible prior to site preparation and to the satisfaction of the CNSC, implement a testing program with respect to post-closure containment of radionuclides and other contaminants that will examine [based on CEAA 13.6]: *[CEAA]* 13.6.1. long term seal performance and seal material behaviour under similar conditions and depths to those that each seal material will experience in the DGR; and

Table 3-5: Radiation and Radioactivity Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
		[CEAA] 13.6.2. consideration of the chemical, hydraulic and physical interaction of the seals with specific rock formations, including the host and cap formations and other formations that may influence the long-term safety case, and the associated excavation damage.
	MIT-R-12	Security measures will be in place.
	MIT-R-13	*[Radiation protection]* operating procedures and training will be implemented. [based on EIS, Table 13-1 (OPG 2011a)]
	MIT-R-14	OPG will, before a licence to operate is issued, finalize and obtain the approval of the CNSC of its Waste Acceptance Criteria, including measures to avoid releases of container contents prior to their emplacement in, and the closure of, the repository panels. [based on CEAA 13.7]
	MIT-R-15	OPG will, before an operating licence is issued and to the satisfaction of the CNSC, review potential thresholds and screening methods for actinides for all waste packages to be emplaced in the DGR. OPG will also, within the same time frame and to the satisfaction of CNSC, develop a contingency plan if needed to ensure wastes with high actinide levels are in appropriate containers. [based on OPG proposed revised wording to CEAA 8.4]
	MIT-R-16	OPG will, before a licence to operate the DGR is issued and to the satisfaction of the CNSC, prepare an inspection protocol for waste containers, beyond visual inspection, that must be followed before their placement in the DGR. The protocol shall include procedures that ensure that container venting mechanisms will remain functional following emplacement in the DGR. [based on CEAA 13.4]
	MIT-R-17	OPG will, starting prior to construction and until the end of operations, investigate and report to the CNSC on a regular basis on the effectiveness of existing and emerging imaging technologies which could be used to detect waste-to-container interactions that may lead to container breaches. If effective non-destructive testing methods become available, subject to the approval of the CNSC, they will be instituted to supplement visual inspections of waste packages. [based on CEAA 13.5]
	MIT-R-18	OPG will, before a licence to operate is issued and to the satisfaction of the CNSC, perform research, and report on, the predicted long-term stability (up to decommissioning) of the solidified active liquid waste sludges and the potential release of liquids when exposed to conditions applicable to the DGR to confirm that no further measures are required to control condensation from, and leakage of, sludges following packaging. [based on CEAA 13.8]
	MIT-R-19	A waste characterization program will be implemented.
	MIT-R-20	OPG will, throughout all preclosure phases, undertake all reasonable measures to prevent accidents and malfunctions that may result in adverse human and/or environmental effects and effectively implement appropriate emergency response procedures and contingencies developed in relation to the Designated Project. [based on CEAA 13.1, EA-148, EA-127, EA-132, EA-152, EA-228, EA-251, LIC-061]
	MIT-R-21	OPG will, before an operating licence is issued and to the satisfaction of the CNSC, develop and implement a detailed plan on how it would mitigate a scenario where intermediate-level waste containers fail in filled chambers while the DGR is still in operation. The plan should evaluate the anticipated exposures to the workforce if the rooms were completely filled, as well as during the period when the retrieval of containers would still be possible via planned access routes. [based on CEAA 8.5]

Table 3-5: Radiation and Radioactivity Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
	MIT-R-22	In the event of an accident or malfunction with the potential to cause adverse environmental effects, OPG will implement measures to minimize any adverse environmental effects associated with the occurrence, in accordance with procedures and protocols established under the CNSC regulations and licencing conditions. [based on CEAA 13.2]
	MIT-R-23	OPG will ensure that a mine rescue plan is prepared and implemented for the DGR Project. In addition, OPG will share DGR Project information with local and regional health and safety service providers about timing and large changes in the magnitude of its on-site labour force and training opportunities applicable to each phase of the DGR Project. [based on EA-251, EA-127, EA-132, EA-148, EA-152, EA-228, LIC-061].
	MIT-R-24	Fire Protection Programs will be developed for the construction phase and for the operations phase of the facility prior to the start of each phase. They will include required elements such as roles and responsibilities, fire response, fire assessments, managing changes that affect fire protection, work practice and procedures, fire planning, inspection and maintenance of fire protection systems, quality assurance, housekeeping, storage and handling of hazardous goods, control of ignition sources, transient material, reporting and drills. [IRC-LPSC-01.47].
	MIT-R-25	Following closure of the repository, institutional controls will be put in place as a safety feature to reduce the likelihood of future human actions that could compromise the repository. [based on LIC-091, LIC-165 (Rec #63)]
	Monitoring Commitments:	
	MON-R-01	OPG will, to the satisfaction of the CNSC, conduct a follow-up program on radiation levels in air, water, soil, sediment, terrestrial and aquatic biota in the Project Area and Local Study Area. [based on CEAA 10.6]
	MON-R-02	OPG will, prior to site preparation and to the satisfaction of the CNSC, develop a follow-up program for radon that includes the establishment of baseline radon levels and ongoing monitoring at locations including within the exhaust air shaft at the surface and near the waste rock management area. Monitoring will continue until the end of operations. [based on CEAA 8.6]
	MON-R-03	OPG will, in order to confirm the environmental assessment prediction of no adverse effects for members of the public and Indigenous communities from exposure to radiation, add the collection of soil samples within the Site Study Area and Local Study Area during construction to the Radiological Environmental Monitoring Program. [based on CEAA 8.3]
	MON-R-04	OPG will, prior to shaft sinking and to the satisfaction of the CNSC, enhance its capability to detect and monitor the movement of the tritium plume originating from the Western Waste Management Facility by adding an adequate number of monitoring wells up-gradient of the DGR shafts. [based on CEAA 11.7]
	MON-R-05	OPG will, to the satisfaction of the CNSC, conduct a comprehensive assessment of the migration of the tritium plume originating from the Western Waste Management Facility site. The assessment shall include updated modelling of the tritium plume migration. If groundwater modelling or monitoring indicates that the tritium plume may reach the shaft before the shaft collars are installed, OPG will prepare a contingency plan, to the satisfaction of the CNSC, and implement that plan as required. [based on CEAA 11.8]
	MON-R-06	OPG will have monitoring programs in place to assure that *[DGR Project]* workers are not exposed to unacceptable doses *[of radiation]*. [EA-010]
	MON-R-07	Plans to monitor waste degradation within the repository will be provided as part of

Table 3-5: Radiation and Radioactivity Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
		submissions supporting the operating licence application. [IRC-EIS-01.23]
	MON-R-08	The need for follow-up monitoring during abandonment will be discussed with the regulator at the time of applying for the Licence to Abandon and will be based on the results of the decommissioning monitoring. If necessary, the follow-up monitoring will be developed using a systematic approach similar to that described in OPG's response to IR-EIS-06-235 *(OPG 2012f)*. [IRC-EIS-06.05]
Non-human Biota	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-R-01 through MIT-R-25	See the descriptions of the mitigation commitments for the Humans VC above.
	MIT-T-06	OPG will, prior to site preparation and to the satisfaction of the CNSC, install barriers to prevent turtles and snakes from entering the DGR Project site. The barriers will include, at minimum, the installation of exclusion fencing along the southern and eastern edges of the Project site and shall be maintained throughout site preparation and construction. [based on CEAA 9.1, LIC-165 (OPG's response to Rec #52)]
	MIT-W-01 through MIT-W-06	See the descriptions of the mitigation commitments in Table 3-4, Aquatic Environment Mitigation and Monitoring Commitments.
	MIT-H-12 through MIT-H-18	See the descriptions of the mitigation commitments for the Surface Water Quality VC in Table 3-2, Hydrology and Surface Water Quality Mitigation and Monitoring Commitments.
	Monitoring Commitments:	
	MON-R-01	OPG will, to the satisfaction of the CNSC, conduct a follow-up program on radiation levels in air, water, soil, sediment, terrestrial and aquatic biota in the Project Area and Local Study Area. [based on CEAA 10.6]
	MON-R-08	The need for follow-up monitoring during abandonment will be discussed with the regulator at the time of applying for the Licence to Abandon and will be based on the results of the decommissioning monitoring. If necessary, the follow-up monitoring will be developed using a systematic approach similar to that described in OPG's response to IR-EIS-06-235 *(OPG 2012f)*. [IRC-EIS-06.05]

Table 3-6: Atmospheric Environment Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
(Additional details for each commitment below are provided in Table A6.)		
Air Quality	**Likely Environmental Effects with Mitigation:** • Residual adverse effect during site preparation and construction, and decommissioning: – Increase in calculated maximum ambient concentrations of 1-hour NO_2, 24-hour NO_2, annual NO_2, 1-hour CO, 24-hour CO, 24-hour SPM, annual SPM, 24-hour PM_{10} and 24-hour $PM_{2.5}$ • No likely adverse effect identified during operations, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-A-01	OPG will, prior to site preparation and to the satisfaction of CNSC, develop a detailed plan to manage air emissions that includes details on the implementation of the identified mitigation measures, frequency of air quality monitoring and site inspections, thresholds for corrective management actions and record keeping. Mitigation measures shall, at minimum, include [based on CEAA 7.1]: *[CEAA]* 7.1.1. the use of construction equipment that will meet, at minimum, Tier 2 emission standards; *[CEAA]* 7.1.2. maintenance of equipment in good working order; *[CEAA]* 7.1.3. watering of roadways for dust suppression; *[CEAA]* 7.1.4. minimization of drop heights of rock and other material; and *[CEAA]* 7.1.5. the use of vehicles meeting the newest emission standards.
	MIT-H-19	Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]
	Monitoring Commitments:	
	MON-A-01	OPG will, during site preparation and construction and to the satisfaction of the CNSC, conduct a monitoring program for nitrogen oxides and particulate matter (PM_{10} and $PM_{2.5}$) with specific consideration given to monitoring any air quality changes that would affect individuals living at or near the critical receptor locations used in the EIS models. [based on CEAA 7.2]
	MON-A-02	Visual inspections for dust emissions will be conducted daily during site preparation and construction, and operations, at the shafts, access roads within the WRMA, and waste rock pile. [EAFMP-035].
	MON-A-03	OPG will, during site preparation and construction and operations and to the satisfaction of the CNSC, conduct a follow-up program to monitor acrolein concentrations at air receptor sites for local residents and for Indigenous communities, defined as AR 1, AR 2, AR 3 and AR 5 in the EIS. [based on CEAA 8.1, LIC-165 (Rec #17)]
	MON-A-04	Certificates of Approval *[air]* will be obtained as required for the DGR. OPG will monitor environmental releases in accordance with these Certificates of Approval and report the results as required. [EA-097, IRC-LPSC-04.30]
	MON-R-01	OPG will, to the satisfaction of the CNSC, conduct a follow-up program on radiation levels in air, water, soil, sediment, terrestrial and aquatic biota in the Project Area and Local Study Area. [based on CEAA 10.6]
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

Table 3-6: Atmospheric Environment Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
Noise Levels	**Likely Environmental Effects with Mitigation:** • Residual adverse effect during site preparation and construction, and decommissioning: – Increase in noise levels at four residences near receptor R2 (Baie du Doré) during the quietest hour • No likely adverse effect identified during operations, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-A-02	On-site vehicles and equipment will be equipped with appropriate silencers *[to control noise]* and maintained in good working order. [EA-123, EA-198, H-09-08, IRC-EIS-09.19, IRC-EIS-09.20, TIS-03-09, H-09-03]
	MIT-A-03	A compact DGR Project site will be maintained. [based on EIS, Table 13-1 (OPG 2011a)]
	MIT-A-04	Noise Screening – Natural vegetation will be retained as much as possible. OPG also plans to plant additional trees for visual screening of the rock pile and these will also provide additional noise screening. Finally, the design of the DGR Project includes the use of low material berms at selected areas along the perimeter of the site. These aspects will collectively assist in reducing off-site noise. [IRC-EIS-09.20, EA-123, EA-198, IRC-EIS-09.19, TIS-03-09, H-09-04, EAFMP-038, EA-014, EA-043, EA-182, IRC-EIS-02.03, IRC-EIS-12.13, TIS-03-08]
	MIT-A-05	Near-surface blasting during only daylight hours – The Project will use best practices for blasting and has already made a commitment to day-time blasting for near surface use. However, this represents a limited amount of blasting as the first 10 to 15 m of the shafts will be opened mechanically (i.e., without explosives). The next 15 to 20 m will be developed using explosives only during daytime hours. Once shaft development is beyond this point, and the headframe is in place, noise effects at off-site receptors due to shaft sinking are not anticipated. Near-surface blasting will not be conducted on Sundays. [IRC-EIS-09.20, H-09-04, EA-123, EA-198, IRC-EIS-09.19, TIS-03-09, EAFMP-038]
	MIT-A-06	Fresh air and return air raise fans will be maintained in good working order *[to control noise]*. [based on EA-124, EA-199, EAFMP-037, and EIS, Table 13-1 (OPG 2011a)]
	MIT-H-19	Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]
	Monitoring Commitments:	
	MON-A-05	OPG will, throughout the preclosure phases of the project and to the satisfaction of the CNSC, implement noise and vibration monitoring at noise receptor sites defined as R1, R2 and R3 in the EIS and at additional monitoring locations identified in consultation with regulatory authorities, Aboriginal groups and permanent and seasonal residents in the Local Study Area. OPG will develop explicit action levels for additional noise mitigation, acceptable to the CNSC, taking into consideration input from Aboriginal groups and permanent and seasonal residents in the Local Study Area. [based on CEAA 8.2]
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

Table 3-6: Atmospheric Environment Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
Vibrations	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-A-05	Near-surface blasting during only daylight hours – The Project will use best practices for blasting and has already made a commitment to day-time blasting for near surface use. However, this represents a limited amount of blasting as the first 10 to 15 m of the shafts will be opened mechanically (i.e., without explosives). The next 15 to 20 m will be developed using explosives only during daytime hours. Once shaft development is beyond this point, and the headframe is in place, noise effects at off-site receptors due to shaft sinking are not anticipated. Near-surface blasting will not be conducted on Sundays. [IRC-EIS-09.20, H-09-04, EA-123, EA-198, IRC-EIS-09.19, TIS-03-09, EAFMP-038]
	MIT-A-07	Explosive weights will be reduced during spawning season, if necessary. [based on EIS, Table 13-1 (OPG 2011a)]
	MIT-H-19	Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]
	Monitoring Commitments:	
	MON-A-05	OPG will, throughout the preclosure phases of the project and to the satisfaction of the CNSC, implement noise and vibration monitoring at noise receptor sites defined as R1, R2 and R3 in the EIS and at additional monitoring locations identified in consultation with regulatory authorities, Aboriginal groups and permanent and seasonal residents in the Local Study Area. OPG will develop explicit action levels for additional noise mitigation, acceptable to the CNSC, taking into consideration input from Aboriginal groups and permanent and seasonal residents in the Local Study Area. [based on CEAA 8.2]
	MON-A-06	Identification of spawning depressions in the North Railway Ditch will be conducted. [based on Table 3a in NWMO (2011a)]
	MON-A-07	A communications program will be implemented to keep neighbours informed of the status of *[the blasting]* activity. [EAFMP-038]
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

Table 3-7: Indigenous Interests Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
(Additional details for each commitment below are provided in Table A7.)		
Indigenous Communities	**Likely Environmental Effects with Mitigation:** • Beneficial effect during site preparation and construction, operations, and decommissioning, as a result of direct, indirect and induced employment opportunities	
	Mitigation Commitments:	
	MIT-I-01	OPG will continue to engage Indigenous organizations on a variety of DGR Project-related opportunities, including employment, business, sponsorship, and contracting. [based on community (non-regulatory) commitments]
	Monitoring Commitments:	
	N/A	None proposed [EIS, Table 13-1 (OPG 2011a)]
Indigenous Heritage Resources	**Likely Environmental Effects with Mitigation:** • Residual adverse effect during site preparation and construction, operations, and decommissioning: – Diminishment of the quality or value of activities undertaken by Indigenous peoples at the Jiibegmegoong burial site located within the Bruce	
	Mitigation Commitments:	
	MIT-I-02	The [*Jiibegmegoong*] burial site itself will not be physically altered by the DGR Project. [IRC-EIS-12.10, IRC-EIS-12.12]
	MIT-I-03	OPG will, in order to mitigate the visual effect of the project, establish a 200 metre buffer area from the Interconnecting Road to the long-term waste rock management area. OPG will provide screening via the construction of berms and/or planting of trees. [based on CEAA 6.2, EA-182, EA-014, EA-043, IRC-EIS-02.03, IRC-EIS-12.13, TIS-03-08, LIC-071 (Section 9.3.3 of PSR), and in EIS, Table 13-1 (OPG 2011a)]
	MIT-A-01	OPG will, prior to site preparation and to the satisfaction of CNSC, develop a detailed plan to manage air emissions that includes details on the implementation of the identified mitigation measures, frequency of air quality monitoring and site inspections, thresholds for corrective management actions and record keeping. Mitigation measures shall, at minimum, include [based on CEAA 7.1]: *[CEAA]* 7.1.1. the use of construction equipment that will meet, at minimum, Tier 2 emission standards; *[CEAA]* 7.1.2. maintenance of equipment in good working order; *[CEAA]* 7.1.3. watering of roadways for dust suppression; *[CEAA]* 7.1.4. minimization of drop heights of rock and other material; and *[CEAA]* 7.1.5. the use of vehicles meeting the newest emission standards.
	MIT-S-10	In the unlikely event that site preparation, construction or decommissioning activities encounter artifacts that could be associated with a cultural or heritage resource, the activities will be curtailed until further assessment (i.e., a Stage 3 and/or 4 archaeological assessments) can be undertaken to protect the resource from further disturbance and conserve its cultural heritage value. [EA-139, EA-256, EAFMP-064, and in EIS, Table 13-1 (OPG 2011a)]
	Monitoring Commitments:	
	MON-A-01	OPG will, during site preparation and construction and to the satisfaction of the CNSC, conduct a monitoring program for nitrogen oxides and particulate matter (PM_{10} and $PM_{2.5}$) with specific consideration given to monitoring any air quality changes that would affect individuals living at or near the critical receptor locations

Table 3-7: Indigenous Interests Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
		used in the EIS models. [based on CEAA 7.2]
	MON-A-02	Visual inspections for dust emissions will be conducted daily during site preparation and construction, and operations, at the shafts, access roads within the WRMA, and waste rock pile. [EAFMP-035].
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]
	MON-S-01	OPG will continue to monitor public attitudes toward the DGR Project. [based on EIS, Table 13-1 (OPG 2011a)]
Traditional Use of Lands and Resources	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-I-02	The [*Jiibegmegoong*] burial site itself will not be physically altered by the DGR Project. [IRC-EIS-12.10, IRC-EIS-12.12]
	MIT-I-04	OPG will ensure that the Saugeen Ojibway Nation have continued access to the Jiibegmegoong burial grounds. [based on CEAA 6.1, EA-183, EA-125, IRC-EIS-12.10, IRC-EIS-12.12]
	Monitoring Commitments:	
	N/A	None proposed [EIS, Table 13-1 (OPG 2011a)]

Table 3-8: Socio-economic Environment Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
(Additional details for each commitment below are provided in Table A8.)		
Human Assets	**Likely Environmental Effects with Mitigation:** • A beneficial effect as a result of increased population associated with DGR Project related employment during all phases of the project • Beneficial effect as a result of increased educational opportunities for local students and others with an interest in nuclear technology through the presence of the DGR Project and the establishment of a centre of energy excellence during all phases of the project	
	Mitigation Commitments:	
	MIT-S-01	OPG will share information with local and regional land use planners and economic development officials as well as local and regional health and safety service providers regarding the timing and magnitude of meaningful changes to its on-site labour and skills requirements for each phase of the DGR Project. [EA-126, EA-249, and in EIS, Table 13-1 (OPG 2011a)] *(community [non-regulatory] commitment)*
	MIT-R-20	OPG will, throughout all preclosure phases, undertake all reasonable measures to prevent accidents and malfunctions that may result in adverse human and/or environmental effects and effectively implement appropriate emergency response procedures and contingencies developed in relation to the Designated Project. [based on CEAA 13.1, EA-148, EA-127, EA-132, EA-152, EA-228, EA-251, LIC-061]
	Monitoring Commitments:	
	MON-S-01	OPG will continue to monitor public attitudes toward the DGR Project. [based on EIS, Table 13-1 (OPG 2011a)]
Physical Assets	**Likely Environmental Effects with Mitigation:** • A very small contributor to the anticipated positive housing growth over the DGR Project life • With respect to transportation infrastructure, no likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-S-02	OPG will review available information respecting rental housing, lodging and tourist accommodations during the construction period in collaboration with planning and economic development officials. [H-20-02, H-20-06] *(community [non-regulatory] commitment)*
	MIT-S-03	The *[property protection plan in the DGR Hosting Agreement]* will be operationalized prior to the licence to operate. [H-20-03] *(community [non-regulatory] commitment)*
	MIT-S-04	A traffic management plan will be developed and implemented to minimize DGR Project related peak hour volumes (e.g., staggering of shifts, encouraging ride sharing and the use of shuttle buses, and off-peak timing of shipments of materials and wastes on and off the DGR Project site). [based on EIS, Table 13-1 (OPG 2011a)]
	Monitoring Commitments:	
	MON-S-01	OPG will continue to monitor public attitudes toward the DGR Project. [based on EIS, Table 13-1 (OPG 2011a)]

Table 3-8: Socio-economic Environment Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
Social Assets	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-S-05	OPG will keep neighbours and the broader public informed concerning DGR Project activities at the Bruce nuclear site, and will continue to make contributions to the community through its Corporate Citizenship Program. [based on EIS, Table 13-1 (OPG 2011a)]
	MIT-S-06	OPG will make the annual report and the executive summary referred to in *[CEAA]* condition 2.5, as well as the implementation schedule referred to in *[CEAA]* condition 15, available on its website upon submission to the CNSC. OPG will, unless otherwise specified by the CNSC, keep these documents available on its website for twenty-five years following the end of operations or until the end of decommissioning of the Designated Project, whichever comes first. [based on CEAA 2.6]
	MIT-S-07	OPG will, where consultation is required [based on CEAA 2.2]: *[CEAA]* 2.2.1 provide written notice of the opportunity for the party or parties to present their views on the subject of the consultation; *[CEAA]* 2.2.2 provide sufficient information and a reasonable period of time to permit the party or parties to prepare their views; and *[CEAA]* 2.2.3 provide a full and impartial consideration of any views presented.
	MIT-S-08	OPG will, where consultation with Indigenous communities is a requirement of the conditions set out in this *[CEAA 2015]* document, first consult each Indigenous group on the most appropriate manner to conduct the consultation. [based on CEAA 2.3]
	MIT-S-09	OPG will continue to work with various stakeholders to deliver its community, recreational and educational initiatives. [based on EIS, Table 13-1 (OPG 2011a)]
	MIT-S-10	In the unlikely event that site preparation, construction or decommissioning activities encounter artifacts that could be associated with a cultural or heritage resource, the activities will be curtailed until further assessment (i.e., a Stage 3 and/or 4 archaeological assessments) can be undertaken to protect the resource from further disturbance and conserve its cultural heritage value. [EA-139, EA-256, EAFMP-064, and in EIS, Table 13-1 (OPG 2011a)]
	Monitoring Commitments:	
	MON-S-01	OPG will continue to monitor public attitudes toward the DGR Project. [based on EIS, Table 13-1 (OPG 2011a)]
Financial Assets	**Likely Environmental Effects with Mitigation:** • Beneficial effects are anticipated during all phases of the project, as follows: – A beneficial effect as a result of new direct, indirect and induced employment opportunities – A positive effect on business activity is anticipated – A beneficial effect as a result of increased municipal revenue – A beneficial effect identified as a result of a substantial amount of direct, indirect and induced income in the Local and Regional Study Areas • With respect to agriculture, no likely adverse effects are identified, with mitigation measures in place	

Table 3-8: Socio-economic Environment Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
	Mitigation Commitments:	
	MIT-S-03	The *[property protection plan in the DGR Hosting Agreement]* will be operationalized prior to the licence to operate. [H-20-03] *(community [non-regulatory] commitment)*
	MIT-S-11	Information will be shared with local and regional economic development officials (i.e., the timing and magnitude of meaningful changes to its on-site labour requirements). [based on EIS, Table 13-1 (OPG 2011a)]
	MIT-S-12	Non-salary expenditures will be sourced locally wherever practical and in accordance with relevant supply chain policies, procedures and standards for competitive purchasing. [EIS, Table 13-1 (OPG 2011a)]
	MIT-S-13	Farmers in the Local Study Area along the transportation route should be informed if and when oversize or slow-moving project-related vehicles will be on local or municipal area roads during the planting or harvesting season [EIS, Table 13-1 (OPG 2011a), EA-253] *(community [non-regulatory] commitment)*
	Monitoring Commitments:	
	MON-S-01	OPG will continue to monitor public attitudes toward the DGR Project. [based on EIS, Table 13-1 (OPG 2011a)]
Natural Assets	**Likely Environmental Effects with Mitigation:** • Residual adverse effect during site preparation and construction, and decommissioning: – Increase in noise levels at four residences near receptor R2 (Baie du Doré) during the quietest hour • No likely adverse effect identified during operations, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-A-02 through MIT-A-06	See the descriptions of the mitigation commitments for the Noise Levels VC in Table 3-6, Atmospheric Environment Mitigation and Monitoring Commitments.
	Monitoring Commitments:	
	MON-S-01	OPG will continue to monitor public attitudes toward the DGR Project. [based on EIS, Table 13-1 (OPG 2011a)]
	MON-S-02	OPG will, prior to site preparation and to the satisfaction of the CNSC, develop a dust and noise follow-up program to examine social and economic effects of offsite dust and noise levels due to the Designated Project. [based on CEAA 8.7]
	MON-A-05	OPG will, throughout the preclosure phases of the project and to the satisfaction of the CNSC, implement noise and vibration monitoring at noise receptor sites defined as R1, R2 and R3 in the EIS and at additional monitoring locations identified in consultation with regulatory authorities, Aboriginal groups and permanent and seasonal residents in the Local Study Area. OPG will develop explicit action levels for additional noise mitigation, acceptable to the CNSC, taking into consideration input from Aboriginal groups and permanent and seasonal residents in the Local Study Area. [based on CEAA 8.2]
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

Table 3-9: Human Health Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
(Additional details for each commitment below are provided in Table A9.)		
Overall Health of Local Residents **Overall Health of Members of Indigenous Communities** **Overall Health of Seasonal Users**	**Likely Environmental Effects with Mitigation:** • Residual adverse effect during the site preparation and construction phase: – Effect to the overall health for local resident and member of Indigenous communities resulting from exposure to acrolein in air	
	Mitigation Commitments:	
	MIT-A-01	OPG will, prior to site preparation and to the satisfaction of CNSC, develop a detailed plan to manage air emissions that includes details on the implementation of the identified mitigation measures, frequency of air quality monitoring and site inspections, thresholds for corrective management actions and record keeping. Mitigation measures shall, at minimum, include [based on CEAA 7.1]: *[CEAA]* 7.1.1. the use of construction equipment that will meet, at minimum, Tier 2 emission standards; *[CEAA]* 7.1.2. maintenance of equipment in good working order; *[CEAA]* 7.1.3. watering of roadways for dust suppression; *[CEAA]* 7.1.4. minimization of drop heights of rock and other material; and *[CEAA]* 7.1.5. the use of vehicles meeting the newest emission standards.
	MIT-A-02 through MIT-A-06	See the descriptions of the mitigation commitments for the atmospheric environment VCs in Table 3-6, Atmospheric Environment Mitigation and Monitoring Commitments.
	MIT-H-19	Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]
	Monitoring Commitments:	
	MON-A-03	OPG will, during site preparation and construction and operations and to the satisfaction of the CNSC, conduct a follow-up program to monitor acrolein concentrations at air receptor sites for local residents and for Indigenous communities, defined as AR 1, AR 2, AR 3 and AR 5 in the EIS. [based on CEAA 8.1, LIC-165 (Rec #17)]
	MON-A-01, MON-A-02, MON-A-05 through MON-A-07	See the descriptions of the monitoring commitments for the atmospheric environment VCs in Table 3-6, Atmospheric Environment Mitigation and Monitoring Commitments.
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]
Health of Workers	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified, with mitigation measures in place	
	Mitigation Commitments:	
	MIT-P-01	The underground repository is designed for mechanical stability (competent rock formation, alignment with in-situ stresses, ground support).
	MIT-P-02	Seismic, severe wind, and lightning protection is incorporated into the DGR design.
	MIT-P-03	The ventilation system is designed for safe working conditions for the DGR personnel. (non-radiological hazards)

Table 3-9: Human Health Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
	MIT-P-04	Fire prevention, detection and protection is incorporated into the DGR design.
	MIT-P-05	Flood protection is incorporated into the DGR design.
	MIT-P-06	Construction of all the emplacement rooms and access tunnels will be carried out prior to, not concurrently with, operations. [LIC-089]
	MIT-P-07	The underground repository design includes refuge stations.
	MIT-P-08	Mitigation and control measures for non-radiological hazards to workers will be implemented as part of the DGR Project. Examples of these measures are provided in Section 8.3.2.4, Effects on Workers, of the EIS [OPG 2011a]. [Note: For each hazardous activity or condition identified in the EIS, recommended detailed control/mitigation measures are listed in EIS, Table C3.9.1-1, Effects on Health of Workers, and Table C3.9.1-2, Effects on Health of Workers related to General Safety Management.]
	MIT-P-09	OPG will meet all regulatory requirements associated with being a licensee, including the following: • take all reasonable precautions to protect the environment and the health and safety of persons; and • take all reasonable precautions to control the release of hazardous substances within the site and into the environment as a result of the licensed activity. [based on H-23-01, LIC-002]
	MIT-P-10	The Explosives and Blasts procedure will be implemented.
	MIT-P-11	The Handling, Storage and Disposal of Hazardous and Liquid Industrial Waste procedure will be implemented.
	MIT-R-12	Security measures will be in place.
	MIT-R-20, MIT-R-23, MIT-R-24	See the descriptions of the mitigation commitments for the emergency management and associated mitigation measures, mine rescue, and fire protection programs in Table 3-5, Radiation and Radioactivity Mitigation and Monitoring Commitments.
	[Note: Mitigation commitments to minimize the radiological exposure of workers are described in commitments MIT-R-01 through MIT-R-25, under the Humans VC in Table 3-5, Radiation and Radioactivity Mitigation and Monitoring Commitments.]	
	Monitoring Commitments:	
	MON-P-01	Air quality of the underground DGR will be monitored under the EMP *[Environmental Management Plan]* to ensure that the health and safety of personnel within the DGR is not compromised during underground construction and operations. [based on EAFMP-033, EA-018, EA-020, EA-100, LIC-036, LIC-037]
	MON-P-02	Monitoring of equipment function (e.g. ventilation system performance, dewatering systems, etc) will be managed through local human-machine interfaces with status of operation provided to the surface control room. [IRC-EIS-05.49]
	MON-P-03	The stack monitor (i.e., surface exhaust air sampling device) will have an alarm which sends a signal back to Control Room if the sampling device has failed (i.e., low air flow). [IRC-LPSC-01.72]
	MON-P-04	The target values for the *[health and safety]* performance indicators indicated in Table 1 *[of OPG response to IR-LPSC-04-66 (OPG 2013a)]* will be reviewed and modified, as necessary, prior to the start of site preparation and construction activities. [IRC-LPSC-04.18]
	MON-H-15	EA follow-up monitoring will be conducted during site preparation and construction

Table 3-9: Human Health Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects	
		and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

Table 3-10: Ecological Features Mitigation and Monitoring Commitments

VC	Mitigation and Monitoring Commitments for Identified Environmental Effects
(Additional details are provided in Table A10.)	
Lake Huron **Stream C** **South Railway Ditch** **Wetland with the Project Area**	**Likely Environmental Effects with Mitigation:** • No likely adverse effects are identified, with mitigation measures in place **Mitigation/Monitoring Commitments:** The ecological feature VCs identified in the EIS for the assessment of combined effects resulting from the DGR project are as follows: 1. Lake Huron 2. Stream C 3. South Railway Ditch 4. Wetland within the Project Area. For each ecological feature VC, their relevant indicator VCs were identified and assessed for their combined effects. The mitigation and monitoring commitments were identified for each relevant indicator VC in previous tables as follows: 1. Lake Huron – the mitigation and monitoring commitments for the relevant indicator VCs are provided in Table 3-1, Table 3-2, Table 3-3, Table 3-4, Table 3-5, Table 3-7, and Table 3-8. 2. Stream C – the mitigation and monitoring commitments for the relevant indicator VCs are provided in Table 3-2, Table 3-3, Table 3-4, and Table 3-5. 3. South Railway Ditch – same commitments as for Stream C. 4. Wetland within the Project Area – the mitigation and monitoring commitments for the relevant indicator VCs are provided in Table 3-1, Table 3-3, Table 3-4, and Table 3-5.

4. OUTDATED COMMITMENTS

The outdated (completed or updated) mitigation and monitoring commitments are provided in Table 4-1. For each commitment, the following are provided:

- the relevant Valued Component associated with the commitment,
- the detailed description of the commitment,
- current status of the commitment, and
- relevant follow-up commitments, if applicable.

Table 4-1: Outdated Mitigation and Monitoring Commitments

VC	Detailed Commitment Description	Status	Follow-up
GEOLOGY			
Shallow Bedrock Groundwater and Solute Transport	Follow-up monitoring of shallow subsurface groundwater flow is dependent on the results of the shaft pilot programs, which are to be established prior to excavation and construction. [EA-207]	**Complete** The site shaft pilot borehole investigation and laboratory testing were completed in 2011 [see OPG response to IR-LPSC-01-05a].	Monitoring of shallow subsurface groundwater flow continues under MON-G-04.
	In 2011, an initial trial was conducted at the proposed location of ventilation shaft to determine the feasibility of a surface-based grouting to a depth of 200 m. The results of this trial were encouraging and demonstrated that surface-based grouting is likely feasible to depths of 200 m. The trial will be continued in 2012 for the purpose of confirming feasibility of surface-based grouting at the DGR project site. [IRC-LPSC-01.93]	**Complete** The deep grouting trial was completed in 2012 and the results from Phase 2 of this trial continue to support feasibility of surface-based grouting as a means of limiting groundwater inflows at the two shafts [see OPG response to IR-LPSC-04-66].	Monitoring of shallow subsurface groundwater flow continues under MON-G-04.
	During the shaft pilot hole investigations and grouting feasibility study, the groundwater regime in the shafts area will be characterized using a variety of field test methods, and may include: hydraulic conductivity tests, slug tests, and pump tests. The results of this work will be used to calculate the amount of dewatering that will be required during shaft sinking. [EAFMP-020]	**Complete** The site shaft pilot hole investigations and the grouting feasibility study were completed as described above.	Calculation of the amount of dewatering required during shaft sinking, to be performed, is covered under the detailed commitments of MON-G-04.
	The shallow groundwater monitoring program commissioned in summer 2012 will provide baseline and future operational data sets to verify this assessment. [IRC-EIS-08.37]	**Complete** Installation of additional shallow groundwater monitoring wells was completed in 2012.	Routine groundwater flow monitoring is covered under the detailed commitments of MON-G-04 and MON-G-07.

Table 4-1: Outdated Mitigation and Monitoring Commitments

VC	Detailed Commitment Description	Status	Follow-up
	The shallow groundwater monitoring well network of eight wells will be installed and baseline monitoring will be conducted to align with the current groundwater quality monitoring program in some of the US and DGR-series wells. [EAFMP-015]	**Complete** Same as above.	Same as above.
	An additional 8 downgradient and 2 background shallow groundwater wells are being installed in 2012 and will become part of the monitoring network to provide baseline information and continue to be monitored through construction. [IRC-EIS-01.06]	**Complete** Same as above.	Same as above.
Intermediate/ Deep Bedrock Water Quality/ Solute Transport	Something that didn't come out of the geoscientific verification program was the additional geotechnical and geomechanical testing that will be done in both of the shafts to ensure that we have the control and we're understanding the performance of the excavations as we progress through both of the shafts. [based on H-25-29]	**Complete** Rev.1 of the Geoscientific Verification Plan (GVP), issued after this commitment was made during the 2013 public hearings, identifies the additional geotechnical and geomechanical testing that will be done in both shafts, and hence the commitment is considered complete.	The geotechnical and geomechanical testing, to be performed, is covered under the detailed commitments of MON-G-09.
	…a geoscientific verification plan has been developed for implementation should future subsurface DGR development be approved. The purpose of the plan is to confirm or verify subsurface conditions as described in the DGR geosynthesis and supporting documents and to support future DGR engineering design decisions. [H-03-01]	**Complete** Same as above.	Same as above.
HYDROLOGY AND SURFACE WATER QUALITY			
Surface Water Quality	Environmental protection policies, programs and procedures will be established and will meet the requirements of the [EA-061]: • OPG Environment Policy OPG-POL-0021; • Biodiversity Policy OPG-POL-0002; • Land Assessment and Remediation Policy OPG-POL-0016; • Spills Management Policy OPG-POL-0020; and • Policy for the Use of Ozone	**Updated** A number of governance documents have been replaced, as noted below: • OPG's Biodiversity Policy OPG-POL-0002, has been replaced by OPG Biodiversity Management OPG-STD-0119, under OPG's current Environment Policy, OPG-POL-0021. • OPG's Land Assessment	See the detailed commitments of MIT-H-19.

Table 4-1: Outdated Mitigation and Monitoring Commitments

VC	Detailed Commitment Description	Status	Follow-up
	Depleting Substances OPG-POL-0015.	and Remediation Policy OPG-POL-0016, has been replaced by Contaminated Lands and Groundwater Management N-PROC-OP-0044, under OPG's current Environment Policy, OPG-POL-0021. • OPG's Spills Management Policy OPG-POL-0020, has been replaced by Spill Management N-STD-OP-0026, under OPG's current Environment Policy, OPG-POL-0021 • OPG's Policy for the Use of Ozone Depleting Substances OPG-POL-0015, has been replaced by Environmental Requirements for Air Conditioning and Refrigeration Equipment N-PROC-OP-0046, under OPG's current Environment Policy, OPG-POL-0021.	
	During the operations phase, environmental policies, programs and procedures will be implemented consistent with the requirements of OPG's existing Environmental Policy (OPG POL-0021) and Spills Management Policy (OPG-POL-0020) [based on EA-157, EA-073, EA-152, H-08-10, LIC-072 (Section 10.3 of PSR), LIC-090]	**Updated** See above.	See the detailed commitments of MIT-H-19.
	Execution of the environmental protection program will be accomplished through an integrated set of documented activities, typical of an Environmental Management System. It will be consistent with the CNSC Standard S-296 and the International Organization for Standardization (ISO) standard 14001, and will meet the requirements of OPG's Environmental, Health and Safety Management Program W-PROG-ES-0001. [EA-062, EA-094, EAFMP-003]	**Updated** A number of governance documents have been replaced, as noted below: • OPG's Environmental, Health and Safety Management Program W-PROG-ES-0001 has been replaced by Environmental Policy, OPG-POL-0021; • Environmental Management System, OPG-PROG-0005; and • Environmental Management, N-PROG-	See the detailed commitments of MIT-H-19.

Table 4-1: Outdated Mitigation and Monitoring Commitments

VC	Detailed Commitment Description	Status	Follow-up
		OP-0006. It is also noted that CNSC Standard S-296 has been superceded by CNSC REGDOC-2.9.1.	
	The EA follow-up monitoring program will be carried-out in accordance with CSA N288.4-10 Environmental Monitoring Programs at Class I Nuclear facilities and Uranium Mines and Mills, CNSC G-296 Developing Environmental Protection Policies, Programs and Procedures at Class I Nuclear Facilities and Uranium Mines and Mills, and CNSC S-296 Environmental Protection Policies, Programs and Procedures at Class I Nuclear Facilities and Uranium Mines and Mills. [EAFMP-003]	**Updated** It is noted that CNSC documents G-296 and S-296 have been superceded by CNSC REGDOC-2.9.1.	See the detailed commitments of MON-H-15.
	The monitoring program will be managed as a whole within the structure of an Environmental Management System (EMS). Planned environmental monitoring activities will be implemented, results will be reviewed and changes to the monitoring program identified if necessary, within the EMS and in accordance with the CSA standard "Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills". [IRC-EIS-08.26]	**Updated** It is noted that CNSC Standard S-296 has been superceded by CNSC REGDOC-2.9.1.	See the detailed commitments of MON-H-15.
RADIATION AND RADIOACTIVITY			
Humans	Generally accessible areas outside the DGR will be maintained at Zone 1 within the dose rate constraint ≤ 0.5 μSv/h. All spaces within the DGR facility perimeter will be classified in accordance with the potential for contamination. All areas of the DGR associated with the handling of radioactive waste will be designated as Zone 2. These include the crossing from the WWMF to the WPRB, the WPRB, shafts and the underground areas. Office and amenities areas at the DGR will be designated Zone 1. A Zone 1 and Zone 2 boundary is located within the amenities area for the movement and tracking of personnel. As all areas underground (i.e. below the shaft collars) will be Zone 2, and access to the lunchroom underground will require the use of the whole body	**Updated** As documented in OPG letter to JRP dated February 10, 2012, the radiological zoning has been updated to include the ventilation shaft headframe and the ventilation exhaust area within Zone 2 in recognition that the ventilation exhaust may contain contaminated air.	See the detailed commitments of MIT-R-07.

Table 4-1: Outdated Mitigation and Monitoring Commitments

VC	Detailed Commitment Description	Status	Follow-up
	and small article monitors. [EA-095, IRC-EIS-01.20, LIC-033]		
	Ash bins will be overpacked in a DGR-ready LLW sheet metal overpack. [LIC-117]	**Updated** Not all ash bins will be overpacked. Additional text has been added to this statement to clarify that this was an assumption for the 2010 reference inventory forecast.	See the detailed commitments of MIT-R-16.
	Non-processible wastes are stored in a family of non-pro boxes having a standard footprint and differing in height (and therefore volume capacity). The boxes are of painted sheet metal, and generally open topped. Lids will be provided when they are transferred (without any overpack) for emplacement in the DGR. [LIC-118]	**Updated** All new waste containers are lidded per current practice, and not open-topped.	See the detailed commitments of MIT-R-16.
SOCIO-ECONOMIC ENVIRONMENT			
Social Assets	OPG is committed to continuing its Public Participation and Indigenous Engagement Program throughout the regulatory approvals process and beyond, including (pending regulatory approval) the DGR Project site preparation and construction. Once the DGR is operating communications are expected to be integrated with OPG communications. [EA-012, EA-005, EA-079, H-01-07, H-17-19, H-17-26, H-17-45, H-17-46, H-23-14, H-25-27, H-25-33, LIC-082, LIC-083, LIC-084, LIC-085, TIS-03-01, TIS-03-04, TIS-03-06]	**Complete** Integration with OPG communications was completed.	OPG's continuing engagement activities related to the DGR Project are covered under the detailed commitments of MIT-S-07.
	Stakeholder Briefings and Presentations – Briefings and presentations will continue to be conducted to present information and provide an opportunity to have questions and comments addressed. Regular updates will be presented to elected officials, the DGR Community Consultation Advisory Group and Kincardine Community Consultation Advisory Committee; and other key stakeholders. [EA-012, IRC-EIS-09.28, EA-005, EA-079, H-01-07, H-17-19, H-17-26, H-17-45, H-17-46, H-23-14, H-25-27, H-25-33, LIC-082, LIC-083, LIC-084, LIC-085, TIS-03-01, TIS-03-04, TIS-03-06]	**Updated** The DGR Community Consultation Advisory Group and the Kincardine Community Consultation Advisory Committee are no longer active.	OPG's continuing engagement activities related to the DGR Project are covered under the detailed commitments of MIT-S-07.

Table 4-1: Outdated Mitigation and Monitoring Commitments

VC	Detailed Commitment Description	Status	Follow-up
	DGR Newsletter – The DGR Project newsletter will continue to be issued. [EA-012, IRC-EIS-09.28, EA-005, EA-079, H-01-07, H-17-19, H-17-26, H-17-45, H-17-46, H-23-14, H-25-27, H-25-33, LIC-082, LIC-083, LIC-084, LIC-085, TIS-03-01, TIS-03-04, TIS-03-06]	**Updated** The DGR project news and updates are currently included in OPG's WWMF Neighbours Newsletter. The DGR Newsletter is no longer issued separately.	OPG's continuing engagement activities related to the DGR Project are covered under the detailed commitments of MIT-S-07.

5. REFERENCES

CEAA. 2015. Canadian Environmental Assessment Agency Deep Geologic Repository for Low and Intermediate Level Radioactive Waste Project - Potential Conditions, June 3, 2015. (CEAA Registry Doc# 2214)

GOLDER. 2012. *OPG's Deep Geologic Repository for Low and Intermediate Level Waste, Soil Investigation for Proposed Surface Facilities, Kincardine, Ontario*. Prepared by Golder Associates Ltd. NWMO Report 1011170042-REP-G2030-0002 R00. (CEAA Registry Doc# 610)

Ontario Ministry of Transportation (MTO). 1997. *MTO Drainage Management Manual. Drainage and Hydrology Section, Transportation Engineering Branch, Quality and Standards Division*.

NWMO. 2011a. *DGR EA Follow-up Monitoring Program*. NWMO Report NWMO DGR-TR-2011-10 R000. (CEAA Registry Doc# 299)

NWMO. 2011b. *Geoscientific Verification Plan*. NWMO Report NWMO DGR-TR-2011-38 R000. (CEAA Registry Doc# 300)

NWMO and CANDESCO. 2011. *Preliminary Decommissioning Plan*. NWMO Report NWMO DGR-TR-2011-39 R000. (CEAA Registry Doc# 300)

NWMO. 2013. *DGR Project Consolidated Commitment Lists*. NWMO Report NWMO DGR-TR-2013-02 R000. (CEAA Registry Doc# 1238)

NWMO. 2014a. *DGR Project Consolidated Commitment Lists*. NWMO Report NWMO DGR-TR-2013-02 R002. (CEAA Registry Doc# 2081)

NWMO. 2014b. *DGR Project Consolidated Commitment Lists*. NWMO Report NWMO DGR-TR-2013-02 R001. (CEAA Registry Doc# 1875)

NWMO. 2014c. *Geoscientific Verification Plan*. NWMO Report NWMO DGR-TR-2011-38 R001. (CEAA Registry Doc# 1792)

OPG. 2001. *Radiation Protection Requirements - Nuclear Facilities*. OPG Requirements N-RPP-03415.1-10001 R07.

OPG. 2010. *Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository*. OPG Report 00216-REP-03902-00003-R003. (CEAA Registry Doc# 300)

OPG. 2011a. *Environmental Impact Statement*. Prepared by Golder Associates Ltd. OPG Report 00216-REP-07701-00001 R000. (CEAA Registry Doc# 298)

OPG. 2011b. *Preliminary Safety Report*. OPG Report 00216-SR-01320-00001 R000. (CEAA Registry Doc# 300)

OPG. 2012a. Letter, Ontario Power Generation to Joint Review Panel, dated March 9, 2012. (CEAA Registry Doc# 363)

OPG. 2012b. Letter, Ontario Power Generation to Joint Review Panel, dated July 9, 2012. (CEAA Registry Doc# 608)

OPG. 2012c. Letter, Ontario Power Generation to Joint Review Panel, dated August 15, 2012. (CEAA Registry Doc# 692)

OPG. 2012d. Letter, Ontario Power Generation to Joint Review Panel, dated September 28, 2012. (CEAA Registry Doc# 759)

OPG. 2012e. Letter, Ontario Power Generation to Joint Review Panel, dated October 24, 2012. (CEAA Registry Doc# 776)

OPG. 2012f. Letter, Ontario Power Generation to Joint Review Panel, dated October 31, 2012. (CEAA Registry Doc# 795)

OPG. 2012g. Letter, Ontario Power Generation to Joint Review Panel, dated November 7, 2012. (CEAA Registry Doc# 793)

OPG. 2012h. Letter, Ontario Power Generation to Joint Review Panel, dated December 12, 2012. (CEAA Registry Doc# 832)

OPG. 2012i. Letter, Ontario Power Generation to Joint Review Panel, dated December 20, 2012. (CEAA Registry Doc# 843)

OPG. 2013a. Letter, Ontario Power Generation to Joint Review Panel, dated April 30, 2013. (CEAA Registry Doc# 989)

OPG. 2013b. Attachment to Letter, Ontario Power Generation to Joint Review Panel, dated September 12, 2013. (CEAA Registry Doc# 1560)

OPG. 2014a. Letter, Ontario Power Generation to Joint Review Panel, dated August 25, 2014. (CEAA Registry Doc# 2081)

OPG. 2014b. Letter, Ontario Power Generation to Joint Review Panel, dated October 17, 2014. (CEAA Registry Doc# 2193)

OPG. 2015. Letter, Ontario Power Generation to the Canadian Environmental Assessment Agency, dated August 21, 2015. (CEAA Registry Doc# 2289)

6. ABBREVIATIONS AND ACRONYMS

AECL	Atomic Energy Canada Limited
ALARA	As Low As Reasonable Achievable
ALW	Active Liquid Waste
CEAA	Canadian Environmental Assessment Agency
CAC	Community Advisory Committee
CNSC	Canadian Nuclear Safety Commission
COPC	Contaminants of Potential Concern
CSA	Canadian Standards Association
DGR	Deep Geologic Repository
DFO	Fisheries and Oceans Canada
DRL	Derived Release Limits
EA	Environmental Assessment
EAFMP	Environmental Assessment Follow-up and Monitoring Program
ECA	Environmental Compliance Approval
EDZ	Excavation Damaged Zone
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMS	Environmental Management System
EPD	Electronic Personal Dosimeter
ERP	Emergency Response Plan
ERT	Emergency Response Team

FP	Fire Protection
FHA	Fire Hazard Analysis
GVP	Geoscientific Verification Plan
HSE	Health, Safety and Environment
HSM	Historic Saugeen Métis
HSMC	Historic Saugeen Métis Community
HVAC	Heating, Ventilation and Air Conditioning
ILW	Intermediate Level Waste
IR	Information Request
ISO	International Organization for Standardization
JRP	Joint Review Panel
L&ILW	Low & Intermediate Level Waste
LHHPC	Low Heat High Performance Cement
LLW	Low Level Waste
MNO	Métis Nation of Ontario
MNRF	Ontario Ministry of Natural Resources and Forestry
MOE	Ministry of the Environment
NBCC	National Building Code of Canada
NEMA	National Electrical Manufacturers Association
NEW	Nuclear Energy Worker
NFCC	National Fire Code of Canada
NFPA	National Fire Protection Association

NRCan	Natural Resources Canada
NWMD	Nuclear Waste Management Division
NWMO	Nuclear Waste Management Organization
OHSA	Ontario Health and Safety Act
OPG	Ontario Power Generation
OPSD	Ontario Provincial Standard Drawing
OPSS	Ontario Provincial Standard Specification
PAR	Public Attitude Research
PTTW	Permit to Take Water
PSR	Preliminary Safety Report
QA	Quality Assurance
REMP	Radiological Environmental Monitoring Program
SAR	Species at Risk
SCS	Site Condition Standards
SON	Saugeen Ojibway Nation
SPM	Suspended Particulate Matter
SWMP	Stormwater Management Pond
TLD	Thermoluminescent Dosimeter
TSD	Technical Support Document
TSS	Total Suspended Solids
URL	Underground Research Laboratory
VC	Valued Component

VOC	Volatile Organic Compound
WAC	Waste Acceptance Criteria
WHMIS	Workplace Hazardous Materials Information System
WIPP	Waste Isolation Pilot Plant
WPRB	Waste Package Receiving Building
WRMA	Waste Rock Management Area
WWMF	Western Waste Management Facility
ZOI	Zone of Influence

[PAGE LEFT INTENTIONALLY BLANK]

APPENDIX A: DETAILED MITIGATION AND MONITORING COMMITMENTS

[PAGE LEFT INTENTIONALLY BLANK]

LIST OF TABLES

Page

[PAGE LEFT INTENTIONALLY BLANK]

TABLE A1: GEOLOGY DETAILED COMMITMENTS
Valued Ecosystem Components
1) Soil Quality 2) Overburden Groundwater Quality 3) Overburden Groundwater Transport 4) Shallow Bedrock Groundwater Quality 5) Shallow Bedrock Groundwater and Solute Transport 6) Intermediate Bedrock Water Quality 7) Intermediate Bedrock Solute Transport 8) Deep Bedrock Water Quality 9) Deep Bedrock Solute Transport

TABLE A1: GEOLOGY DETAILED COMMITMENTS

1) Soil Quality

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-G-01. OPG will, during site preparation and construction and to the satisfaction of the CNSC, place a liner under the waste rock management areas to direct leachate to a treatment facility or the stormwater management pond. [based on CEAA 11.2]

- Verification of subsurface permeability and continuity will be performed during the preparation of the WRMA. Should areas of discontinuity in the till be encountered, natural or synthetic liners will be introduced to protect the groundwater system. [H-13-04]
- The WRMA will be prepared in such a way that provides for a foundation in the in situ tills, to ensure that there is no connectivity into the groundwater system. As previously stated, if there are areas within that area that do not have the sufficient till lens as anticipated, a synthetic or a secondary liner system would be installed for the pile. It is graded such that the water coming from the storm - the waste rock management area is directed into the stormwater ditch system and then directed into the stormwater management pond. [H-23-23]

MIT-H-02. OPG will, during site preparation and construction and to the satisfaction of the CNSC, place a liner under the stormwater management pond. [based on CEAA 11.1]

- For details, see commitment MIT-H-02 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MIT-G-02. Waste rock management will be implemented.

- The WRMA will be constructed within an area underlain by between 0.7 to 1.5 m of surficial sand and gravel to clayey silt (fill materials) overlying at least 10 m of hard low-permeability glacial till (refer to OPG's response to Information Request IR-EIS-03-54 (OPG 2012b) and GOLDER 2012). The cohesionless surficial fill materials within the footprint of the WRMA and SWMP will be removed as part of site preparation activities. [based on IRC-EIS-05.22, IRC-EIS-05.51]
- The ultimate height of the *[waste rock]* pile will be 15 metres and occupy approximately nine hectares in the DGR project site. [H-13-03]
- All waste rock storage locations will be stripped of vegetation and topsoil, which will be temporary stockpiled and re-used elsewhere on site, and then prepared to receive the waste rock. The base of the waste rock storage areas will be graded to promote drainage towards perimeter ditches. Thus any precipitation onto the waste rock piles will not pond inside the piles and will be directed to the perimeter ditches. The perimeter ditching will be located between the waste rock piles and the wetland to the northeast and this ditching will prevent seepage from the waste rock piles reaching the wetland. [IRC-EIS-03.12, IRC-LPSC-01.91, EA-035, LIC-071 (Section 9.2.2 of PSR)]
- The waste rock will be segregated at surface into three areas based on the type of rock (dolostones, shales, limestone). The shale and dolostones resulting from the shaft excavations will either be reused onsite or covered within one year of excavation, therefore further segregation is not proposed. Additionally, the rock reused in berms will be covered, providing further means to manage and redirect runoff. [IRC-EIS-04.46]
- The shale pile will be covered with overburden excavated from the shafts or other clean fill from on-site projects, should the shale pile remain on-site for more than one year. [EA-210, EA-040, H-03-02, H-03-04, H-13-02, H-13-13, LIC-071 (Section 9.3.3 of PSR)]
- With respect to the Guelph and the Salina A1 formations, although they may be stockpiled for a very short period of time, it is expected that those rocks will be excavated and deposited directly into their final resting place as part of the overall site grading plan, as the intent would be to minimize handling of waste rock specifically in the shaft excavations. [based on H-13-11, H-13-12,

TABLE A1: GEOLOGY DETAILED COMMITMENTS

1) Soil Quality

H-24-39]

MIT-G-03. Prior to the deposition of waste rock in the WRMA, silt curtains will be installed between the drainage ditches and the toe of the waste rock pile (i.e. the permanent stockpile of limestone). These will be maintained for the development of the waste rock pile during of the construction phase until it is observed that silty material is no longer being released from the waste rock pile. In addition, vegetation will be re-established in the area between the silt curtain and the waste rock pile to assist in limiting the migration of sediment to the silt curtains and the drainage ditches. [IRC-EIS-05.32, EA-039, EA-267, IRC-EIS-08.13, IRC-EIS-08.16, IRC-EIS-09.36]

MIT-G-04. OPG will not, during any phase of the project, dispose of waste rock outside the boundaries of the stormwater management system without the permission of the CNSC. [based on CEAA 11.3, LIC-165 (Rec #31)]

- Local aggregate use and market effects will be limited as excavated rock will be kept on-site. [EA-178]

Additional mitigation measures:

MIT-G-05. In the event of such *[malfunction or accident]*, follow-up monitoring *[of soil quality]* may include a number of activities, including surficial soil sampling, subsurface soil investigations (i.e., borehole drilling with soil sampling for analysis), and potentially, soil remediation. The purpose of these activities would be to ensure compliance with the prevailing regulatory standards, which are currently the MOE Table 3 SCS *[Site Condition Standards]*. If non-compliant, determine additional mitigation required to be compliant, as required under Ontario Environmental Protection Act. [EA-212, EA-160, H-23-12]

- Effects of any contamination as a result of a malfunction or accident (i.e., spill) will be identified and monitored to ensure compliance during site preparation and construction, and operations phases. [EIS, Table 13-1 (OPG 2011a)]

MIT-H-18. OPG will, prior to site preparation and to the satisfaction of the CNSC, develop and implement a detailed spill response plan throughout all Designated Project phases. Containment methods, locations and strategies set out in the plan shall be designed and implemented in a manner that will enable spill mitigation to be deployed in time to prevent downstream effects. [based on CEAA 13.3, LIC-165 (Rec #27)]

- See detailed commitments associated with MIT-H-18 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

- See detailed commitments associated with MIT-H-19 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MONITORING COMMITMENTS:

MON-G-01. Soil sampling will be undertaken prior to the site preparation and construction phase in order to establish a baseline with which future soil investigation results can be compared. [EAFMP-023]

MON-R-03. OPG will, in order to confirm the environmental assessment prediction of no adverse effects for members of the public and Indigenous communities from exposure to radiation, add the collection of soil samples within the Site Study Area and Local Study Area during construction to the Radiological Environmental Monitoring Program. [based on CEAA 8.3]

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and

TABLE A1: GEOLOGY DETAILED COMMITMENTS
1) Soil Quality
H-17-05] • See detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments [Note: Additional details on the above monitoring are provided in Table 2, and Table 4a of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A1: GEOLOGY DETAILED COMMITMENTS

2) Overburden Groundwater Quality
3) Overburden Groundwater Transport

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-G-01. OPG will, during site preparation and construction and to the satisfaction of the CNSC, place a liner under the waste rock management areas to direct leachate to a treatment facility or the stormwater management pond. [based on CEAA 11.2]

- For details, see commitment MIT-G-01 associated with Soil Quality VC

MIT-H-02. OPG will, during site preparation and construction and to the satisfaction of the CNSC, place a liner under the stormwater management pond. [based on CEAA 11.1]

- For details, see commitment MIT-H-02 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MIT-H-08. The shaft liner is designed with the objective to operate as a dry facility, with little to no seepage through the shaft lining *[to avoid the groundwater inflow following construction]*, and therefore less water to manage in the stormwater management system. [based on EIS, Table 13-1 (OPG 2011a)]

- For details, see commitment MIT-H-08 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MIT-G-06. Prior to establishing the shaft collars and the start of shaft sinking, the upper 180 m of bedrock around each shaft will be treated by either ground freezing or grouting (refer to *[OPG's response to]* IR-LPSC-01-31 *[OPG 2012a]*). [IRC-EIS-01.03]

- For details, see commitments associated with Shallow Bedrock Groundwater and Solute Transport VC, and see also Section 9.4.1 of PSR [LIC-071].

Additional mitigation measures:

MIT-G-07. In the event of such *[a malfunction or accident]*, follow-up monitoring *[related to overburden groundwater quality]* may include a number of activities, including monitoring well installation, periodic groundwater quality monitoring, and, if necessary, groundwater remediation. The purpose of these activities would be to ensure compliance with the prevailing regulatory standards, which are currently the MOE Table 3 SCS *[Site Condition Standards]*. If non-compliant, determine additional mitigation required to be compliant, as required under Ontario Environmental Protection Act. [EA-213, H-23-12]

- Effects of any contamination as a result of a malfunction or accident (i.e., spill) will be identified and monitored to ensure compliance during site preparation and construction, and operations phases. [EIS, Table 13-1 (OPG 2011a)]

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

- See detailed commitments associated with MIT-H-19 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MONITORING COMMITMENTS:

MON-G-02. Groundwater quality and flow monitoring will be conducted prior to and during site preparation and construction and operations to establish a baseline*, [to confirm the assumptions made in the EA, and to confirm that there are no adverse effects during the site preparation and construction, and operations phases as a result of the Waste Rock Management Area (WRMA), the Stormwater Management Pond*

TABLE A1: GEOLOGY DETAILED COMMITMENTS
2) Overburden Groundwater Quality **3) Overburden Groundwater Transport**
(SWMP) and shaft excavation and dewatering]. [EAFMP-012 and Section 3 of NWMO (2011a)]
MON-G-03. The overburden groundwater transport will be monitored to confirm EA predictions of no measurable change in groundwater levels beyond the Site Study Area. [based on EA-218, EA-161, also in EIS, Table 13-1 (OPG 2011a)]
MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05] • See detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

TABLE A1: GEOLOGY DETAILED COMMITMENTS

4) Shallow Bedrock Groundwater Quality
5) Shallow Bedrock Groundwater and Solute Transport

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-G-01. OPG will, during site preparation and construction and to the satisfaction of the CNSC, place a liner under the waste rock management areas to direct leachate to a treatment facility or the stormwater management pond. [based on CEAA 11.2]

- For details, see commitment MIT-G-01 associated with Soil Quality VC

MIT-H-02. OPG will, during site preparation and construction and to the satisfaction of the CNSC, place a liner under the stormwater management pond. [based on CEAA 11.1]

- For details, see commitment MIT-H-02 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MIT-H-08. The shaft liner is designed with the objective to operate as a dry facility, with little to no seepage through the shaft lining *[to avoid the groundwater inflow following construction]*, and therefore less water to manage in the stormwater management system. [based on EIS, Table 13-1 (OPG 2011a)]

- For details, see commitment MIT-H-08 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MIT-G-06. Prior to establishing the shaft collars and the start of shaft sinking, the upper 180 m of bedrock around each shaft will be treated by either ground freezing or grouting (refer to *[OPG's response to]* IR-LPSC-01-31 *[OPG 2012a]*). [IRC-EIS-01.03]

- The ground treatment in the upper 170 m of the two shafts is designed to reduce or eliminate inflows of water and the zone of influence. [based on EIS, Table 13-1 (OPG 2011a), LIC-165 (Rec #60)] *[Note: The depth of the ground treatment has been updated based on subsequent data results.]*
- If required, additional in-shaft grouting will be performed to ensure groundwater inflows do not exceed 3 L/s for shaft sinking. [IRC-EIS-04.34]
- During shaft sinking, the Salina A1 and Guelph formations will be treated by cover grouting. Water discharged from the grouted Salina A1 and Guelph formations will be monitored during shaft sinking. If the actual quantity and quality of saline water discharging from these formations is predicted to cause elevated salinity in the SWMP discharge water, then additional grouting of these two formations will be performed to further reduce flow before a water quality issue is created. [IRC-EIS-09.42, H-08-11]
- For additional details, see also Section 9.4.1 of PSR. [LIC-071]

Additional mitigation measures:

MIT-G-08. OPG will, prior to site preparation and to the satisfaction of the CNSC, use information from existing and planned groundwater monitoring wells to verify the zone of influence from dewatering during excavation and construction. OPG will use the results to inform the final design of shaft excavation procedures and infrastructure, including mitigation of groundwater inflow from surficial and shallow bedrock groundwater zones. [based on CEAA 11.4, LIC-165 (Rec #10)]

MIT-G-09. OPG will, to the satisfaction of the CNSC, implement a follow-up program for groundwater quality and groundwater inflow rates into the shafts and repository. If groundwater inflows exceed predicted values or if the zone of influence is larger than expected, OPG will implement mitigation measures to either reduce

TABLE A1:
GEOLOGY DETAILED COMMITMENTS

4) Shallow Bedrock Groundwater Quality

5) Shallow Bedrock Groundwater and Solute Transport

groundwater inflow or the zone of influence. If groundwater loadings and/or concentrations of contaminants of concern exceed environmental assessment predictions, OPG will implement mitigation measures to avoid adverse effects to surface water quality, to the satisfaction of the CNSC. [based on CEAA 11.5]

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

- See detailed commitments associated with MIT-H-19 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MONITORING COMMITMENTS:

MON-G-04. The shallow bedrock groundwater and solute transport will be monitored to confirm predictions of the Geosynthesis program. [based on EA-219, EA-162, EA-217]

- General:
  - Groundwater flow monitoring will be conducted prior to and during site preparation and construction and operations to establish a baseline. [EAFMP-012, LIC-165 (Rec #59)]
  - Baseline shallow groundwater monitoring will be conducted and will continue throughout the site preparation and construction phase (see also OPG's responses to IRs EIS-05-172 and EIS-05-173 [OPG 2012g] and NWMO 2011a). As the detailed project design is finalized, the monitoring program will be updated accordingly. At a minimum, the follow-up monitoring program will be evaluated once every five years, or once during each project phase, to ensure the program remains effective and relevant (NWMO 2011a, Section 16). [IRC-EIS-09.18, EAFMP-018, IRC-EIS-10.10, H-24-09, LIC-165 (Rec #59)]
  - Shallow groundwater baseline and follow-up monitoring is planned on a quarterly basis to establish seasonal fluctuations and to confirm the assumptions used to predict that there will be no adverse effect on the shallow groundwater flow attributable to shaft excavation and dewatering, the operation of the stormwater management pond (SWMP), and any infiltration through the waste rock management area (WRMA). The shallow groundwater monitoring well network comprises upgradient and downgradient wells, and will serve as an early detection network of on-site or off-site contaminant migration on or through the DGR Project site. [IRC-EIS-09.47, H-17-13, IRC-EIS-08.41]
  - Once the hydrostatic shaft liners are installed and sealed (nominal depth 230 m below ground surface), the shafts will be hydraulically isolated and no longer influence the groundwater system. Verification of assessment results will be achieved through proposed routine groundwater and shaft discharge monitoring programs. [IRC-EIS-01.05]
  - Water level monitoring of engineering controls associated with the project, such as foundation drains, sumps, or drainage ditches, may be undertaken throughout the life of the project to evaluate potential changes in the local shallow groundwater flow regime. [EA-209]
  - Follow-up monitoring of shallow subsurface groundwater flow is dependent on the results of the shaft pilot programs, which are to be established prior to excavation and construction. [EA-207]
    [Note: The site shaft pilot borehole investigation and laboratory testing were completed in 2011.]
  - In 2011, an initial trial was conducted at the proposed location of ventilation shaft to determine the feasibility of a surface-based grouting to a depth of 200 m. The results of this trial were encouraging and demonstrated that surface-based grouting is likely feasible to depths of 200 m. The trial will be continued in 2012 for the purpose of confirming feasibility of

TABLE A1:
GEOLOGY DETAILED COMMITMENTS

4) Shallow Bedrock Groundwater Quality

5) Shallow Bedrock Groundwater and Solute Transport

surface-based grouting at the DGR project site. [IRC-LPSC-01.93]
[Note: Phase 2 of the deep grouting trial was completed in 2012.]

- During the shaft pilot hole investigations and grouting feasibility study, the groundwater regime in the shafts area will be characterized using a variety of field test methods, and may include: hydraulic conductivity tests, slug tests, and pump tests. The results of this work will be used to calculate the amount of dewatering that will be required during shaft sinking. [EAFMP-020]
  [Note: The site shaft pilot hole investigations and the grouting feasibility study were completed.]
- Verification of assessment results will be achieved through proposed routine groundwater and shaft discharge monitoring programs, as discussed in the DGR EA Follow-up Monitoring Program (NWMO 2011a, Section 3). The shallow groundwater monitoring program in particular, described in the EA Follow-up Monitoring Program (NWMO 2011a, Table 3a, with additional detail provided in OPG's response to IR-EIS-05-173 (OPG 2012g)), will be capable of identifying any changes to the local water table and shallow hydraulic gradients that may have an impact on base flow and recharge in the site study area. It is by these means that the accuracy of the predictions and effectiveness of the mitigation measures presented in the EIS will be verified. [IRC-EIS-07.23]

- Hydraulic head monitoring:
  - EA follow-up monitoring will also include hydraulic head monitoring in some of the existing US and DGR-series wells and the new shallow groundwater wells during site preparation and construction. The monitoring program will begin prior to the site preparation and construction phase to establish a baseline and seasonal variability. The program will be re-evaluated at the end of the site preparation and construction phase. The program, if continued, will be continued as part of the EMP monitoring program and will be re-evaluated every 5 years. [EAFMP-019, EAFMP-013]
- Establishing the zone of influence (ZOI) and drawdown characteristics during shaft dewatering:
  - Prior to the construction of underground facilities, it is expected that a test well(s) and pumping test program will be implemented to assess the Project Area aquifer(s) properties, estimate the expected Zone of Influence (ZOI), and prepare a dewatering plan for the construction of underground facilities. This testing program would also include implementation of a water level monitoring program before, during, and after the pumping test. Anticipated ZOI benchmark to be established during the pumping test for Permit to Take Water Application (regulatory requirement – Ontario Water Resources Act). [EA-216, EAFMP-021, IRC-EIS-07.14, H-23-12]
- Dewatering volumes monitoring:
  - Dewatering volumes will also be recorded. [EAFMP-014]
  - Water volumes will be monitored daily during dewatering and total daily flow volumes will be recorded as part of the regulatory monitoring program to confirm that the daily water takings are below the limit in the PTTW *[Permit to Take Water]*, but will also serve to confirm the effectiveness of the advance grouting or freezing. [EAFMP-022]
  - If daily water taking records exceed the maximum daily volume in the PTTW, dewatering will be halted until mitigation measures can be implemented (e.g., additional grouting). [EAFMP-056, IRC-EIS-06.25, H-17-04]

- Groundwater level monitoring near the marsh:

TABLE A1:
GEOLOGY DETAILED COMMITMENTS

4) Shallow Bedrock Groundwater Quality

5) Shallow Bedrock Groundwater and Solute Transport

- Groundwater levels will be monitored in the shallow groundwater well closest to the marsh to determine water table fluctuations. [EAFMP-030]
- Although the till underlying the DGR site is expected to prevent any shallow groundwater flow to the wetland, the shallow groundwater monitoring well network will also be capable of detecting changes resulting from site activities and changes to the water table near the marsh in the northeast portion of the Project Area (NWMO 2011a, Section 3.1). [IRC-EIS-05.08]

MON-G-05. The shallow bedrock groundwater quality will be monitored to confirm predictions of the Geosynthesis program. [based on EA-219, EA-162, EA-217; also in EIS, Table 13-1 (OPG 2011a)]

- Groundwater quality monitoring will be conducted prior to and during site preparation and construction and operations to establish a baseline. [EAFMP-012]
- Baseline shallow groundwater monitoring will be conducted and will continue throughout the site preparation and construction phase (see also OPG's responses to IRs EIS-05-172 and EIS-05-173 [OPG 2012g] and NWMO 2011a). As the detailed project design is finalized, the monitoring program will be updated accordingly. The follow-up monitoring programs will be assessed annually for effectiveness. At a minimum, the follow-up monitoring program will be evaluated once every five years, or once during each project phase, to ensure the program remains effective and relevant (NWMO 2011a, Section 16). [IRC-EIS-09.18, EAFMP-018, IRC-EIS-10.10, H-24-09, LIC-165 (Rec #59)]
- Shallow groundwater baseline and follow-up monitoring is planned on a quarterly basis to establish seasonal fluctuations and to confirm the assumptions used to predict that there will be no adverse effect on the shallow groundwater quality attributable to shaft excavation and dewatering, the operation of the stormwater management pond, and any infiltration through the waste rock management area. The shallow groundwater monitoring well network comprises upgradient and downgradient wells, and will serve as an early detection network of on-site or off-site contaminant migration on or through the DGR Project site. [IRC-EIS-09.47, H-17-13, IRC-EIS-03.05, IRC-EIS-08.41]
- Shallow groundwater quality monitoring began in 2011. This information will be used in the future to determine whether there is migration of contamination into or away from the DGR site. [H-24-12]
- Analysis for pH, conductivity, temperature and major ions will provide basic information on groundwater quality and will allow for a charge balance to be completed as a quality assurance measure. Trace elemental analysis will allow for the early detection of elements which may indicate groundwater contamination from activities at the surface facilities. Petroleum hydrocarbons are included in order to detect any influence from vehicular sources and other common industrial sources at the surface facilities. Quarterly sampling will allow seasonal trends to be identified. [IRC-EIS-05.15, EAFMP-042]
- Values for COPCs *[contaminants of potential concern]* will be assessed against baseline levels and Table 3 of Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act for a non-potable groundwater condition. In support of the Data Quality Objective process, Method Detection Limits (MDLs) are being reviewed to ensure they are adequately low compared to current levels of COPCs or regulatory criteria where they exist, to ensure the monitoring program can detect any significant changes from baseline conditions. [IRC-EIS-05.16, H-23-12]
- The EA follow-up groundwater monitoring will be capable of detecting spatial and temporal changes in groundwater quality within the uppermost aquifer beneath the DGR surface structures. [EAFMP-016]
- EA follow-up monitoring will include groundwater quality monitoring. If the groundwater quality

TABLE A1:
GEOLOGY DETAILED COMMITMENTS

4) Shallow Bedrock Groundwater Quality

5) Shallow Bedrock Groundwater and Solute Transport

monitoring results from the EA follow-up monitoring fall within the predictions of the EIS during the site preparation and construction phase, the groundwater monitoring will be transferred to the EMP monitoring program. [based on EAFMP-013]

MON-G-06. OPG will, prior to site preparation and to the satisfaction of the CNSC, update the hydrogeologic properties of the till cover in the water balance and surface water/groundwater interaction numerical models and undertake further updates to the models as more data become available. [based on CEAA 11.6]

- OPG to confirm the baseline groundwater, water balance and surface water/groundwater interaction modelling results from groundwater data of the newly installed monitoring wells. [based on LIC-165 (Rec #11)]

MON-G-07. Monitoring wells have been established as part of the Geoscientific Site Characterization Program and monitoring will continue during construction and operation of the DGR. [EA-011]

- The DGR *[shallow groundwater]* monitoring well network was installed in the summer of 2012. Routine monitoring activities, which will include hydraulic head sampling, will be conducted on a quarterly basis. [IRC-EIS-08.36]
- The shallow groundwater monitoring program commissioned in summer 2012 will provide baseline and future operational data sets to verify this assessment. [IRC-EIS-08.37]
  [Note: Installation of the shallow groundwater wells was completed.]
- The routine quarterly shallow groundwater monitoring program implemented in summer 2012 for the DGR project area will provide baseline groundwater quality data with which to confirm this assessment during facility operation. [IRC-EIS-08.38]
- Data from the shallow groundwater wells will serve as an additional verification of the piezometric surface and will be used to refine the understanding of groundwater flow as required once installation is complete and surveyed elevations are available. [UT-01-01]
- The shallow groundwater monitoring well network of eight wells will be installed and baseline monitoring will be conducted to align with the current groundwater quality monitoring program in some of the US and DGR-series wells. [EAFMP-015]
  [Note: Installation of the shallow groundwater wells was completed.]
- An additional 8 downgradient and 2 background shallow groundwater wells are being installed in 2012 and will become part of the monitoring network to provide baseline information and continue to be monitored through construction. [IRC-EIS-01.06]
  [Note: Installation of the shallow groundwater wells was completed.]
- This *[groundwater system]* indicator is measured by routine annual groundwater level monitoring of the current WWMF monitoring well network, and will continue to be measured through monitoring of this network and future monitoring locations that may be established as the DGR Project proceeds throughout all of its phases. [EA-208, EA-215]

MON-R-04. OPG will, prior to shaft sinking and to the satisfaction of the CNSC, enhance its capability to detect and monitor the movement of the tritium plume originating from the Western Waste Management Facility by adding an adequate number of monitoring wells up-gradient of the DGR shafts. [based on CEAA 11.7]

- See detailed commitments associated with MON-R-04 in Table A5, Radiation and Radioactivity Detailed Commitments

MON-R-05. OPG will, to the satisfaction of the CNSC, conduct a comprehensive assessment of the migration of the tritium plume originating from the Western Waste Management Facility site. The assessment shall include updated modelling of the tritium plume migration. If groundwater modelling or monitoring indicates that

TABLE A1:
GEOLOGY DETAILED COMMITMENTS

4) Shallow Bedrock Groundwater Quality

5) Shallow Bedrock Groundwater and Solute Transport

the tritium plume may reach the shaft before the shaft collars are installed, OPG will prepare a contingency plan, to the satisfaction of the CNSC, and implement that plan as required. [based on CEAA 11.8]

- See detailed commitments associated with MON-R-05 in Table A5, Radiation and Radioactivity Detailed Commitments

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

- See detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

[Note: Additional details on the above monitoring are provided in Table 2, Table 3a, Table 4b, and Table 6 of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A1: GEOLOGY DETAILED COMMITMENTS

6) - 7) Intermediate Bedrock Water Quality / Solute Transport
8) - 9) Deep Bedrock Water Quality / Solute Transport

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-H-08. The shaft liner is designed with the objective to operate as a dry facility, with little to no seepage through the shaft lining *[to avoid the groundwater inflow following construction]*, and therefore less water to manage in the stormwater management system. [based on EIS, Table 13-1 (OPG 2011a)]

- For details, see commitment MIT-H-08 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

Additional mitigation measures:

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

- See detailed commitments associated with MIT-H-19 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MONITORING COMMITMENTS:

MON-G-08. The following will be monitored to confirm predictions of the Geosynthesis program [based on EA-219, EA-162, EA-217; also in EIS, Table 13-1 (OPG 2011a)]:

- Intermediate bedrock quality
- Intermediate bedrock solute transport
- Deep bedrock water quality
- Deep bedrock solute transport

MON-G-09. Details of the testing and investigations commitments, confirming that the geologic/hydrogeologic setting underneath the Bruce nuclear site, are provided in the Geoscientific Verification Plan (GVP).

General:

- As the detailed design of the DGR is progressed, the Geoscientific Verification Plan will be updated and reissued as necessary. Any comments received from the CNSC about this revision of the plan (i.e. Rev 001) will be considered in a future revision of this plan. The plan will ultimately be developed in sufficient detail to allow the development of technical specifications for procurement of equipment and for services to execute the plan. [IRC-EIS-12.21, H-24-27, H-03-01, LIC-165 (Rec #23)]
- While not expected, given evidence presented in the DGR Safety Case, in the remote event that the data arising from any of the various geosciences verification activities are materially different than those used in DGR safety analyses, the following actions will be taken: (a) the data will be assessed to determine its reliability and (b) new analyses will be undertaken to test the implications on the DGR Safety Case. [IRC-EIS-12.24, LIC-152]
- Geoscience verification activities will be completed, or sufficiently completed, during the construction phase such that they directly support an operating licence application and updated repository Safety Case. In certain circumstances long-term demonstration experiments initiated during construction activities will continue into the operation phase. [IRC-EIS-12.23, H-23-05, IRC-EIS-12.20]
- The geological/ hydrogeological setting underneath the Bruce nuclear site provides excellent isolation and containment of the repository wastes. [EIS, Table 13-1 (OPG 2011a)]

TABLE A1:
GEOLOGY DETAILED COMMITMENTS

6) - 7) Intermediate Bedrock Water Quality / Solute Transport
8) - 9) Deep Bedrock Water Quality / Solute Transport

- The rock mass in which the repository will be constructed is geomechanically stable, and shallow groundwater resources will be protected. [H-14-03]

Geotechnical Verification (Section 2 and Section 3 of GVP):

- Section 2 and Section 3 of the Geoscientific Verification Plan (GVP), NWMO DGR-TR-2011-38 R001, include the commitments related to geotechnical verification. These two sections are essentially commitments. [LIC-152, LIC-018, LIC-068, H-04-04, H-24-13, IRC-EIS-02.02, IRC-EIS-06.11, IRC-EIS-07.29, IRC-EIS-07.33, IRC-EIS-07.34, IRC-EIS-07.35, IRC-EIS-08.35, IRC-EIS-08.47, IRC-EIS-12.26, IRC-EIS-12.28, IRC-EIS-12.29, IRC-LPSC-02.14, IRC-LPSC-03.03]
- Underground rock and shaft concrete structures will be monitored using rock mass and pillar convergence instrumentation, embedded and surface-mounted concrete load cells in the shaft linings, and rock dowel load cells. [EA-099]
- A detailed geotechnical investigation and monitoring plan will be developed for the shaft and repository excavations in advance of development activities. This plan will include geotechnical monitoring and related instrumentation/ equipment, geological and geomechanical investigations during construction, as well as, long-term monitoring requirements during the operation phase. [IRC-EIS-07.28]
- At time of installation, selected bolts will be proof-tested and performance-tested as per recognized standard or procedure (e.g. ASTM D4435-13, BS8081:1989 or equivalent) to confirm that the bolts have been installed in accordance with specifications. If there is evidence of improper bolt installation, the load capacity of the defective bolt will be degraded and additional bolts will be installed and tested. [IRC-EIS-12.31]
- NRCan has made recommendations for geomechanical modelling and additional testing, which NWMO plans to implement as part of the construction phase. [H-03-03, EAFMP-052]
- A detailed *[geotechnical verification]* testing plan, beyond that described in the Geoscience Verification Plan, will be developed prior to DGR shaft construction. [IRC-EIS-07.32, H-25-29]
- The trigger values and mitigation activities will be further refined at a later date when the DGR design has progressed closer to 'issue-for-construction' status and contractor equipment and execution approach are defined. This information will be included in future *[geotechnical verification]* test plans for the work identified in the GVP. [IRC-EIS-12.22]

Geoscience Verification (Section 2 and Section 4 of GVP):

- Section 2 and Section 4 of the Geoscientific Verification Plan (GVP), NWMO DGR-TR-2011-38 R001, include the commitments related to geoscience verification. These two sections are essentially commitments. [LIC-152, LIC-096, LIC-101, LIC-103, LIC-108, LIC-116, EA-075, H-04-06, H-04-07, IRC-EIS-06.13, IRC-EIS-07.31, IRC-EIS-08.33, IRC-LPSC-01.09, IRC-LPSC-04.03]
- The measurement techniques applied will ultimately be selected based on best available technology as demonstrated at Underground Research Laboratories (URL), for example, Mont Terri (Switzerland), Bure (France) and Aspo (Sweden). [IRC-EIS-06.15, IRC-EIS-06.10, IRC-EIS-06.14]
- Other suitable geophysical techniques, such as ground penetrating radar, resistivity, sonic, acoustic emission and seismo-electrical methods will also be considered depending on the site situation. [IRC-EIS-06.12]
- The total number of horizontal boreholes required at each measurement location and their bearing will be adjusted during detailed planning to capture maximum expected EDZ development. Based on the Geoscientific Verification Plan (NWMO 2011b), like other EDZ characterization activities, the hydraulic measurement will be conducted at selected horizons in the Salina Formation (F, C, A2 and A1 Units), the Cabot Head Formation, the Queenston Formation, the Georgian Bay Formation and the Blue Mountain Formation. As noted above, best practice will be followed for physical measurement of EDZ permeabilities based on URL experience. [IRC-EIS-06.16]

TABLE A1:
GEOLOGY DETAILED COMMITMENTS

6) - 7) Intermediate Bedrock Water Quality / Solute Transport
8) - 9) Deep Bedrock Water Quality / Solute Transport

  - Site investigation and monitoring boreholes will be appropriately sealed at the end of their useful lifetime. [LIC-100, LIC-067, LIC-098, IRC-EIS-09.34]

- As part of the proposed under-excavation tests identified in the GVP (NWMO 2011b), pore-pressure measurements would be obtained in the Cobourg Formation with consideration taken as to the reliability of measurements. Pore-pressure measurements would be part of the detailed test plan developed for the under-excavation tests that are to take place in the Geoscience Room. [IRC-EIS-12.25]
- Rock creep and geophysical methods for fracture detection will be monitored by OPG/NWMO and discussed as part of future geoscience planning that will be informed by research and international studies. [IRC-EIS-12.30]
- Several of these experiments will be conducted within a geosciences niche situated within the Cobourg formation at the repository horizon. It is expected that several demonstration experiments would extend into the DGR operating phase. [H-24-26]
- All proposed verification activities would be performed within the main shaft. Proposed investigative methods are described in the geoscientific verification plan framework, although specific details regarding instrumentation, sequencing and means of taking advantage of international experience, particularly that from underground research laboratories, will be developed under a project quality plan to assure best scientific practice is followed. [H-24-28]
- Every time a *[new]* face *[will be]* exposed *[during the geological mapping, in the development of the emplacement rooms]*, a geologist will inspect it, look at their various features and note them and then document it using LiDAR and photography. [based on H-24-32]
- As part of the characterization of the excavation damage zone in the lateral development identified in the GVP, relative humidity would be monitored. Monitoring of relative humidity would be part of the detailed test plan/procedures. [IRC-EIS-12.27]
- In terms of timing, all geoscientific verification activities will be coordinated with the construction schedule for vertical and lateral DGR development. This will need to consider: i) construction progress in gaining shaft access to the nine proposed horizons (i.e., Salina (F, C, A2 and A1 Units), Cabot Head, Queenston, Georgian Bay, Blue Mountain and Cobourg formations (NWMO 2011b, Table 2.2)); and ii) the necessity to obtain verification results as early as achievable to support design verification and preparation of an operating licence application. [IRC-EIS-07.36]
- During development, the geoscientific verification plan will be executed and the performance of the contractor monitored. The requirements of the verification plan will be integrated into the contractor's schedule as routine mapping and periodic monitoring equipment installations are required. [IRC-LPSC-02.12]
- DGR technical reports would be made available *[to the CNSC]* as they are issued. [based on H-24-30]
- If results *[from the geoscientific verification activities]* are better or worse than what was expected, OPG would test those because an individual data point may, by itself, not be significant, and the test needs to be done within the context of the overall analysis. OPG would review the results within the project based on their confidence in that particular data point, the nature of the conclusions. OPG would have a regular contact with the CNSC and would share the results with the CNSC staff at that point. [H-24-29]

MON-G-10. OPG will, prior to operations and to the satisfaction of the CNSC, augment the Geoscientific Verification Plan to provide additional gas generation modelling for the decommissioned DGR and to include modelling of gas generation from decommissioning waste in a manner that will ensure there will be timely information available for the design and implementation of the mitigation measures associated with reduction of gas generation. [based on CEAA 14.3]

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and

TABLE A1: GEOLOGY DETAILED COMMITMENTS
6) - 7) Intermediate Bedrock Water Quality / Solute Transport **8) - 9) Deep Bedrock Water Quality / Solute Transport**
H-17-05] • See detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments [Note: Additional details on the above monitoring are provided in Table 2, Table 3a and Table 4b, of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A2: HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS
Valued Ecosystem Components
1) Surface Water Quantity and Flow 2) Surface Water Quality

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

1) Surface Water Quantity and Flow

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-H-01. OPG will, during all preclosure phases and to the satisfaction of the CNSC, establish and maintain a stormwater management system, including a stormwater management pond, to collect all discharge from the waste rock management area and runoff from the Project site, and to manage water quality downstream of the Project site. [based on CEAA 3.1]

- Stormwater Management Pond Design:
  - The stormwater management pond will be constructed as part of site preparation activities, and the site graded to capture all stormwater collected on the site, and directed it to the stormwater management pond. [IRC-EIS-08.14, IRC-EIS-09.37, IRC-EIS-09.39]
  - The pond will have a maximum storage volume of about 10,000 m^3 which is the air volume between the permanent pool of water at base of pond and the crest of the weir. During the 6-hour, 25-mm storm event, rainfall run-off and construction water will flow into the pond. The rate of water inflow due to these two sources of water will exceed the discharge capacity of the discharge pipe. Thus most of water inflow during the storm event will be contained in the storage volume until discharged through the discharge pipe. [IRC-LPSC-01.34]
  - Treatment for suspended solids concentrations will be achieved by the provision of retention and a permanent pool in the SWMP. [IRC-EIS-04.15]
  - The retention pond will be designed so that it is never dry and will have body of water that is permanently stored in the pond. It will be designed to retain runoff from 6-hour, 25-mm rainfall event on a 23 Ha area for a period of 24 hours. [EAFMP-053]
  - The SWMP with its base at 177.5 metres would be excavated into till which is at an elevation of 180 metres or higher in this area based on the four boreholes drilled on the SWMP perimeter. [IRC-EIS-05.51]
  - The pond invert elevation will be set at 177 to 179 mASL (invert elevation will be confirmed with the detailed site grading plan), and thus there would be a minimum of 7 m of glacial till separating the base of the pond and the underlying bedrock aquifer. [IRC-EIS-03.06, IRC-EIS-10.09]
  - The Stormwater Management Pond (SWMP) will be constructed within an area underlain by between 0.7 to 1.5 m of surficial sand and gravel to clayey silt (fill materials) overlying at least 10 m of hard low-permeability glacial till (refer to OPG's response to Information Request IR-EIS-03-54 (OPG 2012b) and GOLDER 2012). The cohesionless surficial fill materials within the footprint of the SWMP will be removed as part of site preparation activities. The SWMP will be excavated into this thick glacial till unit and the till will serve as a natural liner for the pond. The pond side walls will be lined, as required, to limit lateral seepage into any surrounding permeable overburden that overlies the till. [based on IRC-EIS-05.22, IRC-EIS-12.03, IRC-LPSC-01.35]
  - During the construction phase, the water in the SWMP will include surface runoff and water pumped from the underground construction areas (i.e., groundwater infiltration and process water from drill and blast). During operations, water from the SWMP will include surface runoff and water pumped from the underground repository (i.e., groundwater infiltration). [IRC-EIS-07.13]
  - The final detailed project design will ensure that runoff from the DGR Project site and the Waste Rock Management Area (WRMA) is managed by the stormwater management pond (SWMP) and will not measurably affect inflows (runoff) to the wetland in the northeast portion of the Project Area. [IRC-EIS-09.44, IRC-EIS-10.08]
  - Dewatering flows and stormwater runoff from the project site will be collected in ditches

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

1) Surface Water Quantity and Flow

around the perimeter of the site and surface facilities and discharged into the pond's sediment forebay. The forebay inlet will be appropriately graded and lined with riprap for erosion protection. The pond outlet structure will be built into an embankment at the discharge-end of the pond and will consist of an overflow weir and a discharge pipe. The overflow weir, together with the available active storage in the pond, will control pond discharges during rainfall events with return periods of 2 to 100 years. The discharge pipe will control low flow discharges from the pond and ensure a minimum retention time for the settling out of suspended solids. In the event that Certificate of Approval criteria are exceeded in the discharge (e.g. increased total suspended solids – TSS), the valve on the discharge pipe can be closed discontinuing discharge. The pond outlet structure will be appropriately graded and lined with riprap for erosion protection. [IRC-LPSC-01.36, IRC-LPSC-01.33, EAFMP-054, EAFMP-055]

- The preliminary grading represented in the response to *Undertaking #12 from the July 18, 2012 Technical Information Session (TIS) #1* was completed to incorporate information collected as part of the 2011 geotechnical investigations, assess impacts of collar height on the stormwater ditch grades and cut-and-fill balances, prepare preliminary site services layouts (e.g. storm and sanitary sewer, fire and service water, electrical) in the shaft and facilities area, and assess perimeter ditch and stormwater management pond inlet elevations to verify gravity flow conditions. Preliminary cut-and-fill estimates were developed to better understand the phasing of site grading, estimate engineered fill requirements, and included the incorporation of material excavated as part of the shaft excavations. This information will need to be further refined as key features, such as the stormwater management pond (SWMP) are finalized through detailed design. [UT-H3-01]
- The detailed SWMP design will be finalized to ensure that there will be no measurable loss of wetland habitat. [IRC-EIS-10.08]
- Additional details on stormwater management are provided in Section 9.3.2 of PSR. [LIC-071]

- Drainage Ditches Design:
  - The stormwater management ditches will be constructed as part of site preparation activities, and the site graded to capture all stormwater collected on the site, and directed it to the stormwater management pond. During operations, the ditch system will be maintained and impervious surfaces will continue to drain to the stormwater system. [IRC-EIS-08.14, IRC-EIS-09.37, IRC-LPSC-01.91]
  - The surface facilities are surrounded by a stormwater ditch, so in the event of a discharge pipe failure, the discharge will be collected in the ditch system and gravity drained to the stormwater management pond. Over-topping of the stormwater ditches will not occur as the ditches are sized to accommodate significantly larger flows associated with storm events than will be pumped from the repository. [UT-H2-01]
  - Stormwater runoff from the 'built' area of the DGR and the Waste Rock Management Area (WRMA) will be collected in a network of vegetated, trapezoidal drainage ditches with widths in the 9 m to 17 m range. Drawing H333000-WP404-10-042-0001 (waste rock management area- site grading and drainage *in PSR, Chapter 17*) is used as a reference. [based on LIC-137, LIC-071 (Section 9.2.2 of PSR)]
  - During the site preparation and construction phase, there will be no activity that would disturb Stream C sediments and few activities that would disturb sediments in the existing ditches. [UT-02-04]
  - There will be no changes in flow in the South Railway Ditch from the DGR Project. [IRC-EIS-12.02]
  - The *[drainage]* ditch *[at the Interconnecting Road]* will be modified in accordance with

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

1) Surface Water Quantity and Flow

accepted practices (e.g., Ministry of Transportation drainage management manual [MTO 1997]), and undergo regular maintenance if current ditch conditions cannot convey the predicted flows (e.g., control of unwanted vegetation) (*NWMO 2013*). [IRC-EIS-12.05]

- Potential surface flooding *[of the DGR site]* (from Stream C) will be mitigated with proper engineering design. [EA-144, LIC-165 (Rec #56)]
- If necessary, improvements will be made to the existing drainage network downstream of the stormwater management pond discharge location to ensure unobstructed flow of water to Lake Huron (via MacPherson Bay). For the drainage ditch under Interconnecting Road, the channel capacity should be evaluated during detailed design to ensure that the ditch can properly convey the expected flows from the stormwater management pond. [EA-037, EA-220, H-13-09, IRC-EIS-12.01, IRC-EIS-12.06, LIC-136, IRC-EIS-07.09]
- Additional details on the drainage system are provided in Section 9.3.2 of PSR. [LIC-071]

MIT-H-02. OPG will, during site preparation and construction and to the satisfaction of the CNSC, place a liner under the stormwater management pond. [based on CEAA 11.1]

- The DGR design will consider the native soils underlying the stormwater management pond, which have a low permeability. [based on EIS, Table 13-1 (OPG 2011a)]

MIT-H-03. OPG will, over the life of the project and to the satisfaction of the CNSC and in order to support the design of the stormwater management system, calibrate and verify hydrological and water quality models with new information as it becomes available, including but not limited to, leachate geochemistry and flow rates. The models should be calibrated and verified prior to site preparation, at the end of construction, and periodically during operations and decommissioning and be used to support the design and operation of the stormwater management system. [based on CEAA 3.5]

MIT-H-04. OPG will, to the satisfaction of the CNSC, review and, if necessary, revise the design of the stormwater management system, based on an assessment of the likelihood of significant changes in the return period and magnitude of major storm events. [based on CEAA 3.6, H-14-02, IRC-EIS-04.09, LIC-165 (Rec #14)]

MIT-H-05. OPG will, prior to construction, develop and regularly update, to the satisfaction of the CNSC, a climate change strategy that [based on CEAA 14.1]:

[CEAA] 14.1.1. incorporates the results of up-to-date climate change models;
[CEAA] 14.1.2. analyses how the environment may affect the Designated Project; and
[CEAA] 14.1.3. identifies any changes to project implementation or mitigation required in light of those analyses.

MIT-H-06. OPG will, to the satisfaction of the CNSC, use the results of the climate change strategy to inform the understanding of probable maximum precipitation events and, if required, adjust design elements including the storm water management system. [based on CEAA 14.2, LIC-138, LIC-165 (Rec #28)]

MIT-H-07. OPG will, prior to construction and to the satisfaction of the CNSC, submit a management plan that provides a detailed description of the options available to increase the capacity of the drainage ditch at Interconnecting Road in the event the flow exceeds the capacity of the ditch, in order to avoid adverse effects on nearshore habitat in MacPherson Bay. The plan shall identify the relative potential effects of each of the options on the ecology of MacPherson Bay, and consider the relative effects when selecting and implementing the preferred option. [based on CEAA 4.5]

MIT-H-08. The shaft liner is designed with the objective to operate as a dry facility, with little to no seepage through the shaft lining *[to avoid the groundwater inflow following construction]*, and therefore less water to manage in the stormwater management system. [based on EIS, Table 13-1 (OPG 2011a)]

- Shaft liner design will minimize the amount of groundwater seepage into the shaft, thus minimizing

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

1) Surface Water Quantity and Flow

sump discharge. [based on IRC-EIS-05.09]

- The upper permeable formations will be contained by the shaft liner, and also the possible installation of a grout curtain. This liner will be inspected and maintained. [LIC-057, IRC-EIS-08.42]
- The concrete shaft liners will be designed as plain concrete structures without reinforcing and will be designed according to Section 22 of CAN3-A23.3-04. [IRC-LPSC-01.10]
- The two circular shaft liners will be poured directly against supported rock (refer to response to IR-LPSC-01-32 *[OPG 2012a]* for preliminary rock support requirements during shaft development). The liners will resist loadings in compression. It is expected the shaft liners will have a minimum thickness of 300 mm, with varying thickness of the liners to resist varying hydrostatic and rock loading conditions. The liners will be constructed as a hydrostatic liner in the upper 200 m of the shafts where rock formations are relatively permeable. [IRC-LPSC-01.11, IRC-LPSC-01.54]
- Geomechanical modeling of the shaft excavations are being completed to estimate rock loading over the full depth of the shafts and to estimate how this loading will vary with time. The modeling is iterative with the liner design and will be used to assess impact of dimensional requirements and construction assumptions for shaft development (e.g., excavated diameter, length of the development round, distance the shaft liner trails the shaft sinking face, etc.) on predicted rock loading. [IRC-LPSC-01.12, IRC-LPSC-01.55]
- These basic load cases will be combined into several load combinations as per 2010 NBCC. Two ANSYS models (one circle ring model simulating of the concrete liner based on plane strain theory, one 3D cylinder model) will be created and analyzed under each load combination. The analysis will identify which parts of the liner exceed the allowable compression and tensile stresses. The liner will be designed against buckling and compression failure under the external load combinations. Elastic mechanics theory will be used to determine the minimum liner thickness to prevent buckling. It is anticipated that the concrete shaft liner will be unreinforced for both the hydrostatic portion of the liner in the Devonian and the Upper Silurian formations above 195 mbgs and the fully drained (leaky) liner below this stratum. [IRC-LPSC-01.13]
- All shaft sections analyzed will be verified using numerical analysis for loading on the liner as well as the changes in stresses in the surrounding rock. Shaft liner loads resulting from the above shaft liner/ground interaction analyses will be used as an input to the structural design of the shaft liner. [IRC-LPSC-01.14]
- There will be a series of ground control measures applied over the length of the shaft. [IRC-LPSC-01.96]

Additional mitigation measures:

MIT-H-09. OPG will, before the stormwater management system is fully functional and to the satisfaction of the CNSC, prepare a contingency plan to mitigate effects of severe storm-related uncontrolled overland flow to Stream C, Baie de Doré, and MacPherson Bay during site preparation. [based on CEAA 3.7]

MIT-H-10. OPG will, during site preparation and to the satisfaction of the CNSC, develop and implement a follow-up program for flow reduction rates in the North Railway Ditch and Stream C that includes the identification of mitigation measures that shall be implemented, if necessary, to address adverse effects on surface water quantity. [based on CEAA 4.3, LIC-165 (Rec #9)]

MIT-H-11. OPG will, prior to beginning construction of the stormwater management system and to the satisfaction of the CNSC, verify that the overburden stratigraphy at the site is the same as predicted in the EIS. If unexpected, higher permeability, stratigraphy is encountered, OPG will assess the potential effect on water levels in the northeast marsh and evaluate and implement mitigation options to the satisfaction of the CNSC. [based on CEAA 9.6, LIC-165 (Rec #35)]

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

1) Surface Water Quantity and Flow

the public and the workers. [based on EA-056, H-16-02]

- See detailed commitments associated with MIT-H-19 under the Surface Water Quality VC.

[Note: Additional details on monitoring groundwater levels to verify that project activities do not affect the marsh habitat are provided in Table A1, Geology Detailed Commitments (Shallow Bedrock Groundwater and Solute Transport VC), and in Table A4, Aquatic Environment Detailed Commitments.]

MONITORING COMMITMENTS:

MON-H-01. The stormwater management pond discharge volume will be measured weekly, averaged monthly and recorded as part of the conventional regulatory monitoring program. The flow rates will be recorded and compared with the predicted increase in flow in the drainage ditch at Interconnecting Road calculated in the Hydrology and Surface Water Quality TSD. [EAFMP-009]

- Baseline SWMP discharge flow rate values will be recorded *[in the drainage ditch at the Interconnecting Road near SWMP outlet and in the North Railway Ditch]* for one year prior to the site preparation and construction phase. [based on EAFMP-010, IRC-EIS-09.45, H-24-09]
- Since the highest flows are predicted for the site preparation and construction phase, the follow-up monitoring will be concluded after three years of monitoring. The SWMP discharge flow rates will continue to be monitored only if required under the regulatory monitoring program. [based on EAFMP-010, IRC-EIS-09.45, H-24-09]

MON-H-02. Quarterly (seasonal) flow monitoring of the North Railway Ditch will be conducted at the south eastern Project Area boundary *[to ensure that there are no significant changes to stream flow at Stream C as a result of the project]*. Flow will also be measured during or immediately following two major storm events each year to confirm that the effect of reduced flow in the North Railway Ditch is not significant. *[Baseline]* flow data will be collected for one year prior to the start of site preparation and construction, and *[follow-up monitoring data will be collected]* for a minimum of three years after the start of site preparation and construction *[to confirm the assumptions made in the EA]*. [based on EAFMP-011, IRC-EIS-07.16, IRC-EIS-09.46, LIC-165 (Rec #9)]

MON-H-03. OPG will, to the satisfaction of the CNSC, implement a follow-up program to monitor water levels in the northeast marsh:

[CEAA] 9.5.1. monthly for a period of one year prior to site preparation and construction to establish baseline levels; and

[CEAA] 9.5.2. weekly during the site preparation and construction phase. [based on CEAA 9.5, IRC-EIS-09.17, IRC-EIS-10.11, LIC-165 (Rec #37.1)]

- Monitoring of the on-site marsh will be conducted for confirmation that excavation of underground facilities does not dewater marsh habitat utilized by burrowing crayfish; the groundwater levels will be compared with a water level gauge located in the marsh to determine if there is any effect on water levels. [based on EA-192, EA-169, EAFMP-028, H-24-11]
- Although no effects on the northeast marsh were predicted, water levels in the marsh will be monitored for one year prior to site preparation and construction to establish baseline, and after the shaft liner has been installed monitoring will continue to verify that there are no effects. If an impact is observed, mitigation will be considered and monitoring will continue until the marsh has been deemed to have satisfactorily recovered. [H-17-11, EAFMP-029]

MON-H-04. Groundwater levels will be monitored in the shallow groundwater well closest to the marsh to determine water table fluctuations. [EAFMP-030]

- Groundwater levels in the closest monitoring well will be monitored and compared with water level gauge located in the marsh to determine if there are any effects for three years following site

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

1) Surface Water Quantity and Flow

preparation and construction [based on EIS, Table 13-1 (OPG 2011a)]

- Although the till underlying the DGR site is expected to prevent any shallow groundwater flow to the wetland, the shallow groundwater monitoring well network will also be capable of detecting changes resulting from site activities and changes to the water table near the marsh in the northeast portion of the Project Area (NWMO 2011a, Section 3.1). [IRC-EIS-05.08]
- If the surface water monitoring program and groundwater level monitoring program, when compared to daily precipitation data, indicate that the wetland water levels may be dropping as a direct result of the shaft dewatering, mitigation measures will be implemented (e.g., a temporary water supply to the marsh). [EAFMP-059]

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

- See detailed commitments associated with MON-H-15 under the Surface Water Quality VC.

[Note: Additional details on the above monitoring are provided in Table 2, Table 3a, Table 3b, and Table 6 of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

2) Surface Water Quality

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-H-12. The DGR Project will not discharge to the North and South Railway Ditches, Stream C or Baie du Doré. [IRC-EIS-07.12, EA-115, EA-262, IRC-EIS-01.11, IRC-EIS-07.10, IRC-EIS-07.11, IRC-EIS-07.15, IRC-EIS-07.17, IRC-EIS-07.20, IRC-EIS-07.21, IRC-EIS-07.24, IRC-EIS-07.26, IRC-EIS-12.16, and in EIS, Table 13-1 (OPG 2011a)]

- As there will be no surface water discharges from the project to Stream C, and only a slight decrease (0.8%) in runoff, changes in surface water should have no measurable effect in temperature. [IRC-EIS-07.15, EA-115, EA-262, IRC-EIS-01.11, IRC-EIS-07.10, IRC-EIS-07.11, IRC-EIS-07.12, IRC-EIS-07.17, IRC-EIS-07.20, IRC-EIS-07.21, IRC-EIS-07.24, IRC-EIS-07.26, IRC-EIS-12.16]
- A diversion of site surface water runoff from the Stream C catchment will be implemented to avoid the discharge of any stormwater from the DGR Project site into the more sensitive coldwater habitat of the Stream C watershed and to ensure the treatment of all the drainage from the DGR Project in a stormwater management pond, prior to discharge to ditches that lead to MacPherson Bay. No releases from the site will be directed to the Stream C watershed. [IRC-EIS-01.11, EA-115, EA-262, IRC-EIS-07.10, IRC-EIS-07.11, IRC-EIS-07.12, IRC-EIS-07.15, IRC-EIS-07.17, IRC-EIS-07.20, IRC-EIS-07.21, IRC-EIS-07.24, IRC-EIS-07.26, IRC-EIS-12.16]

MIT-H-13. All stormwater runoff from the DGR Project site, including the WRMA, will be collected in drainage ditches that flow into the stormwater management pond. The key design features to control contaminant concentrations in the stormwater discharge include:

  - all surface water (including the shaft sump discharge) from the site will drain to the SWMP via a perimeter ditch system for a single point of discharge from the site;
  - vegetated perimeter ditches for the DGR site to control sediment loading;
  - SWMP design will control sediment and suspended solids;
  - an oil/water separator (e.g., stormceptor) will control hydrocarbon releases, Total Suspended Solids (TSS), and metals associated with TSS;
  - SWMP discharge is conveyed through approximately 1 km of vegetated drainage ditch prior to discharge to MacPherson Bay. [based on EIS, Table 13-1 (OPG 2011a) and IRC-EIS-05.09, EA-112, H-24-36, IRC-EIS-04.17, IRC-EIS-05.07, IRC-EIS-05.34, IRC-EIS-07.13, IRC-EIS-08.39, IRC-EIS-12.17, IRC-EIS-12.15]

- Same in-design mitigation commitments as shown under commitment MIT-H-01, Surface Water Quantity and Flow VC.
- During construction, a temporary settling pond will be used to settle out any excess solids in water pumped from underground before discharge into the ditch system leading to the SWMP. [IRC-EIS-12.18]
  - The contractor(s) for shaft sinking and lateral development will be required to have a portable *[water]* treatment plant available on site. It will be available for rapid deployment in the event that oil, grease or suspended solids in process water (i.e., water used for drilling and dust suppression) have elevated concentrations and cannot be effectively treated by the installed systems. [IRC-EIS-09.43]
  - A temporary water treatment plant, provided by the selected contractor, will be located in the vicinity of the shafts to receive water pumped from underground in the event there are abnormally high concentrations of oil, grease and/or grit in the water. It, however, will not be used to treat water in the stormwater management pond in the unlikely event contaminant concentrations in the water exceed the discharge limits established through the permitting

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

2) Surface Water Quality

process for the DGR Project. [EA-044, H-13-05, H-13-14, IRC-LPSC-01.31, IRC-LPSC-04.02]

- This weekly inspection will also occur in the temporary settling pond during construction. If the results of this weekly inspection show there is excessive amounts of oil and grease being routinely released into the water, then steps will be taken to eliminate the source of this oil and grease. If the source of oil and grease cannot be eliminated then treatment with the temporary water treatment plant will be implemented. The frequency of this monitoring could be increased if oil and grease is shown to be an ongoing concern. In the event that the Total Suspended Solids (TSS) concentration in the discharge water from the SWMP is found above acceptable levels and the elevated TSS is due to excessive solids in water being pumped from underground, then the temporary water treatment plant will be put into use. [IRC-EIS-04.18]
- This *[pre-treatment of total suspended solids during construction, if needed]* is one of the items that will have as part of our contracting strategy going into the selection of the shaft sinking contractor and the lateral development contractor to have these contingency options identified. [H-13-07]
- And in the event that they do not have one *[readily available system to pre-treat the total suspended solids]*, then the accommodations will be for a contingency option to have one sourced and available. [H-13-08]

- Generally accepted Best Management Practices during construction will be used to minimize the transfer of soils from the DGR Project site to natural features within the Project Area and Site Study Area, including the installation and monitoring of a silt management fence. [based on IRC-EIS-08.16, EA-039, EA-267, IRC-EIS-05.32, IRC-EIS-08.13, IRC-EIS-09.36]

Additional mitigation measures:

MIT-H-14. OPG will, prior to construction, submit to the CNSC a plan for treatment of all water destined for discharge from the stormwater management pond. OPG will, throughout construction, operations and decommissioning and to the satisfaction of the CNSC, treat stormwater management pond releases to ensure compliance with section 36 of the *Fisheries Act*. [based on CEAA 3.2, LIC-165 (Rec #25)]

MIT-H-15. Water sampling and testing is proposed to confirm that all water released from the DGR Project site via the stormwater management pond has concentration levels below certificate of approval discharge criteria. [EIS, Table 13-1 (OPG 2011a), EA-097, IRC-LPSC-04.40]

- *[Preliminary water quality modelling was performed as part of the design of the Stormwater Management Pond (SWMP) and the modeling has identified potential water quality issues related to: a) nitrogen compounds from blasting residues; and b) salinity from the groundwater entering the shafts at two discreet locations.]* Going forward, these potential water quality issues will be addressed through source reduction or elimination. Specifically to manage nitrogen compounds in SWMP discharge, use of emulsion explosives will be maximized and best-blasting practices will be implemented so as to minimize the amount of blast residue on the waste rock. To manage salinity, the Salina A1 and Guelph formations will be grouted to reduce or eliminate saline groundwater inflow from these formations into the two shafts and ultimately to the SWMP (see OPG's response to Information Request EIS-04-130 (OPG 2012d)). [IRC-EIS-09.41, IRC-EIS-04.13, IRC-EIS-05.25]
- Several options, largely related to source reduction or elimination, will be explored to ensure the concentrations of salinity and nitrogen compounds are below acceptable levels in the SWMP discharge. [IRC-EIS-04.12]
- Same in-design mitigation commitments for waste rock management, as shown under commitment MIT-G-02, associated with Soil Quality VC.

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

2) Surface Water Quality

MIT-H-16. Flow from the SWMP can be stopped if criteria are not met. [EIS, Table 13-1 (OPG 2011a)]

- OPG will obtain a Certificate of Approval for the stormwater management pond. Effluent from the stormwater management pond will be analyzed. In the event that contaminant levels exceed certificate of approval discharge criteria, effluent will not be released until discharge criteria are met. [IRC-EIS-02.01, IRC-EIS-04.07, H-13-06, H-24-16, H-23-13, EA-193, EAFMP-026]
- In the event that a noticeable oil sheen, foam or deleterious substance is noted, the discharge will be closed until the substances can be skimmed off the surface *[of the SWMP]*. [EAFMP-051]
- If exceedances of the *[certificate of approval]* discharge criteria are detected, the SWMP outlet will be closed. Treatment will be applied as appropriate. SWMP water will be tested prior to release to confirm that the treatment is effective and that the discharge criteria are achieved. Daily samples will be collected and analyzed for the first week. Provided there are no exceedances, sampling will revert to the normal frequency. The type of treatment will depend on the parameters that exceed the discharge criteria. In the event that total suspended solids concentrations exceed the discharge criteria, additional mitigation measures such as additional sediment, erosion and dust control measures can be implemented where appropriate. [EAFMP-050, EA-002, EA-113, EA-114, EA-116, EA-159, EA-163, EA-164, EA-211, EA-214, EA-221, EA-222, EA-223, IRC-EIS-04.16, IRC-EIS-05.30, IRC-LPSC-01.90]
- A spill to one of the on-site ditches would be collected, and directed via the stormwater management ditches to the stormwater management pond where it can be held until it is determined that it is suitable for discharge. [EA-230]
- Water treatment will be employed in the drainage system upstream of the stormwater management pond for the duration of the site preparation and construction phase, and possibly the first two years of operations depending on monitoring results. In the unlikely event that monitoring detects concentrations exceeding established limits, it is possible to close the gate at the discharge location, thereby containing the contaminated water. Appropriate actions would then be taken to treat the water so that it could be safely discharged from the pond. [EA-016]

MIT-H-17. OPG will maintain the drainage network and the SWMP on the DGR site and the drainage system downstream on the Bruce nuclear site. [based on IRC-EIS-04.19]

- The maintenance program will consist of the following:
  - Regular inspections of the stormwater management system. Weekly inspection are proposed during site preparation and construction, and monthly inspection during operations. The system will also be inspected after significant runoff events. Inspections will be conducted to:
    - check for trash, debris and sediment buildup in the drainage network and pond;
    - monitor the erosion of channels, embankments and the pond shoreline;
    - check the level of the permanent pool in the pond;
    - check for unwanted vegetation growth and algal blooms in the drainage ditches and pond;
    - check for a sheen, frothiness and discoloration of the water in the pond; and
    - confirm the health of plantings around the pond shoreline.

    Corrective maintenance will be carried out should any significant issues, with respect to the proper function of the stormwater management system, be identified during regular inspections.
  - Routine monitoring of the water quality, water level and sediment depth in the SWMP to ensure that the system is operating as designed.
  - Regular maintenance of the sewerage system including:
    - cleaning of catch basins, sewers lines and manholes;

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

2) Surface Water Quality

- inspection of sewer lines by visual or camera techniques; and
- repair or replacement of damaged catchbasins, pipes and manholes.

– Regular maintenance of the drainage ditches and culvert crossings including:

- removal of trash, debris and accumulated sediment;
- control of unwanted vegetation growth;
- replanting of grass lining in channels; and
- repairs to channels and culvert pipes and embankments.

– Regular maintenance of the SWMP including:

- removal of floating trash and debris from the pond surface;
- drainage of the permanent pool and removal of accumulated sediment;
- handling of algal blooms in the pond should these occur;
- addition of makeup water to the permanent pool if the water surface falls below the normal water level;
- control of unwanted vegetation growth and replanting of desired vegetation around the pond perimeter;
- embankment and shoreline repairs;
- removal of trash, debris and plugged ice from the inlet and outlet works;
- repairs or replacement of pipe culverts, concrete structures; and
- lubrication and replacement of seals in the valve in the discharge pipe.

Sediment accumulation and clear-out frequency is being considered in the design of the SWMP. An allowance has been made for sediment accumulation in the permanent pool; this volume is sufficiently large such that the clear-out frequency will be annually, at a maximum. [based on IRC-EIS-04.19, EAFMP-007, EAFMP-008, EAFMP-031, IRC-EIS-05.12, IRC-EIS-05.33, IRC-EIS-12.04, EA-185]

- As for the ongoing operational management of the pond (i.e. removal of fines from the pond), it is expected that these materials will be retained within the project site or the Bruce nuclear site. Prior to removal, the fines will be sampled, analysed, and should there be a need, appropriate off-site waste management plans developed. [IRC-EIS-12.34]

MIT-H-18. OPG will, prior to site preparation and to the satisfaction of the CNSC, develop and implement a detailed spill response plan throughout all Designated Project phases. Containment methods, locations and strategies set out in the plan shall be designed and implemented in a manner that will enable spill mitigation to be deployed in time to prevent downstream effects. [based on CEAA 13.3, LIC-165 (Rec #27)]

- Measures for spill containment, spill emergency response and environmental protection will be in place before any potentially hazardous materials are brought on-site. [EA-150, EA-233]

  – The environmental management plan will include the site spills and release response plan. An environmental management plan will be in place for the site preparation and construction phase *[described in Section 4 of EIS]*. This plan will include the site spills and release response plan. [based on EA-157, EA-073, EA-152, H-08-10]

  – Any spills would be responded to quickly. [EA-232]

  – To mitigate the effects of spills, appropriately equipped and trained on-site spills response teams will be available at all times as part of emergency response programs. For example, a spill of diesel fuel would be mitigated by quickly assessing the situation for any immediate health and safety risks to the spills response team, on-site workers and the public by controlling the source of the spill and notifying the appropriate regulatory agencies, deploying containment booms to surround and contain the spill, and finally, by implementing an effective clean-up program that would likely involve the use of specialized equipment to pump the diesel fuel into secure containers. [EA-231, EA-149, EAFMP-065]

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

2) Surface Water Quality

  - Spills management and response for the WWMF, or equivalent, will be extended to the DGR Project. [EA-156]

- Surface diesel and unleaded fuel storage for mobile equipment is limited to the site preparation and construction phase, and will be removed prior to operations with the exception of the emergency diesel generator fuel storage. [EA-026, LIC-014, IRC-EIS-07.01]

- The storage tank will be located on a concrete pad which drains to a sump and all releases will be contained. [IRC-EIS-07.04]

- Berms will be constructed as needed to ensure that any spillage of fuel or lubricant will be retained within the storage and refuelling areas. [EA-028, IRC-EIS-07.02, IRC-EIS-09.38]

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

- Environmental protection policies, programs and procedures will be established and will meet the requirements of *[the following documents]* [EA-061]:

  - OPG Environment Policy OPG-POL-0021;

  - Biodiversity Policy OPG-POL-0002;
    [Note: This policy has been replaced by OPG Biodiversity Management OPG-STD-0119, under OPG's current Environment Policy, OPG-POL-0021.]

  - Land Assessment and Remediation Policy OPG-POL-0016;
    [Note: This policy has been replaced by Contaminated Lands and Groundwater Management N-PROC-OP-0044, under OPG's current Environment Policy, OPG-POL-0021.]

  - Spills Management Policy OPG-POL-0020;
    [Note: This policy has been replaced by Spill Management N-STD-OP-0026, under OPG's current Environment Policy, OPG-POL-0021.] and

  - Policy for the Use of Ozone Depleting Substances OPG-POL-0015.
    [Note: This policy has been replaced by Environmental Requirements for Air Conditioning and Refrigeration Equipment N-PROC-OP-0046, under OPG's current Environment Policy, OPG-POL-0021.]

- During the operations phase, environmental policies, programs and procedures will be implemented consistent with the requirements of OPG's existing Environmental Policy (OPG POL-0021) and Spills Management Policy (OPG-POL-0020). [based on EA-157, EA-073, EA-152, H-08-10, LIC-072 (Section 10.3 of PSR), LIC-090]
  [Note: The Spills Management Policy (OPG-POL-0020) has been replaced by Spill Management N-STD-OP-0026, under OPG's current Environment Policy, OPG-POL-0021.]

- Execution of the environmental protection program will be accomplished through an integrated set of documented activities, typical of an Environmental Management System. It will be consistent with the CNSC Standard S-296 and the International Organization for Standardization (ISO) standard 14001, and will meet the requirements of OPG's Environmental, Health and Safety Management Program *W*-PROG-ES-0001. [EA-062, EA-094, EAFMP-003]
  [Note: OPG's Environmental, Health and Safety Management Program W-PROG-ES-0001 has been replaced by OPG's Environmental Policy, OPG-POL-0021. It is also noted that CNSC Standard S-296 has been superceded by CNSC REGDOC-2.9.1.]

- OPG will ensure that all of the applicable requirements of these Acts *[Environmental Protection and the Ontario Water Resources Act]* will be met. There are other requirements that OPG will implement for the project, as they are applicable to project activities, such as the mining regulations. [H-23-12, IRC-LPSC-01.99]

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

2) Surface Water Quality

- As part of the Environmental Management System, an environmental monitoring program will be implemented for the DGR Project. The monitoring plan will address radiological contaminants, chemical contaminants and physical stressors that may present a risk to either human health or non-human biota. [EA-063]
  - Environmental management of the DGR Project will be done in accordance with NWMO's DGR Project Environmental Management Plan (EMP) (DGR-PLAN-07002-1001) which is part of the NWMO's ISO 14001 (Environmental Management System Requirements) registered environmental management system. This plan will be reviewed and modified as necessary, prior to start of the site preparation and construction activities. [IRC-LPSC-04.21, IRC-EIS-08.21, H-17-34, H-24-04]
  - An environmental management plan will be implemented for site preparation and construction to control environmental effects associated with above-ground construction activities. [based on EA-031, EA-093, H-24-07, H-24-08, H-25-18, IRC-LPSC-04.22]
  - With respect to the environment, the DGR Project environmental management plan will further describe roles, responsibilities and accountabilities for the execution of work. These areas would be registered/certified to the ISO 14001 standard, and will be externally audited for compliance. Event identification, notification and follow-up requirements and accountabilities will be detailed in the plans and associated procedures. [based on IRC-EIS-05.43, H-08-01, H-18-10, IRC-EIS-05.44, IRC-LPSC-01.106]
- Action level criteria will be developed as part of the Data Quality Objectives in the detailed sampling plans as per the DGR EA Follow-up Monitoring Program and in accordance with CSA N288.4-10. [Table 1 (note) in IRC-EIS-09.09]
- Waste minimization and recycling:
  - Construction materials will be re-used or recycled, if possible. [EA-038]
- An assessment of the annual performance of the EA follow-up monitoring program will be completed in conjunction with the preparation of the annual report for the site preparation and construction phase follow-up monitoring, as well as during the operations phase. The annual assessment will identify the effectiveness of the existing follow-up monitoring program design and identify any problems and gaps. It will be conducted by the person(s) responsible for the operation of the Environmental Management System (EMS). All aspects of the program assessment will be documented and incorporated into the EMP records. [EAFMP-069, EAFMP-001, IRC-EIS-04.21, IRC-EIS-06.24, IRC-EIS-07.27, IRC-EIS-08.19, IRC-EIS-08.20, IRC-EIS-09.10, H-25-10]
  - The *[Environmental Management]* program will typically be reviewed by a team of qualified persons of various expertise involved with different aspects of the EA Follow-up Program (i.e., program coordinator, manager of engineering, QA/QC auditor). Assessment tools, such as a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis, will typically be used to assess the program. The analysis of opportunities, weaknesses and threats will assist in the identification of potential program gaps. The identified gaps would be addressed by considering possible improvements or recommendations for improvement. [IRC-EIS-09.11]
  - Typically the recommendations will be analyzed using a decision making tool such as a Force Field Analysis. A report will be prepared based on the analysis, and recommendations and improvements will be tracked through the EMS *[Environmental Management System]*. [IRC-EIS-09.12]
  - Any environmental events or incidents that occur will also be identified as a nonconformance under the EMS. Events will include any event that results in the implementation of a contingency plan, accidents and spills, but can also include exceedances to criteria and unpredicted trends and effects. Through the EMS *[Environmental Management System]*, these events will be identified as 'nonconformance events', and will cause the development

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

2) Surface Water Quality

and implementation of a corrective or preventative action. [IRC-EIS-09.13]

- Conformance with the NWMO ISO 14001 EMS, and CSA N288.4-10 standard will ensure that the annual assessment of the program will contribute timely and effective feedback and will allow changes to be made to the *[Environmental Management]* program. [IRC-EIS-09.14, IRC-EIS-09.15]

- A program evaluation of the core components of the EA follow-up and EMP programs will be conducted once every five years, and once during each project phase, at a minimum in accordance with CSA N288.4-10. [EAFMP-070, EAFMP-002]

[Note: Additional details on the above mitigation measures are provided in Table 3a, Table 3b, Table 4a, and Table 4b of the EA Follow-up Monitoring Program (NWMO 2011a).]

MONITORING COMMITMENTS:

MON-H-05. OPG will, prior to construction and to the satisfaction of the CNSC, improve the characterization of the leachate that will be generated by the waste rock piles, by performing kinetic leach tests on existing dolostone, shale and limestone core samples. During shaft excavation OPG will conduct field cell studies on the material being deposited in the dolostone, shale and limestone waste rock piles to verify leachate compositions and the acid generation potential under prevailing conditions. [based on CEAA 12.1, LIC-165 (Rec #33, Rec #64)]

MON-H-06. OPG will, prior to construction and to the satisfaction of the CNSC, submit a waste rock characterization program for the duration of construction that will include sampling of full-strength leachates to examine contaminants of concern other than those linked to acid generating potential (including, but not limited to metals and metalloids released under alkaline conditions, total dissolved solids and hydrocarbons). [based on CEAA 12.2, LIC-165 (Rec #24, Rec #32, Rec #33)]

- Waste rock testing will include elemental composition (by aqua regia digestion and XRF), acid-base accounting, and short-term leach testing (modified from ASTM D3987 for a 4:1 water to rock ratio). [IRC-EIS-04.42]

- As the waste rock pile will develop slowly during the first year while the shafts are being excavated, a reasonable approach to confirm the geochemical properties and modelling predictions would be to monitor the waste shale rock as it is excavated, as well as the drainage chemistry from the WRMA. Should monitoring results indicate that the waste shale rock pile is behaving differently than suggested by the laboratory data, adjustments can be made such as removing the shale from the site, covering the shale pile earlier or changing runoff collection routing, to ensure proper mitigation and treatment. [IRC-EIS-04.40]

- The waste rock monitoring program will include collection and geochemical testing of rock samples from each major horizon during shaft sinking, at a maximum interval of 50 metres [IRC-EIS-04.41]

- Waste rock monitoring will be concurrent with surface water quality monitoring and each will complement and inform the other. Surface water samples will be submitted for laboratory analysis for metals, anions and salinity, among others, and will provide additional assurance that the waste rock and its leachate have been accurately characterized. These data will also provide information that can be used to design additional mitigation measures if required. [IRC-EIS-04.43, LIC-165 (Rec #7)]

- Because of the variability of site conditions (waste rock characteristics and seasonal variations in precipitation and runoff events), the timing and frequency of the sampling will be determined in the field to best observe and understand the characteristics of the WRMA runoff. [IRC-EIS-04.45]

- Monitoring results characterizing the initial waste rock at the repository horizon will be available before the majority of rock from this horizon is brought to surface. These rock characteristics will be used to confirm whether proposed surface water management strategies are appropriate. [IRC-

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

2) Surface Water Quality

EIS-04.47]

- The rock will be monitored throughout the construction phase as discussed in OPG's response to IR-EIS-04-160 (OPG 2012d) and the quality of water that comes into contact with the rock in the WRMA will be monitored in the construction phase and in the first few years of the operations phase. [IRC-EIS-08.45]
- To better understand the behaviour of hydrocarbons that could be present in the permanent limestone waste rock, a characterization program will be performed as the waste rock is excavated from repository. This will be incorporated into the waste rock management monitoring already described in *[OPG's response to]* IR-EIS-04-160 (OPG 2012d) and complemented by the surface water and sediment monitoring program. [UT-H5-01]
- If there is found that the leachate does exist and is of a concentration that we have to address, OPG can isolate the shale pile and implement mitigation, as required. [H-03-03, EAFMP-052]
- Most of the leachate that will be generated at the base of the waste rockpile will be collected in the drains around that engineered environment. [H-03-05]
- Monitoring of the runoffs and the leachate, will be done through monitoring of the waste rock and characterization of the waste rock which will provide a good indication of the water quality going into the ditch system. [based on H-13-10, H-13-15]

MON-H-07. OPG will, prior to construction and to the satisfaction of the CNSC, develop a waste rock follow-up program which shall be implemented throughout all preclosure phases of the Designated Project and will, based on sampling of full strength leachates, include monitoring the quantity and quality of leachate and surface runoff directed to the stormwater management system. [based on CEAA 12.3]

- OPG will collect and analyze composite water samples from the rock pile(s) during first flush events until contaminant levels in runoff appear stable or show a decreasing trend below acceptable benchmarks. [IRC-EIS-08.46]
- OPG will monitor several inputs to the stormwater management pond separately, for example, waste rock runoff, to provide early warning or potential increase to contaminant levels in the pond and provide the opportunity to implement adaptive management measures to avoid adverse effects. [H-24-17]

MON-H-08. OPG will, during all preclosure phases and to the satisfaction of the CNSC, monitor concentrations of contaminants and conduct acute and chronic toxicity tests on the discharge from the stormwater management pond. During the initial period of operation, the monitoring and testing shall be undertaken prior to any release of water from the pond. Once there is an established baseline, and with the concurrence of the CNSC, OPG will establish action levels and monitoring frequencies that would allow the pond to operate in a normal continuous discharge mode as long as the relevant parameters remained below the action levels. [based on OPG proposed revised wording to CEAA 3.3]

- Collection of surface water samples from the drainage ditch at the Interconnecting Road and from MacPherson Bay will establish a baseline for the surface water sampling program and for Environmental Compliance Approval (ECA) permit applications. [based on Table 2, EA Follow-up Monitoring Program (NWMO 2011a)]
- The discharge from the SWMP is expected to meet the criteria that will be set as part of the permitting process and to prevent adverse effects to the surface water quality of MacPherson Bay. This prediction will be verified by the surface water quality sampling program (including temperature) described in the DGR EA Follow-up Monitoring Program (NWMO 2011a, Tables 3a and 6). Since the SWMP is the only pathway for effects on surface water from the DGR Project to MacPherson Bay, this program will meet the requirement to verify the accuracy of the environmental assessment and to determine the effectiveness of the mitigation measures, as outlined in the EIS Guidelines. [IRC-EIS-07.22]

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

2) Surface Water Quality

- OPG's responses to IR-EIS-07-298 and IR-EIS-07-301 (OPG 2012i) discuss the absence of a groundwater pathway between the DGR project and Stream C, as well as the *[water level]* monitoring activities that will confirm this prediction. [IRC-EIS-08.40, H-24-37]
- EA follow-up sampling will occur for one year during operations to confirm: the predictions in the Environmental Impact Statement that the concentrations of COPCs *[contaminants of potential concern]* will peak during site preparation and construction; that the effects will be mitigated through the stormwater management system design; and that the discharge criteria are not exceeded. If data are not consistent with predictions, then further monitoring will be recommended, as part of the EA follow-up monitoring process. Note that surface water sampling will continue for the ECA throughout the operations phase as described in the EA Follow-up Monitoring Program (NWMO 2011a, Table 6, Activity C-REG-SW1) and will comply with the conditions of the approval. [IRC-EIS-05.11]

MON-H-09. OPG will, during all preclosure phases and to the satisfaction of the CNSC, implement a follow-up program to monitor a broad spectrum of parameters (e.g., metals, phosphate, total petroleum hydrocarbons) quarterly at the point of discharge of the storm water management pond. [based on CEAA 3.4, LIC-165 (Rec #30)]

- The quality of the water that comes in contact with the waste rock (both seepage water and runoff) will be monitored to determine concentrations of Contaminants of Potential Concern (COPC) that would drain to the Stormwater Management Pond (SWMP). [IRC-EIS-08.44]
- Monitoring at the Project Area discharge point (Interconnecting Road) quarterly during site preparation and construction phase, and for one year during the operations phase will confirm site discharge meets regulatory requirements and water treatment is effective. [based on EIS, Table 13-1 (OPG 2011a)]

MON-H-10. Regular scheduled monitoring (weekly inspection during construction of rail bed crossing) of the both the silt management fence and temporary construction fencing is planned to prevent fence failure through the identification of damage and direct repairs or replacement. [based on IRC-EIS-08.16, EA-039, EA-267, IRC-EIS-05.32, IRC-EIS-08.13, IRC-EIS-09.36]

MON-H-11. OPG will, prior to site preparation and to the satisfaction of the CNSC, develop and implement a follow-up program for aquatic life in the stormwater management system and the ditch at Interconnecting Road. The program shall include the collection of water quality and sediment quality data and the conduct of a risk assessment for fish, fish habitat and aquatic birds based on those data. [based on CEAA 4.4]

MON-H-12. OPG will, to the satisfaction of the CNSC, implement a follow-up monitoring program during site preparation and construction and operations to determine the effectiveness of the stormwater management system in mitigating water quality impacts in MacPherson Bay. The follow-up program shall include:

[CEAA] 4.6.1 conducting an effluent dispersion study in MacPherson Bay after commissioning of the stormwater management pond as support for the design for the follow-up monitoring program;

[CEAA] 4.6.2 collecting baseline data for all follow-up monitoring indicators prior to site preparation, including the collection of additional baseline sediment quality data in MacPherson Bay; and

[CEAA] 4.6.3 examining water quality, sediment quality, benthic invertebrate community indicators, and caged bivalve studies at determined sampling locations and frequencies. [based on CEAA 4.6, LIC-165 (Rec #8, Rec #13)]

MON-H-13. OPG will, during construction and operations and to the satisfaction of the CNSC, conduct a sediment quality follow-up program in MacPherson Bay. Prior to construction, OPG will collect additional baseline sediment quality data at the ditch at Interconnecting Road and MacPherson Bay. [based on CEAA 4.7,

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

2) Surface Water Quality

LIC-165 (Rec #8)]

MON-H-14. Certificates of Approval *[water]* will be obtained as required for the DGR. OPG will monitor environmental releases in accordance with these Certificates of Approval and report the results as required. [EA-097, IRC-LPSC-04.30]

- Acceptance criteria:
  - Final water quality criteria for the effluent from the SWMP will be developed as part of the Ontario Environmental Compliance Approval (ECA). The limits will be established taking into consideration the Provincial Water Quality Objectives, the acute toxicity thresholds for sensitive species that are present in the receiving environment, and the existing water quality in the receiving water at MacPherson Bay. The regulatory process will not allow the release of effluent from the SWMP that is acutely toxic to aquatic receptors. [IRC-EIS-04.10, IRC-EIS-05.23, IRC-EIS-07.18, IRC-EIS-12.19]
  - Particular attention will be paid to salinity and nitrogen compounds when developing water quality criteria. [IRC-EIS-04.11, IRC-EIS-05.24]
  - Further identification of performance or acceptance criteria for surface water data will be developed concurrently with the detailed sampling plan for site preparation and construction, and will incorporate input from the regulators during the ECA process. Preliminary baseline monitoring is currently underway, and will include statistical analysis that will influence the detailed sampling plan and data quality objectives, including the performance/acceptance criteria. [IRC-EIS-05.14]
- Sampling locations:
  - Surface water samples will be collected from three locations:
    - The discharge point of the stormwater management pond during site preparation and construction, and operations;
    - The discharge point of the shaft sump water during site preparation and construction, and operations (at the stormceptor); and
    - The perimeter drainage ditch near the WRMA, at a location to be determined. [EAFMP-006, IRC-EIS-10.13, LIC-165 (Rec #29)]
  - At least one surface water monitoring location will be sited immediately downstream of the WRMA in order to characterize the runoff prior to discharge to the stormwater management pond. Samples will be collected quarterly at a minimum throughout the site preparation and construction phase as described in the EA Follow-up Monitoring Program *(NWMO 2011a)*. [IRC-EIS-04.44]
  - Underground water will be monitored prior to being released into the surface drainage system. A second monitoring location, at a location to be determined based on final design of the stormwater system, will also be in place. Waste water characteristics will be monitored to provide an indication of the quality of runoff from the pile. Three monitoring points will be sufficient to provide an early indication of elevated contaminants of concern that would warrant implementation of contingency measures. [H-17-12]
  - One sample location will be sited at the sump discharge, through which all underground water will flow, in order to characterize the sump water quality. A second location, chosen near the Waste Rock Management Area, will characterize the surface water runoff from the waste rock piles and other areas of the DGR Project site. The sample site located at the SWMP outlet will be used to verify that the discharge meets Environmental Compliance Approval (ECA) criteria (previously called Certificate of Approval discharge criteria). [IRC-EIS-05.06]

TABLE A2:
HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS

2) Surface Water Quality

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

- The EA follow-up monitoring program will be carried-out in accordance with CSA N288.4-10 Environmental Monitoring Programs at Class I Nuclear facilities and Uranium Mines and Mills, CNSC G-296 Developing Environmental Protection Policies, Programs and Procedures at Class I Nuclear Facilities and Uranium Mines and Mills, and CNSC S-296 Environmental Protection Policies, Programs and Procedures at Class I Nuclear Facilities and Uranium Mines and Mills. [EAFMP-003]
  [Note: It is noted that CNSC documents G-296 and S-296 have been superceded by CNSC REGDOC-2.9.1.]
- The monitoring program will be managed as a whole within the structure of an Environmental Management System (EMS). Planned environmental monitoring activities will be implemented, results will be reviewed and changes to the monitoring program identified if necessary, within the EMS and in accordance with the CSA standard "Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills". [IRC-EIS-08.26, H-17-02]
  [Note: It is noted that CNSC standard has been superceded by CNSC REGDOC-2.9.1.]
- OPG will revise and obtain CNSC approval of the EA follow-up monitoring program and initiate additional baseline monitoring. *[repeated a few times during the hearing*] [H-23-07, H-17-10]
- OPG's environmental monitoring for the DGR Project will include three types of monitoring; environmental baseline monitoring where identified as needed to support EA follow-up monitoring, EA follow-up monitoring for verifying effects predictions and effectiveness of mitigation measures, and environmental compliance monitoring which is sometimes referred to as environmental protection monitoring. Environmental monitoring programs will be in place for the DGR Project for each of these three identified purposes. [based on H-24-02, H-24-15]
  - Environmental compliance monitoring will be undertaken in the site preparation and construction, and the operations phases. [H-24-06]
  - Environmental compliance monitoring shown on the right side of the figure *[on slide 3 of OPG's presentation]* will be developed through regulatory processes if the project receives a site preparation and construction licence. [H-24-03]
- Environmental monitoring of the DGR Project will be comprehensive in terms of substances, media and locations, and will include, at the minimum, the following:
  - sampling and analyzing run-off leaving the DGR Project site;
  - groundwater monitoring;
  - monitoring airborne emissions from the WPRB;
  - measuring average ambient radiation dose rates at the perimeter of the DGR Project site;
  - storage structure integrity checks; and
  - contamination checks and radiation surveys within the DGR Project site. [EA-096]
- All samples will be analyzed at a Standards Council of Canada and/or Canadian Association of Laboratory Accreditation Inc. accredited laboratory. [EAFMP-017]
- If the background data sets are deemed inadequate, further baseline studies may be conducted prior to start of the site preparation and construction phase. [EAFMP-066]
- A surface water follow-up monitoring program will include a surface water sampling program, flow rate measurements and a visual inspection program. [EAFMP-005, H-24-10, IRC-EIS-07.25]
- The results of the monitoring will be coupled to criteria, established through relevant regulatory processes described in OPG response to IR EIS-04-130 *[OPG 2012d]*, which will ensure there are no significant adverse effects to the environment. [IRC-EIS-04.14]

TABLE A2: HYDROLOGY AND SURFACE WATER QUALITY DETAILED COMMITMENTS
2) Surface Water Quality
• Monitoring of some aspects such as groundwater will be carried throughout the project as required. [H-17-01] • Based on this conceptual plan *[the EA Follow-up Monitoring Program]*, detailed monitoring plans will be developed for monitoring activities should OPG receive a site preparation and construction license. [H-17-06] • The planned duration of the monitoring activities will be specified in the detailed monitoring plans. [H-17-29] [Note: Additional details on the above monitoring are provided in Table 2, Table 3a, Table 3b, Table 4a, Table 4b, and Table 6 of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A3:
TERRESTRIAL ENVIRONMENT DETAILED COMMITMENTS

Valued Ecosystem Components

1) Plant Species and Communities:

   1.1. Eastern white cedar
   1.2. Heal-all, Common cattail

2) Mammals:

   2.1. Northern short-tailed shrew
   2.2. Muskrat
   2.3. White-tailed deer

3) Herpetofauna:

   3.1. Midland painted turtle
   3.2. Northern leopard frog

4) Birds:

   4.1. Mallard
   4.2. Red-eyed vireo
   4.3. Wild turkey
   4.4. Yellow warbler
   4.5. Bald eagle

TABLE A3:
TERRESTRIAL ENVIRONMENT DETAILED COMMITMENTS

1) Plant Species and Communities: Eastern White Cedar, Other Plants (Heal-all, Common cattail)

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-T-01. The DGR Project will avoid disturbance of the marsh area, and no vegetation within the marsh area will be cleared. [IRC-EIS-01.12]

- The eastern white cedar within the marsh is not expected to be affected by the project as the marsh areas of the site will be avoided. [EA-141]
- No *[vegetation]* wetland communities or open water will be removed during site preparation. [EA-264]
- No deciduous forest communities will be removed during site preparation. [EA-265]

MIT-T-02. Exclusionary fencing to prevent additional loss *[beyond that which cannot be avoided]* during construction surrounding the DGR Project site will be installed. Temporary construction fencing to protect vegetation will help prevent incidental damage and soil compaction within driplines and along vegetation community edges caused by equipment and workers encroaching into areas proposed for protection within the Site Study Area. [based on IRC-EIS-08.15, IRC-EIS-01.13, IRC-EIS-01.15, IRC-EIS-12.07, EA-266, H-17-16, H-24-33, H-24-40]

MIT-T-03. The project will minimize the disturbance to the natural vegetation on the site in the areas not identified for buildings, access, equipment/materials storage and waste rock storage. [based on IRC-EIS-09.39]

MIT-T-04. Where required, trees will be felled, skidded and piled in the cut area, and if salvageable, chipped and reused for landscaping on the DGR Project site or elsewhere on the Bruce nuclear site. [EA-033]

- Roots, stumps, embedded logs and debris will be removed by grubbing and disposed of according to existing management practices. [EA-034]

Additional mitigation measures:

MIT-T-05. Rehabilitation and re-vegetation plans will be considered as part of OPG's biodiversity program. [based on EIS, Table 13-1 (OPG 2011a), and H-32-01]

Site Preparation and Construction Phase:

- Re-vegetation will be completed for the rock pile as described in OPG's response to Information Request IR-EIS-05-171 (OPG 2012g). Re-growth will be monitored as described in EA Follow-up Monitoring Program (NWMO 2011a, Tables 3 and 6). Trees will be planted on the berms, and architectural trees will be planted near the amenities buildings. Once site preparation and construction is completed, all unpaved surfaces will be re-vegetated with native, non-invasive species. [IRC-EIS-08.17, IRC-EIS-09.39, LIC-071 (Section 9.3.3 of PSR)]
- OPG would consider the appropriate plans for rehabilitation during the site preparation and construction (e.g., tree planting), as part of OPG's biodiversity program. [H-32-01, H-30-02]

Decommissioning Phase:

- Upon completion of the project, rehabilitation plans include re-establishment of high-quality mixed wood habitats containing large portions of eastern white cedar on the site. [IRC-EIS-12.08]
- Following removal of all surface facilities, the DGR Project site will be graded and vegetated. [EA-084]
- Vegetation will be consistent with that of local conditions and that it is capable of providing vigorous, plentiful cover not later than its third growing season with minimal care (Environmental Protection Act - Ontario Regulation 232/98, s.29(1)). The use of native species will be incorporated in the detailed revegetation plan while invasive species will be avoided. Opportunities to develop

TABLE A3:
TERRESTRIAL ENVIRONMENT DETAILED COMMITMENTS

1) Plant Species and Communities: Eastern White Cedar, Other Plants (Heal-all, Common cattail)

habitat will be considered during the development of the revegetation plan. [IRC-EIS-05.05, H-23-12]

- The limestone pile will not be capped, but it will be covered and vegetated with native plant stock, as appropriate, during decommissioning activities. [EA-041]
- Waste rock remaining in the waste rock management area at the time of decommissioning the DGR will be covered by a soil cap and vegetated (OPG 2011b, Section 13.6.5). The rock pile will be covered with a minimum of 15 cm of soil and topsoil that is suited to the requirements of the local flora (refer to OPG's response to Undertaking TIS-09 [OPG 2012c]). Prior to covering, the waste rock surface will be scarified in the areas where the rock has been compacted by vehicle traffic. [IRC-EIS-05.03, EA-087, EA-268, IRC-EIS-03.11, IRC-EIS-05.04]
- The surface of the rock pile will be contoured to promote drainage and to minimize wind and water erosion. Wind breaks will be established, if necessary, for further erosion control until such time that the vegetation is sufficiently established. The pile will be inspected for tension cracks at the crest of any slopes for signs of new or ongoing failure, and rill or gully erosion both on the rock pile and on the soil cover. [IRC-EIS-05.04, EA-087, EA-268, IRC-EIS-03.11, IRC-EIS-05.03]
- Additional details on the mitigation measures are provided in Section 5.5, Site Restoration, Section 5.4.7, Waste Rock Management Area, and Section 9.1.3, Vegetation, of the Preliminary Decommissioning Plan (NWMO and CANDESCO 2011) and in Chapter 13 of the PSR (OPG 2011b). [LIC-153, LIC-086]

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

- See detailed commitments associated with MIT-H-19 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MONITORING COMMITMENTS:

MON-T-01. OPG will, prior to site preparation and to the satisfaction of the CNSC, develop a follow-up program to monitor any changes to cattail and other aquatic plant habitat within the stormwater system, including the stormwater management pond. Baseline conditions shall be established prior to habitat disturbance, and follow-up monitoring shall take place following the disturbance of habitat during all preclosure phases. OPG will address any adverse change in these plant communities that, in turn, may adversely affect significant species, such as amphibians and reptiles, in accordance with the *Species at Risk Act*. [based on CEAA 10.1]

MON-T-02. OPG will, prior to construction and to the satisfaction of the CNSC, develop a follow-up program to monitor the naturalization of disturbed areas during construction and operations. If monitoring indicates the presence of invasive plant species and noxious weeds, OPG will implement appropriate mitigation measures. [based on CEAA 10.3]

MON-T-03. OPG will, during site preparation and construction and to the satisfaction of the CNSC, monitor for indications of potential effects on plants as a result of changes in air quality caused by the Designated Project in the Project Area and the Site Study Area. [based on CEAA 10.4]

MON-T-04. OPG will, prior to site preparation and to the satisfaction of the CNSC, confirm the absence of significant plant species in the Project Area. If significant species are located, OPG will, following consultation with appropriate regulatory agencies and the CNSC, take action to avoid or mitigate the potential loss. [based on CEAA 10.5]

MON-T-05. The plant species and communities adjacent to areas which have been cleared during site preparation and construction will be monitored. [based on EIS, Table 13-1 (OPG 2011a)]

- One-time *[visual inspection]* monitoring of the plant species and communities will be conducted

TABLE A3:
TERRESTRIAL ENVIRONMENT DETAILED COMMITMENTS

1) Plant Species and Communities: Eastern White Cedar, Other Plants (Heal-all, Common cattail)

after construction of the surface facilities in the mixed forest adjacent to the areas which have been cleared during the site preparation and construction phase (NWMO 2011a, Table 3a). Presence of suitable habitat will be used as a measure of success. [IRC-EIS-08.18, EA-165, EA-261, EAFMP-024, H-10-03, H-17-14]

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

- See detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

[Note: Additional details on the above monitoring are provided in Table 3a of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A3: TERRESTRIAL ENVIRONMENT DETAILED COMMITMENTS

2) Mammals: Northern short-tailed shrew, Muskrat, White-tailed deer

MITIGATION COMMITMENTS:

In-design mitigation measures:

- None identified [EIS, Table 13-1 (OPG 2011a)]

Additional mitigation measures:

- None identified [EIS, Table 13-1 (OPG 2011a)]

MONITORING COMMITMENTS:

MON-T-06. The wildlife habitat use in adjacent areas to those that are cleared during the site preparation and construction phase will be monitored. [based on EIS, Table 13-1 (OPG 2011a)]

- One-time *[visual inspection]* monitoring of the wildlife habitat use will be conducted after construction of the surface facilities in the mixed forest adjacent to the areas which have been cleared during the site preparation and construction phase (NWMO 2011a, Table 3a). Presence of suitable habitat will be used as a measure of success. [IRC-EIS-08.18, EA-165, EA-261, EAFMP-024, H-10-03, H-17-14]
- Vehicle strikes will be monitored in the follow-up monitoring program and reported as part of the existing Bruce nuclear site reporting program for one year. Provided the results confirm the EA predictions in the first year, this activity will be discontinued under the EA follow-up monitoring program and will be transferred to the EMP monitoring program. [EAFMP-025, H-17-17]

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

- See detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

[Note: Additional details on the above monitoring are provided in Table 3a, Table 4a, and Table 4b of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A3: TERRESTRIAL ENVIRONMENT DETAILED COMMITMENTS

3) Herpetofauna: Midland painted turtle, Northern leopard frog

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-T-01. The DGR Project will avoid disturbance of the marsh area, and no vegetation within the marsh area will be cleared. [IRC-EIS-01.12]

MIT-T-06. OPG will, prior to site preparation and to the satisfaction of the CNSC, install barriers to prevent turtles and snakes from entering the DGR Project site. The barriers will include, at minimum, the installation of exclusion fencing along the southern and eastern edges of the Project site and shall be maintained throughout site preparation and construction. [based on CEAA 9.1, LIC-165 (OPG's response to Rec #52)]

- The site preparation activities will avoid key habitat areas for herpetofauna. [EA-263]
- The primary focus of reptile mitigation measures in Ontario has been the installation of reptile exclusion fencing surrounding areas that will be disturbed during site preparation and construction activities. This fencing would remain in place throughout the year to prevent snakes from entering the DGR Project Site where construction activities will occur. [IRC-EIS-10.06, H-10-02]
- In the event of a spring construction start, and with considerations for spring emergence, exclusionary fencing around the DGR Project site will be erected prior to May 25 in time to ensure mobile reptiles do not enter the construction site. [based on IRC-EIS-01.13, IRC-EIS-10.07]
- Installation of exclusion fencing to prevent *[snapping]* turtles from overwintering in poorly drained areas that will be cleared during the site preparation activities. [IRC-EIS-09.61, IRC-EIS-09.62, H-10-02].

Additional mitigation measures:

MIT-T-07. OPG will, to the satisfaction of the CNSC, implement measures to avoid adverse effects to snapping turtles and other turtle species at risk, including:

[CEAA] 9.2.1 conducting turtle surveys of "Wetland 3" throughout the years prior to its infilling. A qualified individual experienced in turtle surveys should conduct a minimum of three surveys per year on sunny days, beginning as soon as the ice cover has melted. The third survey should occur no later than mid-June. [based on OPG proposed revised wording to CEAA 9.2, LIC-165 (OPG's response to Rec #46, OPG's response to #48)]

[CEAA] 9.2.2. relocating snapping turtles from "Wetland 3" to the northeast marsh prior to the infilling of "Wetland 3. [based on OPG proposed revised wording to CEAA 9.2, LIC-165 (Rec #49)]

- Avoidance through timing of activities to allow turtles to move from wintering to spring and summer habitats (when feasible). [IRC-EIS-09.61, IRC-EIS-09.62, H-10-02]
- Close consultation with the local Ministry of Natural Resources and Forestry (MNRF) to develop mitigation plans, including strategies for relocating species to optimal habitats located within the Site Study Area and Local Study Area. The plans will be developed and applied prior to the commencement of any construction activities. [IRC-EIS-09.61, IRC-EIS-09.62, EAFMP-058, H-10-02]
- A detailed relocation/handling plan, reviewed by Environment Canada and MNRF to ensure that OPG is dealing with Snapping Turtles in an acceptable manner, could include the following:
    1) The setting of the traps and the relocation of the Snapping Turtles must be conducted by qualified biologists.
    2) The turtle traps are to be set using appropriate protocols (including details described above) regarding timing and leaving a portion of the trap well above water level (taking into consideration flooding due to storm events) to allow breathing room for the species.

TABLE A3:
TERRESTRIAL ENVIRONMENT DETAILED COMMITMENTS

3) Herpetofauna: Midland painted turtle, Northern leopard frog

3) The locations where the Snapping Turtles will be released must be clearly identified.

4) The timing of turtle capture/relocation activities must be specified. [based on LIC-165 (Rec #50)]

- Wetland 3 will be disturbed by site preparation and construction activities; however, appropriate environmental management plans will ensure that potential effects on sensitive turtles that might be utilizing the habitat at that time are controlled through generally accepted mitigation measures. [IRC-EIS-05.02, IRC-EIS-09.60]

MIT-T-08. OPG will, during and after the re-routing of the drainage ditch and to the satisfaction of the CNSC, maintain water levels in the northeast marsh at appropriate levels to protect snapping turtle habitat. [based on CEAA 9.4, LIC-165 (OPG's response to Rec #47)]

MIT-T-09. OPG will develop and implement a management plan to the satisfaction of the CNSC, to ensure its activities do not disrupt eastern ribbonsnake or eastern milksnake individuals, their eggs, gestation sites, hibernacula or habitat during site preparation and construction. [based on CEAA 9.3, LIC-165 (Rec #51)]

MIT-T-10. Should a rare or endangered species or its critical habitat be encountered during site preparation and construction, appropriate measures will be implemented to avoid destruction, injury or interference with the species, its residence and/or its habitat (e.g., through siting, timing or design changes). If the foregoing cannot be avoided, work will cease and the local Ontario Ministry of Natural Resources and Forestry (MNRF) office will be contacted for advice regarding mitigation measures. [EAFMP-057]

- Species-specific mitigation measures will be developed on an as-needed basis with input from MNRF Species at Risk biologists. Mitigation measures are likely to be focused around avoidance of the species during important life cycle periods. [IRC-EIS-10.21]

MIT-T-11. OPG will maintain an awareness of newly listed at-risk species that may potentially use the site, and include them in management programs. [H-10-01, H-24-14]

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

- See detailed commitments associated with MIT-H-19 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MONITORING COMMITMENTS:

MON-T-07. OPG will, prior to construction and to the satisfaction of the CNSC, submit a follow-up program to monitor the use of the SWMP and drainage ditch system by amphibians, birds, invertebrates and small-bodied fish. The program shall contain mitigation measures to be taken, should concentrations of total dissolved solids in the storm water management system be observed at levels with the potential to affect sensitive plant or animal species. [based on OPG proposed revised wording to CEAA 10.2]

- The wildlife habitat use in adjacent areas to those that are cleared during the site preparation and construction phase will be monitored. [based on EIS, Table 13-1 (OPG 2011a)]
- One-time *[visual inspection]* monitoring of the wildlife habitat use will be conducted after construction of the surface facilities in the mixed forest adjacent to the areas which have been cleared during the site preparation and construction phase (NWMO 2011a, Table 3a). Presence of suitable habitat will be used as a measure of success. [IRC-EIS-08.18, EA-165, EA-261, EAFMP-024, H-10-03, H-17-14]

MON-T-08. Regular inspections will be scheduled to monitor for the effectiveness of the exclusion fencing.

- Monitor the effectiveness of the exclusion fencing for turtles and snakes. This would be done

TABLE A3:
TERRESTRIAL ENVIRONMENT DETAILED COMMITMENTS

3) Herpetofauna: Midland painted turtle, Northern leopard frog

through an inspection process, so there would be regular inspections included in OPG's environmental management plan program for that particular component of the monitoring program. The frequency of inspection would be identified and a procedure would be documented. [H-24-33, EA-266, H-17-16, H-10-05, H-24-40, IRC-EIS-08.15, IRC-EIS-12.07]

- Regular monitoring of exclusion fencing to prevent *[snapping]* turtles from overwintering in poorly drained areas that will be cleared during the site preparation activities. [IRC-EIS-09.61, IRC-EIS-09.62, H-10-02]

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

- See detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

[Note: Additional details on the above monitoring are provided in Table 3a of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A3:
TERRESTRIAL ENVIRONMENT DETAILED COMMITMENTS

4) Birds: Mallard, Red-eyed vireo, Wild turkey, Yellow warbler, Bald eagle

MITIGATION COMMITMENTS:

In-design mitigation measures:

- None identified [EIS, Table 13-1 (OPG 2011a)]

Additional mitigation measures:

MIT-T-10. Should a rare or endangered species or its critical habitat be encountered during site preparation and construction, appropriate measures will be implemented to avoid destruction, injury or interference with the species, its residence and/or its habitat (e.g., through siting, timing or design changes). If the foregoing cannot be avoided, work will cease and the local Ontario Ministry of Natural Resources and Forestry (MNRF) office will be contacted for advice regarding mitigation measures. [EAFMP-057]

MIT-T-11. OPG will maintain an awareness of newly listed at-risk species that may potentially use the site, and include them in management programs. [H-10-01, H-24-14]

MIT-T-12. OPG will carry out all preclosure phases of the Project in a manner that protects and avoids harming, killing or disturbing migratory birds or destroying or taking their nests or eggs. In this regard, OPG will take into account Environment Canada's Avoidance Guidelines. OPG's actions in applying the Avoidance Guidelines, will be in compliance with the *Migratory Birds Convention Act*, 1994 and with the *Species at Risk Act.* [based on CEAA 5.1]

- In accordance with the Migratory Birds Convention Act, the site preparation activities will avoid vegetation clearing during the breeding bird season (May 1st to July 31st), wherever possible. If clearing cannot be scheduled outside the prime nesting season, a nest survey should be conducted to ensure there are no active nests in the trees to be felled. If found, no active nests will be removed or disturbed in accordance with the Migratory Birds Convention Act. [EA-269, EA-117, IRC-EIS-01.14, LIC-071 (Section 9.2.2 of PSR), LIC-165 (Rec #45), EIS, Table 13-1 (OPG 2011a)]
- Close consultation [regarding the surveys for Whip-poor-will] with the local MNRF SAR *[Species at Risk]* biologist will take place at the onset of the survey program to ensure that field biologists are following the most current generally accepted protocol suitable for both the site and project. [IRC-EIS-10.22]

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

- See detailed commitments associated with MIT-H-19 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MONITORING COMMITMENTS:

MON-T-07. OPG will, prior to construction and to the satisfaction of the CNSC, submit a follow-up program to monitor the use of the SWMP and drainage ditch system by amphibians, birds, invertebrates and small-bodied fish. The program shall contain mitigation measures to be taken, should concentrations of total dissolved solids in the storm water management system be observed at levels with the potential to affect sensitive plant or animal species. [based on OPG proposed revised wording to CEAA 10.2]

- See detailed commitments associated with MON-T-07 in Table A3, Terrestrial Environment Detailed Commitments

MON-T-09. OPG will, prior to site preparation and to the satisfaction of the CNSC, develop and implement a follow-up program to monitor and assess the effectiveness of the mitigation measures used to avoid harm to migratory birds, their eggs and nests. This monitoring will be conducted throughout all preclosure phases. [based on CEAA 5.2]

TABLE A3: TERRESTRIAL ENVIRONMENT DETAILED COMMITMENTS
4) Birds: Mallard, Red-eyed vireo, Wild turkey, Yellow warbler, Bald eagle
• The wildlife habitat use in adjacent areas to those that are cleared during the site preparation and construction phase will be monitored. [based on EIS, Table 13-1 (OPG 2011a)] • One-time *[visual inspection]* monitoring of the wildlife habitat use will be conducted after construction of the surface facilities in the mixed forest adjacent to the areas which have been cleared during the site preparation and construction phase (NWMO 2011a, Table 3a). Presence of suitable habitat will be used as a measure of success. [IRC-EIS-08.18, EA-165, EA-261, EAFMP-024, H-10-03, H-17-14] • Vehicle strikes will be monitored in the follow-up monitoring program and reported as part of the existing Bruce nuclear site reporting program for one year. Provided the results confirm the EA predictions in the first year, this activity will be discontinued under the EA follow-up monitoring program and will be transferred to the EMP monitoring program. [EAFMP-025, H-17-17] [Note: Additional details on the above monitoring are provided in Table 3a, Table 4a, and Table 4b of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A4: AQUATIC ENVIRONMENT DETAILED COMMITMENTS
Valued Ecosystem Components
1) Redbelly Dace 2) Creek Chub 3) Burrowing Crayfish 4) Benthic Invertebrates 5) Variable-Leaf Pondweed 6) Lake Whitefish 7) Smallmouth Bass 8) Spottail Shiner 9) Brook Trout

TABLE A4:
AQUATIC ENVIRONMENT DETAILED COMMITMENTS

1) – 5) Redbelly Dace, Creek Chub, Burrowing Crayfish, Benthic Invertebrates, Variable-Leaf Pondweed

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-W-01. OPG will, during site preparation and construction, implement measures to avoid adverse effects to fish and fish habitat associated with culvert installation at the North and South Railway Ditches, including [based on CEAA 4.1, EA-118, EA-187, and in EIS, Table 13-1 (OPG 2011a)]:

[CEAA] 4.1.1. embedding culverts below the bed of the South Railway Ditch;

- Culverts will be used to provide for water flow in the two existing ditches (i.e., the North and South Railway Ditches). [EA-015, IRC-LPSC-01.32, LIC-165 (Rec #65)]

[CEAA] 4.1.2. isolating and dewatering the culvert site;

- Isolate and dewater the section of the South Railway Ditch wherein the culvert will be placed. Prior to dewatering the work area, a fish salvage and relocation will be conducted so as to avoid harming any fish or other aquatic life (frogs, turtles) during construction. [based on EA-120, EA-188, EAFMP-058, and in EIS Table 13-1 (OPG 2011a)]
- If fish salvage is required prior to the construction of the crossing over the abandoned rail bed, a Fish Collection Permit will be obtained from the Ontario Ministry of Natural Resources. [EA-195]

[CEAA] 4.1.3. deploying erosion and sediment control measures; and

- Install effective sediment and erosion control measures before starting work to prevent silt/sediment laden runoff from directly entering the water in the South Railway Ditch. Inspect them regularly during the course of construction and make necessary repairs if damage occurs. [based on EA-120, EA-188, EA-036, LIC-165 (Rec #65), and in EIS, Table 13-1 (OPG 2011a)]
- Drainage ditches will undergo routine inspection and maintenance as described in OPG's response to Information Requests EIS-04-130 *[OPG 2012d]* and IR-EIS-05-192 *[OPG 2012e]*. In the event of sediment buildup in the ditches the sediment will be excavated from the ditch and disposed of as per established waste handling practices. The inspection and maintenance program for the drainage ditches will consist of the following:
  - Regular inspections of the stormwater management system. NWMO (2011a) proposes weekly inspection during site preparation and construction, and monthly inspection during operations. The system will also be inspected after significant runoff events. Inspections will be conducted to:
    - check for trash, debris and sediment buildup in the drainage network and pond;
    - monitor the erosion of channels, embankments and the pond shoreline;
    - check the level of the permanent pool in the pond;
    - check for unwanted vegetation growth and algal blooms in the drainage ditches and pond;
    - check for a sheen, frothiness and discoloration of the water in the pond; and
    - confirm the health of plantings around the pond shoreline.
  - Corrective maintenance will be carried out should any significant issues, with respect to the proper function of the drainage ditch system, be identified during regular inspections.
  - Regular maintenance of the drainage ditches and culvert crossings including:
    - removal of trash, debris and accumulated sediment;
    - control of unwanted vegetation growth;
    - replanting of grass lining in channels; and
    - repairs to channels and culvert pipes and embankments. [IRC-EIS-05.33, IRC-EIS-

TABLE A4:
AQUATIC ENVIRONMENT DETAILED COMMITMENTS

1) – 5) Redbelly Dace, Creek Chub, Burrowing Crayfish, Benthic Invertebrates, Variable-Leaf Pondweed

04.19, IRC-EIS-05.12, IRC-EIS-08.17, IRC-EIS-12.04, EA-185, EAFMP-007, EAFMP-008]

- During construction of the rail bed crossing, weekly visual inspections will be conducted as part of the EMP monitoring program to confirm that best management practices are undertaken and that regular maintenance of the ditches is completed. [EAFMP-031]

[CEAA] 4.1.4. re-vegetating banks upon completion of construction at the North and South Railway Ditches.

- The site will be graded to direct all precipitation collected on the site to the ditch system and to the stormwater management pond. The project will minimize the disturbance to the natural vegetation on the site in the areas not identified for buildings, access, equipment/materials storage and waste rock storage. Additional effort will be placed on the revegetation of berms, embankments and areas that will not be used for laydown of equipment. Post construction, laydown areas will be cleared, cleaned and revegetated. [IRC-EIS-09.39]
- Vegetate any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses and cover such areas with mulch to prevent erosion and to help seeds germinate. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring. Re-vegetation will be completed for the drainage ditches as described in OPG's response to IR-EIS-05-192 (OPG 2012e). Re-growth will be monitored as described in EA Follow-up Monitoring Program (NWMO 2011a, Tables 3 and 6). [based on EA-120, IRC-EIS-08.17, EA-036, EA-188, LIC-137, and in EIS Table 13-1 (OPG 2011a)]

MIT-W-02. OPG will ensure that in-water works do not occur between July 1 and September 30. [based on CEAA 4.2]

- Timing of the construction of the abandoned rail bed crossing will take place according to the DFO Operational Statement-Timing Windows to ensure that critical life history stages such as spawning activities are protected by restricting the conduct of works or undertakings in and around water at certain times of the year. The South Railway Ditch contains a warm water fish community and generally, the warm water timing window begins July 1 and ends March 31. However, the Saugeen Valley Conservation Authority has made a specific recommendation for this particular construction work of an 'in-water' timing window of July 1 to September 30. No in-water work will be performed during this period. [EA-186, EA-119, EAFMP-032, LIC-165 (Rec #65)]
- Construction of the South Railway Ditch crossing will be scheduled in accordance with regulatory requirements, to ensure protection of the fish community. [based on EIS, Table 13-1 (OPG 2011a)]

MIT-W-03. The DGR Project design will avoid the marsh in the northeast portion of the Project Area where there is known crayfish habitat. [based on EIS, Table 13-1 (OPG 2011a)]

- The DGR Project will avoid disturbance of the marsh area, and no vegetation within the marsh area will be cleared. [IRC-EIS-01.12]
- The DGR Project will maintain a 30 m setback from the marsh area in the northeast portion of the Project Area (referred to as Wetland #4) to any of the project facilities activities. Therefore, it is not expected that a permit will be necessary for the project activities. [based on EA-194, and H-10-04, IRC-EIS-12.14]

Additional mitigation measures:

MIT-W-04. Machinery will be operated on land and in a manner that minimizes disturbance to the banks of the South Railway Ditch. Machinery is to arrive on-site in a clean condition and is to be maintained free of fluid leaks. Wash, refuel and service machinery and store fuel and other materials for the machinery away

TABLE A4: AQUATIC ENVIRONMENT DETAILED COMMITMENTS

1) – 5) Redbelly Dace, Creek Chub, Burrowing Crayfish, Benthic Invertebrates, Variable-Leaf Pondweed

from the water to prevent any deleterious substance from entering the water. Keep an emergency spill kit on-site in case of fluid leaks or spills from machinery. [based on EA-120, EA-188, and in EIS Table 13-1 (OPG 2011a)]

MIT-W-05. Measures will be used to prevent deleterious substances such as new concrete (i.e., it is precast, cured and dried before use near the watercourse), grout, paint and preservatives from entering the watercourse. [based on EA-120, EA-188]

MIT-W-06. Department of Fisheries and Oceans Canada's Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters set out that "No explosive may be used that produces or is likely to produce, a peak particle velocity greater than 13 mm/s in a spawning bed during egg incubation". If the monitoring program detects exceedances of this peak particle velocity and spawning is observed, a mitigation plan will be prepared outlining additional procedures for protecting fish and their habitat, as described in the guidelines. [based on EA-203, and EAFMP-061]

MIT-T-10. Should a rare or endangered species or its critical habitat be encountered during site preparation and construction, appropriate measures will be implemented to avoid destruction, injury or interference with the species, its residence and/or its habitat (e.g., through siting, timing or design changes). If the foregoing cannot be avoided, work will cease and the local Ontario Ministry of Natural Resources and Forestry (MNRF) office will be contacted for advice regarding mitigation measures. [EAFMP-057]

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

- See detailed commitments associated with MIT-H-19 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

[Note: Additional details on the above mitigation measures are provided in Table 4a of the EA Follow-up Monitoring Program (NWMO 2011a).]

MONITORING COMMITMENTS:

MON-W-01. The aquatic species EA Follow-up monitoring program will include visual inspections, surface water level monitoring, and groundwater well monitoring. Visual inspections will be conducted to:

- Verify re-growth of riparian vegetation in disturbed areas (ditches);
- Identify bank stability deficiencies;
- Verify the presence of crayfish chimneys in the Project Area; and
- Monitor the marsh for confirmation that excavation does not dewater and affect marsh habitat. [based on EAFMP-027, EA-166, EA-168, EA-184, EA-189, EA-191, H-17-15]

- Monitoring will be conducted annually for three years following site preparation and construction for re-growth of riparian vegetation and deficiencies in bank stability. [based on EIS, Table 13-1 (OPG 2011a)]

MON-H-03. OPG will, to the satisfaction of the CNSC, implement a follow-up program to monitor water levels in the northeast marsh:

[CEAA] 9.5.1. monthly for a period of one year prior to site preparation and construction to establish baseline levels; and

[CEAA] 9.5.2. weekly during the site preparation and construction phase. [based on CEAA 9.5, IRC-EIS-09.17, IRC-EIS-10.11, LIC-165 (Rec #37.1)]

- See detailed commitments associated with MON-H-03 in Table A2, Hydrology and Surface Water

TABLE A4:
AQUATIC ENVIRONMENT DETAILED COMMITMENTS

1) – 5) Redbelly Dace, Creek Chub, Burrowing Crayfish, Benthic Invertebrates, Variable-Leaf Pondweed

Quality Detailed Commitments

MON-H-04. Groundwater levels will be monitored in the shallow groundwater well closest to the marsh to determine water table fluctuations. [EAFMP-030]

- See detailed commitments associated with MON-H-04 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MON-T-07. OPG will, prior to construction and to the satisfaction of the CNSC, submit a follow-up program to monitor the use of the SWMP and drainage ditch system by amphibians, birds, invertebrates and small-bodied fish. The program shall contain mitigation measures to be taken, should concentrations of total dissolved solids in the storm water management system be observed at levels with the potential to affect sensitive plant or animal species. [based on OPG proposed revised wording to CEAA 10.2]

- See detailed commitments associated with MON-T-07 in Table A3, Terrestrial Environment Detailed Commitments

[Note: Additional details on the above monitoring are provided in Table 3a and Table 6 of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A4:
AQUATIC ENVIRONMENT DETAILED COMMITMENTS

6) – 9) Lake Whitefish, Smallmouth Bass, Spottail Shiner, Brook Trout

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-H-12, MIT-H-13. See the descriptions of the mitigation commitments in Table 3-2, Hydrology and Surface Water Quality Mitigation and Monitoring Commitments.

- See the in-design mitigation measures MIT-H-12 and MIT-H-13 for Surface Water Quality VC in Table A2, Hydrology and Surface Water Quality Detailed Commitments.

Additional mitigation measures:

MIT-H-14 through MIT-H-18. See the descriptions of the mitigation commitments in Table 3-2, Hydrology and Surface Water Quality Mitigation and Monitoring Commitments.

- See additional mitigation measures MIT-H-14 through MIT-H-18 for Surface Water Quality VC in Table A2, Hydrology and Surface Water Quality Detailed Commitments.

MIT-T-10. Should a rare or endangered species or its critical habitat be encountered during site preparation and construction, appropriate measures will be implemented to avoid destruction, injury or interference with the species, its residence and/or its habitat (e.g., through siting, timing or design changes). If the foregoing cannot be avoided, work will cease and the local Ontario Ministry of Natural Resources and Forestry (MNRF) office will be contacted for advice regarding mitigation measures. [EAFMP-057]

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

- See detailed commitments associated with MIT-H-19 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MONITORING COMMITMENTS:

MON-W-02. OPG will, prior to site preparation and to the satisfaction of the CNSC, develop a lake whitefish follow-up program which includes provisions to incorporate input from interested stakeholders and the Saugeen Ojibway Nation. The follow-up program will take into consideration the increasing understanding of the role of MacPherson Bay in the ecology of the area, and identify mitigation measures that shall be implemented, if necessary, to protect lake whitefish and lake whitefish nursery areas. [based on CEAA 4.8]

MON-W-03. One time monitoring will be undertaken after construction of drainage ditches and stormwater management pond for bank stability and re-vegetation of new ditches. [based on EIS, Table 13-1 (OPG 2011a)]

[Note: Additional details on the above monitoring are provided in Table 3a of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A5: RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS
Valued Ecosystem Components
1) Humans 2) Non-human Biota

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-R-01. The DGR provides long-term isolation and containment. [PSR, Table 14-4]

- The DGR is situated deep underground.
- The DGR is enclosed by multiple natural barriers.
- The DGR is positioned within a stable deep diffusion dominant groundwater system.
- The DGR is situated in a seismically quiet region.
- DGR openings are geomechanically stable.
- Natural resource potential is low, reducing potential for human intrusion.
- Chemical and hydrogeologic conditions limit contaminant mobility at the repository depth.
- Resaturation of the repository with groundwater will be very slow.
- Shaft design provides long-term isolation and DGR integrity.
- Radioactivity of waste will decrease with time due to radioactive decay.
- Corrosion resistant ILW degrades very slowly.

MIT-R-02. The DGR design includes mitigation measures to reduce the probability from potential human intrusion [based on OPG response to IR-EIS-06-246 *(OPG 2012h)*]:

- Repository is located a nominal 680 m below ground surface below the depth of casual construction excavation or easy drilling.
- Repository is placed in a location with low potential for natural resources (minerals, salt, gas).
- Repository is located at a depth where there is no potable water (below 170 m from surface).

MIT-R-03. OPG will, before a licence to operate is issued and to the satisfaction of the CNSC, perform probabilistic calculations for radiation exposures to humans and non-human biota for the Normal Evolution and Disruptive Scenarios. These calculations should supplement the deterministic calculations in the current long-term safety case assessment. [based on CEAA 13.9]

MIT-R-04. OPG's future modelling for all variant cases of the Disruptive Scenarios shall, to the satisfaction of the CNSC, provide clear and accessible evaluations of the amounts and activities of discharges into Lake Huron via the shallow and intermediate groundwater systems. [based on on CEAA 13.10]

MIT-R-05. Shielding is incorporated into the DGR design (waste package, Waste Package Receiving Building, Amenities Building) [based on EIS, Table 13-1 (OPG 2011a)]

Waste Package Design:

- Waste packages transferred to the DGR will contain additional shielding as needed in order to meet the waste acceptance criteria (Table 5-5). [LIC-010]
- ILW resin liners will be transferred to the DGR in either an unshielded liner, or in one of three types of shield packages. [LIC-049]
- For operational radiation protection purposes, most resin liners will be overpacked in cylindrical concrete shields. Each overpack will contain one or two resin liners, depending on the specific design. The reference concrete overpack has a concrete wall thickness of 0.25 m. Variant concrete overpacks will also be used where greater shielding is needed (one with a wall thickness of 0.35 m, and one with wall thickness of 0.35 m and a 40 mm thick steel insert). [LIC-120]
- For other classes of higher dose-rate wastes, such as some ion exchange resins, shielding overpacks will be used in order to meet the waste package dose rate restrictions of the waste acceptance criteria. The reference overpacking and shielding assumptions for each waste type are given in Table 2.1 of the DGR Reference Inventory report (OPG 2010). These will be reviewed as the DGR design and the waste acceptance criteria are finalized. Note that some of the overpacks

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

have not yet been designed. These will be developed in conjunction with the finalization of the DGR design, safety assessment and waste acceptance criteria development to ensure that they meet all applicable requirements and are fully integrated into the design and safety assessment. [IRC-EIS-09.48, IRC-EIS-10.05, IRC-LPSC-01.111, LIC-147]

- Optimize the design of the ILW Shield waste containers: The detailed design of these waste packages is not currently available, as they are not intended for use until *[the first year after obtaining the Operating Licence]*. For the Preliminary ALARA assessment, the package dose rates were therefore assumed conservatively high. The design will be prepared incorporating the ALARA *[As Low As Reasonable Achievable]* principle, before such packages are put into service. [IRC-LPSC-01.111, IRC-EIS-09.48, IRC-EIS-10.05, LIC-147]

Waste Package Receiving Building Design:

- A wall around the WPRB staging area similar in thickness to LLSB *[Low Level Storage Building]* walls will need to be incorporated in the detailed design to ensure that the external dose rate outside of the WPRB remains below 25 µSv/h (OPG Radiation Protection Requirements, PSR Section 7.1.2.1) and that the dose rate in the office/main control room is below 10 mSv/year, if multiple packages are routinely staged within the WPRB. [LIC-048, IRC-EIS-13.03, IRC-EIS-13.04]
- The amount of shielding required is currently being assessed as part of the detailed design. [IRC-LPSC-01.109]
  - The results of the detailed shielding assessment will specify the shielding requirements in the WPRB that will help ensure that dose rates remain below regulatory limits for NEWs (Zone 2) and non-NEWs (Zone 1), and are ALARA. [IRC-LPSC-01.17]
  - The maximum allowable dose rate for multiple packages will be assessed as part of the detailed shielding design. [IRC-LPSC-01.18]

Amenities Building Design:

- The locations of the Control Room and Offices within the Amenities Building will be reviewed as part of the detailed design, with detailed shielding assessments conducted in the occupied areas to ensure dose rates remain consistent with the specific location zoning (Zone 1 or Zone 2) and are ALARA. [IRC-LPSC-01.19, IRC-LPSC-01.20]

MIT-R-06. End and closure walls are designed to be installed in the underground repository when appropriate.

- Each end-wall adjacent the ventilation exhaust tunnel will be equipped with a personnel door for egress. This provides for multiple egress/refuge capability. In the event that an end wall is required at the entrance to the emplacement room for shielding purposes, personnel will not have access to the emplacement room. [IRC-EIS-03.04, IRC-LPSC-03.06]
- Once an emplacement room has been filled with waste, a wall may be constructed at the end of the room using reinforced concrete blocks. The wall will likely extend above the waste package height within the room, but not to the roof. Ventilation air will continue to flow through the wall opening, across the emplacement room, and out a similar opening at the back end of the room and into the ventilation drift. [LIC-104]
- After a group of rooms have been filled with waste packages and following a period of monitoring, closure walls will be constructed in the access and exhaust ventilation tunnels to fully isolate this group of rooms. The underground space behind the closure walls will not be ventilated and all services terminated. [LIC-038]
- After a group of emplacement rooms have been filled with waste packages, thick concrete closure walls will be constructed in the access tunnel to isolate this group of rooms. The walls will be designed to limit the release of gases and any potentially contaminated water during the operational period but will not be designed to provide any long-term postclosure isolation and containment. There may be six closure walls in place at the end of repository operations in the final

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

preliminary design. The rail lines will remain in the rooms and tunnels. [LIC-095]

- During the operational phase, there will be concrete plugs in the access tunnels to isolate panels of filled rooms, but no bulkheads on the rooms. [IRC-EIS-03.09]
- Panel 1 will be filled in two stages (Panel 1a and 1b). [IRC-EIS-09.31]

MIT-R-07. Zoning is designed to prevent spread of contamination in or around the DGR. [based on EIS, Table 13-1 (OPG 2011a)]

- Generally accessible areas outside the DGR will be maintained at Zone 1 within the dose rate constraint ≤ 0.5 µSv/h. All spaces within the DGR facility perimeter will be classified in accordance with the potential for contamination. All areas of the DGR associated with the handling of radioactive waste will be designated as Zone 2. These include the crossing from the WWMF to the WPRB, the WPRB, shafts and the underground areas. Office and amenities areas at the DGR will be designated Zone 1. A Zone 1 and Zone 2 boundary is located within the amenities area for the movement and tracking of personnel. As all areas underground (i.e. below the shaft collars) will be Zone 2, and access to the lunchroom underground will require the use of the whole body and small article monitors. [EA-095, IRC-EIS-01.20, LIC-033]
  [Note: As documented in OPG letter to JRP dated February 10, 2012, the radiological zoning has been updated to include the ventilation shaft headframe and the ventilation exhaust area within Zone 2 in recognition that the ventilation exhaust may contain contaminated air.]

MIT-R-08. The ventilation system is designed for safe working conditions for the DGR personnel. (radiological hazards)

- The data from the fixed air quality monitoring system will be displayed in the Control Room and the flow of ventilation air will be adjusted, as required, to ensure safe working conditions for underground personnel. Air quality readings that are approaching predefined limits in the air stream will trigger alarms. Any high levels of air contaminants can be reduced by increasing the air volumes in that area. Air volumes in various parts of the underground facility will be controlled by adjusting the louvers at end of emplacement rooms and by adjusting the main underground fan. [IRC-LPSC-01.78, IRC-LPSC-01.77]
- The ventilation shaft conditions are monitored, and if necessary, worker exposure can be reduced through use of appropriate protective equipment and/or by adjusting the air flow for the duration of each inspection to provide cleaner air. [EA-247]
- The general ventilation levels for emplacement rooms will be as follows:
  - Active (i.e., rooms in the process of being filled) emplacement rooms will be ventilated at a rate of 18 m^3/s during the day and 3 m^3/s at night.
  - Empty emplacement rooms will not be ventilated.
  - Filled emplacement rooms will be ventilated at a rate of approximately 1 m^3/s. A wall will be installed at the entrance to the room, but will still allow for ventilation. [LIC-133]
- During day time normal operations, sufficient airflow will be delivered underground to ensure adequate ventilation in all areas occupied by workers and equipment. Ventilation air will be provided to all actively used rooms in the underground services area. Because it is currently envisaged that the DGR facility will only be active during weekdays during the operational phase, it is likely that the underground facility will be unoccupied during off-production hours. [IRC-LPSC-01.38]
- Prior to closure of each panel section, the emplacement rooms in that portion of the repository will be ventilated. [IRC-EIS-09.32]
- Air samples will be collected to monitor radioactivity in vent exhaust air, including the measurement of the concentration of radon in underground facilities to ensure the worker exposure to radioactivity is limited. [EA-241, LIC-165 (Rec#41)]

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

- *[The WPRB sumps are not expected to be a routine source of contaminated water, because]* the *[WPRB]* building will be actively ventilated (limiting concentration and condensation) and there will be no *[waste handling]* activities involving routine use of water within the waste package handling area. [LIC-044]
- A maintenance program will be established for the operation of the *[ventilation]* system. [based on EA-017]

MIT-R-09. Emission control measures will be implemented. [based on EIS, Table 13-1 (OPG 2011a)]

- OPG will develop and propose DGR-specific DRLs *[Derived Release Limits]* for CNSC approval prior to submitting its application for an Operating Licence for the DGR. These DRLs will be calculated as per applicable CSA and CNSC guidance in effect at that time. [IRC-LPSC-01.112]
- The actual dilution will be assessed explicitly as part of preparing the DGR-specific DRLs. [IRC-LPSC-01.113]

MIT-R-10. Sump and stormwater will be collected and managed. [based on EIS, Table 13-1 (OPG 2011a)]

- See the detailed mitigation commitments in Table A2, Hydrology and Surface Water Quality Detailed Commitments.
- *[The WPRB sumps are not expected to be a routine source of contaminated water, because]* the *[WPRB]* building will be actively ventilated (limiting concentration and condensation) and there will be no *[waste handling]* activities involving routine use of water within the waste package handling area. [LIC-044]

MIT-R-11. OPG will, as soon as possible prior to site preparation and to the satisfaction of the CNSC, implement a testing program with respect to post-closure containment of radionuclides and other contaminants that will examine [based on CEAA 13.6]:

[CEAA] 13.6.1. long term seal performance and seal material behaviour under similar conditions and depths to those that each seal material will experience in the DGR; and

[CEAA] 13.6.2. consideration of the chemical, hydraulic and physical interaction of the seals with specific rock formations, including the host and cap formations and other formations that may influence the long-term safety case, and the associated excavation damage.

- The final shaft seal design will be informed by laboratory tests, longer-term in-situ tests at the site, and international/national experiences in seal performance. The results from all these tests will enhance the confidence in the performance of the final DGR shaft seal design, to be submitted and reviewed as part of the decommissioning licence application several decades from now. [based on IRC-EIS-06.18, LIC-070, IRC-EIS-03.08, IRC-EIS-03.10]
- The preliminary design of the shaft seals is based on durable materials and is consistent with international practice. This design concept is summarized below.
  - A concrete monolith will be constructed at the base of each shaft.
  - Concrete bulkheads will be placed in each shaft at specific points. These will provide immediate permeability control as well as structural support. One bulkhead will be located towards the top of the Silurian rock formations at the boundary between the saline lower rock formations and the upper freshwater formations. Two other bulkheads will be located around the two more permeable zones in the Silurian rock formations. Other bulkheads may be added for further structural support, or if needed to separate the bentonite/sand and asphalt seals.
  - The shaft will be sealed at closure with about 500 metres of with durable materials. A bentonite/sand mix will be used for the majority of seals, especially in the lower Ordovician formations. An asphalt mastic mix will be used in one section to provide a different low-

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

permeable material barrier. The shaft in the upper formations will be filled with compacted engineered fill such as sand.

- A concrete cap will be constructed at the top of each shaft. [LIC-126, H-04-02, LIC-113, LIC-063, LIC-065, LIC-087, IRC-EIS-05.40]

- The shaft base will be filled on closure with a concrete monolith at the foot of each shaft. Each monolith provides long-term support for the shaft seals and for the rock around the shafts. The concrete will be placed in mass (i.e., without structural reinforcement). Once completed, the monolith will extend from each shaft's base (taken to be 719.1 mBGS for the main shaft and 746.4 mBGS for the ventilation shaft) to 662.1 mBGS in both shafts. The monoliths will extend into the repository tunnels to form a single monolith at repository level. Bulkheads (to contain the monolith's concrete) will be located to ensure support to a minimum distance of 60 m from each of the shafts. There will be no removal of the damaged zone in the tunnels. [LIC-122]

  - The top 180 metres of shaft will be closed with engineered fill and concrete. The properties of this fill will be selected to be consistent with the surrounding permeable rock. The base area around the shafts will be backfilled with an extensive concrete monolith for long-term support. [H-04-03, LIC-006]

  - A low heat generating concrete, such as AECL's LHHPC *(low heat high performance cement)*, will be used for the monoliths and bulkheads (and the rock handling and ramp excavations) will be placed in mass (i.e., without structural reinforcement). The concrete will use sulphate-resistant Portland cement and will be expansive with a low permeability and a low heat of hydration. [based on LIC-128, LIC-131, LIC-064, LIC-114, H-05-01]

  - *[Bentonites will degrade at high pH conditions into non-swelling minerals. In the DGR, alkaline conditions are anticipated near the concrete monolith and shaft concrete plugs.]* However, in the DGR the temperatures will be low, groundwater movement will be very slow (i.e., diffusion-dominant transport), and a low-pH cement will be used, which will minimize the extent of this reaction to a small portion of the bentonite/sand seal adjacent to the concrete. [IRC-EIS-10.12]

- The reference clay seal is bentonite mixed with sand to a 70:30 mix (by weight). The reference bentonite is Wyoming Type Sodium Bentonite (MX80), which is a montmorillonite-based clay material. The reference sand component will be a washed, silica-based material with particle sizes no greater than 2.5 mm. Alternatives that may be considered for the final design include use of a higher clay fraction, and also the use of finely crushed limestone sand rather than silica sand. [LIC-129, LIC-113]

  - The asphalt mastic mix is taken to have the same composition at that proposed for use in the shaft seal for the Waste Isolation Pilot Plant. It will contain 70% (by weight) silica sand (with a maximum diameter of 2.36 mm), 20% (by weight) asphalt and 10% (by weight) hydrated lime. [LIC-130]

- At the time of DGR decommissioning and shaft seal emplacement, approximately 40 to 45 years following initiation of operation, all infrastructure including shaft support structures, concrete liners and an estimated 0.5 m thick layer of EDZ damaged rock along the shafts will be removed. The EDZ properties measured from the activities in the Geoscientific Verification Plan (NWMO 2011b) will be re-assessed to confirm predicted seal performance and adequacy. [IRC-EIS-06.17]

  - Decommissioning will also be planned so as to minimize the EDZ. [IRC-LPSC-03.12]

- The location of the shafts will be appropriately secured *[during decommissioning]*. [EA-085]

- Additional details on the shaft seal system are provided in Section 5.4.1, Preparing for Shaft Sealing, Section 5.4.2, Decommissioning and Sealing of the Underground Services Area, Section 5.4.3, Decommissioning and Sealing the Ventilation Shaft, Section 5.4.4, Construction the Main Shaft Monolith, and Section 5.4.5, Decommissioning and Sealing the Main Shaft, in the Preliminary Decommissioning Plan (NWMO and CANDESCO 2011) and in Chapter 13 of the PSR

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

(OPG 2011b). [LIC-153, LIC-086]

MIT-R-12. Security measures will be in place.

- Personnel working at the Bruce nuclear site will be further restricted from access to the DGR Project through the project's restricted access. Visitors to the project site will be escorted in accordance with procedure. [IRC-LPSC-04.15]
- Consistent with current WWMF procedures, access to the buildings/structures associated with the DGR Project will be limited to designated personnel and those escorted by qualified personnel. [EA-106]
- No access or harvest for consumption will be allowed within the Site Study Area. [IRC-EIS-08.32]
- Additional information on security measures are described in Section 9.2.1 of PSR (OPG 2011b). [LIC-071]
- Security measures during the decommissioning phase are similar to those during previous DGR project phases, see Section 11, Security, of the Preliminary Decommissioning Plan (NWMO and CANDESCO 2011). [LIC-153]

MIT-R-13. *[Radiation protection]* operating procedures and training will be developed and implemented. [based on EIS, Table 13-1 (OPG 2011a)]

Operating Procedures:

- For the DGR, operational programs and procedures will be developed to protect the environment, and health and safety of the public and the workers. OPG will follow all international and CSA standards for exposures to workers and the public. [EA-056, H-06-03, H-16-02]
- The DGR will be compliant with these regulations:
  - PSR, Section 1.4.1, Section 7.1.2.1 and Section 10.1, and Preliminary ALARA Assessment, Section 4.1 indicate that the Radiation Protection Regulations (SOR/2000-203) are applicable to the DGR.
  - PSR, Table 6-1 and Section 6.10.1, and Preliminary ALARA Assessment, Section 4.2.1 indicate that the DGR will be compliant with the OPG Radiation Protection Requirements. These OPG requirements include equivalent dose limits that are equal to the CNSC limits (Sections 4.1 to 4.3, OPG 2001). [IRC-LPSC-01.15]
- A radiation protection program for the DGR will be based on OPG's existing Radiation Protection Program N-PROG-RA-0013. [EA-057, LIC-072 (Section 10.1 of PSR), LIC-090]
  - This *[radiation protection]* program will be consistent with the OPG Radiation Protection Requirements - Nuclear Facilities (OPG 2001) and related procedures [IRC-LPSC-01.69]
  - Records governed by the Radiation Protection Program will follow OPG's Radiation Protection Requirements N-RPP-03415.1-10001. [EA-071]
  - All dose records will be managed as per OPG's Creating and Maintaining Dose Records N-HPS-03413.1-0004. [EA-070]
  - As many of the [*WIPP*] Phase 1 Report findings are directly related to radiological operations, future operating plans and procedures specific to the DGR will consider the WIPP findings in their development. [IRC-EIS-13.15, IRC-EIS-13.16, IRC-EIS-13.17]
  - OPG has a long history of maintaining an effective and regulatory compliant radiation protection program. This is accomplished through a commitment to regulatory compliance, well trained and qualified staff, staying current with advancements in technology and practices and by a continuous view to the industry to learn and improve from operating

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

experience. Prior to placing the DGR into operations, OPG will have demonstrated to the CNSC that it has established an effective radiation protection program which meets all applicable regulatory requirements. [IRC-EIS-13.11]

- OPG has an active maintenance program *[of the critical equipment and components contributing to the radiological detection and release]* and will apply this to the DGR. [IRC-EIS-13.10]

- Worker doses will be kept within OPG limits and consistent with the ALARA principle through design measures (such as shielding or distance) to be developed as part of the detailed design, and through the use of monitoring, administrative controls and procedures during operations. [IRC-EIS-08.12, LIC-039, LIC-072 (Section 10.1 of PSR), LIC-090]
  - The doses arising from routine waste management operations are monitored and assessed against dose targets. Thermoluminescent Dosimeter (TLD) badges will be worn as a minimum external dosimetry requirement for personnel involved in the operation of the DGR Project. [EA-105, LIC-139, IRC-LPSC-01.117]
  - As long as the worker whole body effective dose remains within its limit, practical experience at WWMF indicates that the worker doses will also remain within the equivalent dose limits. This expectation will be confirmed during operations. [IRC-LPSC-01.16]
  - The activities will be controlled such that the worker's cumulative dose exposure will be within OPG's Administrative Dose Limits. [IRC-EIS-01.22, IRC-EIS-01.19]
  - Dose limits will be further managed through operational procedures including task dose planning, monitoring of individual worker doses and assignment of tasks, and scheduling of package deliveries. As an example of the latter point (which would benefit both NEWs and non-NEWs), it is planned to initially transfer mostly LLW from WWMF into the DGR, which will allow additional time for in-situ decay of ILW at WWMF before it is transferred. [IRC-LPSC-01.21]
  - The dose planning and monitoring program for the DGR Project will implicitly incorporate the dose contributions from all licensed activities. [IRC-EIS-01.18]
  - While individual annual worker dose is within CNSC worker dose limits and OPG's internal Administrative Dose Limits, it exceeds OPG's Exposure Control Level of 10 mSv/year. Measures would be taken to prevent this exposure from occurring. Doses are expected to be ALARA due to design measures developed using an iterative design approach and through the use of administrative controls and procedures that will be in place during the operational phase. [LIC-150]
  - Administrative procedures will be developed for the operations phase, and will take into account the necessary placement of waste to ensure ALARA dose to workers. [IRC-LPSC-01.110]
  - During DGR operations, OPG's ALARA practice at the Western Waste Management Facility (WWMF) will be followed. [IRC-LPSC-01.116]
  - Additional equipment or facility shielding could be provided. Facility operational requirements as stated in OPG's RPRs *[Radiation Protection Requirements]* include access control, signage, contamination control, hazard detection, monitoring and alarms. For example, the use of Electronic Personal Dosimeters (EPDs) will be implemented. [LIC-143, LIC-139, TIS-02-01, IRC-LPSC-01.117]
  - Further information *[on how individual worker doses will be kept ALARA]* will be provided in the Final ALARA Assessment that will be prepared as part of the DGR Operating Licence application. [IRC-LPSC-01.117, IRC-EIS-01.21, LIC-139, LIC-140, LIC-149]

- The DGR package handling areas are mostly unoccupied except for the duration of the delivery of items to be emplaced. The procedures for the handling, stacking and placement of waste packages

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

within the buildings and emplacement rooms will minimize worker contact with the waste to reduce radiation exposure and the risk of personal contamination. Facility and equipment inspection and maintenance procedures can be designed to minimize exposure and the proximity of workers to the stored waste packages. [LIC-144]

- Monitoring and handling of ILW packages requiring shielding will be a well defined activity using trained operators and operating procedures, and Electronic Personal Dosimeters (EPDs) worn by DGR staff will provide additional monitoring redundancy for preventing inadvertent exposure. [LIC-050]
- Increasing the distance from waste packages, where practical, is a common method used to decrease dose. This can be ensured by imposing physical barriers and providing the necessary tools to complete the required task at a safe distance. Tasks will be typically performed at the greatest reasonable distance. [LIC-145, LIC-148]
- There will be variability in dose rate within waste packages. It is recommended that waste packages with relatively high dose rate be emplaced at the far end of the emplacement room or WPRB staging area, so they are shielded by lower dose rate packages at the front of the room. This is current practice at WWMF, but was not credited in this ALARA assessment. [LIC-148]
- The external dose calculations for workers show that high dose rates are possible in specific locations, especially near the face of an array of higher dose rate LLW or ILW packages in emplacement rooms. Generally, workers would not need to spend much time in these locations, nor are most packages at high dose rates. However, it will be planned to monitor the radiation fields in these locations, and if necessary to limit the worker exposure, use shielded forklifts and/or use greater stand-off distances. This will be considered further within the context of ALARA. [LIC-062, EA-240]

Note: Decommissioning activities will be also performed in accordance with the ALARA principle. Similar procedures would be in place for radiological safety during the decommissioning phase. Details are provided in Section 10.2, Radiological and Environmental Safety, of the Preliminary Decommissioning Plan (NWMO and CANDESCO 2011). [LIC-153]

- Upon the completion of emplacement room construction, there will be a period of time before active emplacement commences. These rooms are considered “confined spaces” (Reg. 854, Part XII) and access to non-active empty rooms prevented. Unventilated empty rooms will therefore require:
  - Installation of a barricade at the entrance to the room;
  - Adequate signage indicating entry is prohibited;
  - A procedure for re-entry (e.g. inspection of regulator, air monitoring, ground inspection, etc.) that meets acceptable atmospheric conditions (Reg. 854 Section 294) and developed health and safety guidelines.

  Following emplacement activities, a filled emplacement room will be monitored while adjacent rooms are being filled. An end wall will be constructed, as required, at the entrance to each emplacement room to provide worker protection from radiation from the waste packages in the room, prevent people from entering the room and act/or to control ventilation airflow. [LIC-017, LIC-134, LIC-135]
- The ventilation exhaust shaft is not a normally occupied area, and would have appropriate access controls to limit exposure. [EA-246]
- During the site preparation and construction and decommissioning phases, the construction workers will not be considered NEWs. [EA-238]
  - Non-NEWs working in the railway ditch area would potentially be exposed to waste packages during transport over the crossing, in addition to any staged LLW in the WPRB. The specific exposure from packages during crossing has not been evaluated in detail. This will be

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

addressed during detailed design. [LIC-046]

- During operations, DGR workers will be NEWs *[Nuclear Energy Workers]*. [EA-238]

Training:

- Site Preparation and Construction:
  - A Training Management Plan will be prepared for the DGR Project. [EA-050]
  - Activity-specific requirements such as common core training will be required for those performing work underground. [H-23-08]
  - OPG will train project personnel to ensure they are knowledgeable on safety and environmental protection measures and other applicable elements of the management system. [H-23-07, H-23-01, H-17-10, LIC-002]
- Operations:
  - A Staffing and Training Program will be developed to ensure the presence of a sufficient number of qualified workers to carry out activities safely and in accordance with the Nuclear Safety and Control Act and its Regulations. Training meeting the requirements of OPG's Training Program N-PROG-TR-0005 will be established and maintained. [EA-064, H-23-01, H-23-19, LIC-002, LIC-072 (Section 10.5 of PSR), LIC-090]
  - There will be detailed procedures and training developed for operations staff which will include standard human performance error prevention tools and standards. In addition there will be emergency procedures developed for accidents. These procedures and training will be developed as part of hand-over preparation and more detail will be provided as part of the Operating Licence application. [IRC-LPSC-01.114, IRC-EIS-05.48, LIC-146, H-24-34]
    - Risk reduction will be primarily achieved through compliance, by competent workers, to effective operational controls, developed through effective risk assessment and safe work planning. [EA-107]
    - All workers in the DGR will receive specific training, so that their tasks can be performed efficiently and safely. For example, forklift drivers that are trained will take less time to place waste packages in the proper location, thus reducing their dose. [LIC-146, IRC-EIS-05.48, IRC-LPSC-01.114]
    - Training records will be managed as per OPG's Records and Documentation N-PROC-TR-0012. [EA-072]

Additional mitigation measures:

MIT-R-14. OPG will, before a licence to operate is issued, finalize and obtain the approval of the CNSC of its Waste Acceptance Criteria, including measures to avoid releases of container contents prior to their emplacement in, and the closure of, the repository panels. [based on CEAA 13.7]

MIT-R-15. OPG will, before an operating licence is issued and to the satisfaction of the CNSC, review potential thresholds and screening methods for actinides for all waste packages to be emplaced in the DGR. OPG will also, within the same time frame and to the satisfaction of CNSC, develop a contingency plan if needed to ensure wastes with high actinide levels are in appropriate containers. [based on OPG proposed revised wording to CEAA 8.4]

MIT-R-16. OPG will, before a licence to operate the DGR is issued and to the satisfaction of the CNSC, prepare an inspection protocol for waste containers, beyond visual inspection, that must be followed before their placement in the DGR. The protocol shall include procedures that ensure that container venting mechanisms will remain functional following emplacement in the DGR. [based on CEAA 13.4]

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

Waste Receipt and Inspection:

- All waste packages delivered to the DGR will be required to meet the Waste Acceptance Criteria (WAC) described in Section 5.5 *[of the Preliminary Safety Report]*. [LIC-023, EA-013, EA-029, IRC-EIS-04.33, IRC-EIS-04.36, LIC-008]
  - There will be no waste conditioning processes at the DGR; all the waste packages arriving at the DGR will be closed with lids, and external loose contamination will be checked prior to acceptance at the DGR. [IRC-EIS-04.23, LIC-023, LIC-042, LIC-043, LIC-092, LIC-141]
  - The packages will be inspected to ensure that damage has not occurred in transfer and confirmed that waste acceptance criteria have been met. [based on LIC-025, EA-053, H-07-01, IRC-EIS-04.04, IRC-EIS-04.37, IRC-EIS-08.06, IRC-EIS-08.07, IRC-EIS-08.09, IRC-EIS-08.11, IRC-EIS-09.49, IRC-EIS-09.57, IRC-EIS-11.02, IRC-EIS-11.07, LIC-051]
  - During DGR operations, all waste packages sent to the DGR will be checked against the DGR waste acceptance criteria, which will include measuring the waste package dose rate to ensure it is within specified limits. [IRC-EIS-01.24]
- Prior to transfer and placement of a waste container into the repository, the exterior surfaces of the waste container will be visually inspected per the Deep Geologic Repository (DGR) Waste Acceptance Criteria (WAC). In the event that a container is found not to be in good condition or does not otherwise meet the DGR WAC, the waste container will be repaired, if practical, repackaged or placed into an approved engineered waste overpack and/or vented. Lifting points (e.g. fork lift pockets) on the container will be inspected, as required per OPG Nuclear (OPG-N) lifting and rigging procedures and OPG-N radiation protection procedures will be followed. Before beginning the overpacking of a container, a pre-job briefing will be conducted with workers, critical tasks, hazards and mitigation measures will be discussed and reviewed, and back-out conditions will be identified. In addition to using a normal waste container handling procedure, a special handling procedure would be prepared, if it was deemed necessary during the work planning process. [IRC-EIS-11.02, EA-053, H-07-01, IRC-EIS-04.04, IRC-EIS-04.33, IRC-EIS-04.37, IRC-EIS-08.06, IRC-EIS-08.07, IRC-EIS-08.09, IRC-EIS-08.11, IRC-EIS-09.49, IRC-EIS-09.57, IRC-EIS-11.07, LIC-025, LIC-051, IRC-EIS-09.08, IRC-EIS-09.07, IRC-EIS-09.51, IRC-EIS-09.52, IRC-EIS-09.55, IRC-EIS-09.56, IRC-EIS-09.58, IRC-EIS-10.04]
  - All treatment, conditioning and packaging of wastes will continue to be performed at the WWMF under its existing operating licence and/or at other specialized facilities licensed for this purpose, prior to transfer to the DGR. [IRC-EIS-09.59, EA-052]
  - OPG continuously operates with waste minimization in mind, stations have waste minimization strategies, and this ongoing process will be applied to retrieved wastes prior to emplacement in the DGR. [IRC-EIS-08.10, H-05-03, H-01-02]
  - Quantitative inspection criteria for container damage have not yet been developed, but will be developed in the future as the waste acceptance criteria are finalized. [IRC-EIS-09.50]
  - Removable shielding and specialized lifting hardware, if required, will be installed at the WWMF during retrieval *[of shield plug containers]* from storage. [LIC-024]
  - For new containers arriving at OPG's Western Waste Management Facility (WWMF), OPG Supply Chain will perform a receipt inspection, including a visual inspection, to ensure that all required QA *[quality assurance]* documents (e.g., material data report or certificates, test result, etc.) are accompanied with the container shipment and that the container's physical condition is acceptable. [IRC-EIS-11.06]
  - All waste packages retrieved from WWMF will be transferred in a DGR-ready state on flat-bed transporters, covered transporters, or forklifts to the WPRB. Prior to the trip, the waste package will be secured to the vehicle using tiedowns attached to designated points on the package and vehicle, as per standard OPG practice. [based on LIC-025, and IRC-EIS-

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

10.15, EA-053, H-07-01, IRC-EIS-04.04, IRC-EIS-04.37, IRC-EIS-08.06, IRC-EIS-08.07, IRC-EIS-08.09, IRC-EIS-08.11, IRC-EIS-09.49, IRC-EIS-09.57, IRC-EIS-11.02, IRC-EIS-11.07, LIC-051]

- These robust waste packages *[retube waste]* are placed into interim storage and will be transferred to the DGR once it is in-service. [IRC-EIS-11.03]

Waste Tracking:

- Waste packages will be tracked regarding their location within the DGR. [EA-054]
- Waste containers and inventories stored at WWMF are presently tracked using OPG's Integrated Waste Tracking System electronic waste tracking database. This system, or a similar one, will be adopted for the DGR, so that waste packages will be tracked with respect to their location within the DGR. This system will contain information on the characteristics of each package, and will have the ability to produce reports on the waste inventory within the DGR at any time. [LIC-009]

Waste Transfer and Handling:

- *[For the 2010 reference inventory forecast, it was assumed that]* ash bins will be overpacked in a DGR-ready LLW sheet metal overpack. [based on LIC-117]
- Non-processible wastes are stored in a family of non-pro boxes having a standard footprint and differing in height (and therefore volume capacity). The boxes are of painted sheet metal, and generally open topped. Lids will be provided when they are transferred (without any overpack) for emplacement in the DGR. [LIC-118]
  [Note: All new waste containers are lidded per current practice.]
- All of the containers are procured using a technical specification for each type, which includes required design life, gross mass and stacking requirements. Similar technical specifications will be prepared for new containers and overpacks that have not yet been designed. [IRC-EIS-09.53]
- Waste packages are loaded on to the rail cart by light duty or heavy duty forklift or by overhead crane, as appropriate for the package type. The load is centered on the cart with the aid of markings or guides on the cart deck. The exact nature of the markings or guides will be determined during the detailed design of the cart. [IRC-EIS-10.16]
  - Detailed specifications for the mobile equipment have not yet been prepared as they are not intended for use until 2019. The Final ALARA assessment will lead to additional dose reduction measures as required. [IRC-LPSC-01.108]
- The need for specific physical restraints (e.g. clamps or tie downs) for various types of waste packages will be determined during the detailed design phase. [IRC-EIS-10.17]
- The inventories in the WPRB will generally be small, as the WPRB is not intended for storage as packages will be transferred directly to the main shaft cage and then down to the repository. However, there will be capacity for some temporary storage for waste packages if necessary. [LIC-041]
- Retube Waste (Pressure Tubes) will be transferred directly to the underground repository. [LIC-047]
- It is expected that a maximum of 24 LLW packages and 2 resin liner shields will be staged inside the WPRB (in the corner of the WPRB, as shown in Figure 3.1 *[of the Preliminary ALARA Assessment]*) at one time. [LIC-142]
- Other ILW packages will need to be provided with an add-on shield to protect workers while these waste packages are transferred underground. This shielding will sometimes be removed if safe to do so and re-used if practical, otherwise it will be retained on the waste after emplacement. [IRC-EIS-04.05]

TABLE A5: RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

- Waste package movement at the DGR, through surface handling, shaft handling, underground transfer and placement in emplacement rooms, will be conducted in a physically stable configuration utilizing practices that meet applicable regulations (refer to OPG 2011b, Section 6.5 for methods of package handling). [IRC-EIS-08.08]
- Carts with waste packages that require off-loading by crane will be driven to the special rail-equipped emplacement rooms under manual pendant control at a maximum speed of approximately 0.5 m/s and off-loaded using a gantry crane. Rigging and lifting practices will be as per approved OPG procedures. [IRC-EIS-10.20]
- The battery-powered rail cart is moved into the cage under manual pendant control at a maximum speed of approximately 0.5 m/s and the brakes applied once it reaches position. Safety stops and electrical interlocks will be designed into the cage to prevent over travel. The cart is then mechanically secured to the cage with a locking device. The cart locking device will be designed during the detailed design phase. [based on IRC-EIS-10.18]
- The light duty model *[forklift]* will be used for the majority of the LLW packages, while the heavy duty model will be used for the heavier packages (mostly shielded ILW packages). [IRC-EIS-10.14]
- Certain waste packages and other irregular shaped waste objects (such as heat exchangers) not suited for forklift handling will be transferred from the WWMF to the DGR on a flatbed or similar truck. Prior to the trip, the waste package will be secured to the vehicle using tiedowns attached to designated points on the package and vehicle, as per standard OPG practice. The vehicle *[flatbed or similar truck]* will be unloaded at the DGR by an overhead crane using OPG approved rigging and lifting practices. [based on IRC-EIS-10.15]
- Waste packages will be stacked according to the specifications for each type using approved procedures, similar to those currently used by OPG in its surface storage facilities. [IRC-EIS-10.19, IRC-EIS-09.54]
- At no time will radioactive waste be transferred in the main cage while personnel are being concurrently transferred in the auxiliary cage under normal operating conditions. [LIC-016]
- Packing optimization and placement scheduling will be further developed through the operating phase of the DGR. [IRC-EIS-03.07]

MIT-R-17. OPG will, starting prior to construction and until the end of operations, investigate and report to the CNSC on a regular basis on the effectiveness of existing and emerging imaging technologies which could be used to detect waste-to-container interactions that may lead to container breaches. If effective non-destructive testing methods become available, subject to the approval of the CNSC, they will be instituted to supplement visual inspections of waste packages. [based on CEAA 13.5]

MIT-R-18. OPG will, before a licence to operate is issued and to the satisfaction of the CNSC, perform research, and report on, the predicted long-term stability (up to decommissioning) of the solidified active liquid waste sludges and the potential release of liquids when exposed to conditions applicable to the DGR to confirm that no further measures are required to control condensation from, and leakage of, sludges following packaging. [based on CEAA 13.8]

- ALW *[Active Liquid Waste]* sludges are stored in carbon steel sludge boxes, which will be placed in LLW sheet metal overpacks prior to consignment to the DGR. [LIC-119]

MIT-R-19. A waste characterization program will be implemented.

- The Waste Inventory Verification Plan included in Attachment C of OPG letter dated May 9, 2014 is essentially commitments. [IRC-EIS-13.05]
  - The ongoing waste characterization program will further improve the completeness and accuracy of the inventories in the various waste streams. [IRC-EIS-06.09, IRC-EIS-01.16, H-

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

07-03, H-23-04]

- Based on actual pressure tube data, and including the inventory of garter springs which are disposed along with pressure tubes, some radionuclides have been identified as being underestimated in the reference inventory. These are being addressed in the ongoing waste characterization programme, and revised inventory values will be used in future updates to the reference inventory. [IRC-EIS-13.02]

- The measurement data are integrated into OPG's waste tracking database. This information will be used to generate an updated estimate of the projected DGR inventory, which will be provided as part of the Operating Licence application. [IRC-EIS-01.25, IRC-EIS-01.10, IRC-EIS-13.01]
- The reference inventory report will be updated if significant new information becomes available, and in particular a revision of the report would be issued around 2017. [H-27-01]
- During DGR operations, an updated current inventory of waste volume and total radioactivity stored at the DGR will be provided on a quarterly or annual basis, similar to the quarterly *[operations]* reports presently issued by the Western Waste Management Facility to the CNSC. An updated projected inventory based on the received waste packages and future forecast packages would be provided in support of subsequent licence renewal applications. [IRC-EIS-01.27, IRC-EIS-01.17]
  - A program for verifying waste inventories during the operational phase will be developed and provided as part of the Operating Licence application. [IRC-EIS-01.26]
  - See also LIC-165 (OPG's response to Rec #3).

MIT-R-20. OPG will, throughout all preclosure phases, undertake all reasonable measures to prevent accidents and malfunctions that may result in adverse human and/or environmental effects and effectively implement appropriate emergency response procedures and contingencies developed in relation to the Designated Project. [based on CEAA 13.1, EA-148, EA-127, EA-132, EA-152, EA-228, EA-251, LIC-061]

Site Preparation and Construction Phase:

- NWMO (site preparation and construction) will establish preventive measures, contingency plans and emergency procedures to prevent incidents and minimize the effects of a fire or spill. [EA-152, EA-127, EA-132, EA-148, EA-228, EA-251, LIC-061, IRC-EIS-08.23]
- The EMP monitoring program will include an ongoing evaluation of site management practices. The monitoring program *[EMP]* includes visual inspections and records checks. It comprises verification that proper safety procedures and accident prevention programs are in place based on good industry management practice, such as:
  - Equipment is properly maintained;
  - Proper environmental training is in place; and
  - Emergency equipment and procedures are tested.

  The malfunctions and accidents prevention monitoring program consists of a checklist of good industry management practice (Table 4c *[of the EA Follow-up Monitoring Program (NWMO 2011a)]*) that will be verified in the field. [EAFMP-047, IRC-EIS-04.27]
- OPG will ensure that an emergency response plan is prepared and implemented for the DGR Project. In addition, OPG will share DGR Project information with local and regional health and safety service providers about timing and large changes in the magnitude of its on-site labour force and training opportunities applicable to each phase of the DGR Project. [based on EA-251, EA-127, EA-132, EA-148, EA-152, EA-228, LIC-061]
- *[The]* ERP *[Emergency Response Plan submitted with OPG's response to IR-LPSC-04-66 (OPG 2013a)]*, was developed to support the 2011 and 2012 field investigation programs and will need to be revised in advance of site preparation and construction to reflect the expanded scope of

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

activities and the associated emergency situations. [based on IRC-LPSC-04.25]

  - See also LIC-165 (OPG's response to Rec #19).

- Emergency response at the DGR will be conducted in cooperation with Bruce Power, as described in NWMD Employee Emergency Response Procedure W-PROC-ES-0002. OPG will ensure that an effective response can be made to address an emergency affecting the health and safety of OPG employees, its business continuity and its property, contractors at the DGR, the environment, and the public. [EA-066, H-23-21]

  - Emergency procedures that are currently in place at the Bruce nuclear site, as well as any additional measures that are conceived in the Preliminary Safety Report (OPG 2011b) due to the presence of the DGR, are designed to ensure that malfunctions and/or accidents will be addressed in a timely manner, which will not allow for a measurable infiltration of radiological or non-radiological contaminants to the sub-surface, and by extension, to potential potable water supply sources. [IRC-EIS-05.26]

  - Bruce Power and OPG will work co-operatively with Emergency Management Ontario and other local emergency responders to assist in the development and testing of emergency plans throughout the life of the DGR Project. Local fire departments may require additional orientation and training of their staff regarding the presence of new above-ground and below-ground facilities and equipment. Some may require specialized training and resources to respond to emergencies, especially below-ground emergencies, which are likely to be new and unfamiliar to emergency response staff, should they be called upon to assist. [EA-250, EA-131, IRC-LPSC-01.114]

  - A detailed ERP *[Emergency Response Plan]* will be prepared prior to the start of construction and incorporate coordination with Bruce Power for the security and safe transport of explosives on the Bruce nuclear site. Emergency response planning, development and implementation of safe operating procedures and monitoring for compliance will be part of the DGR Project managed systems including the Health and Safety Management Plan and Environmental Management Plan. [IRC-EIS-09.06]

  - The Bruce site emergency plan will be modified to include the DGR facility in its notification and response areas when the DGR starts construction. [IRC-EIS-08.22]

- The project will have trained first aid responders, both staff and contractors, for front-line medical incidents. Depending on the severity of the incident, Bruce Power's emergency response team (ERT) will be contacted to respond. [IRC-LPSC-01.118]

- Contingency plans have yet to be developed for the project to reflect the potential for simultaneous emergencies and expected response. Selected contractor capabilities could have an effect on the requirements of external support. This area will require future consideration and will be reflected in the DGR Response Plan as appropriate. [IRC-LPSC-01.122]

- The project health and safety organization will be responsible to maintain the emergency response and communication equipment specified for the site, including contractor supplied equipment. This will include routine inspections and testing of equipment and maintaining records of such inspection. [IRC-LPSC-01.119]

- The site emergency response requirements will be modified through the project phases to reflect the nature of the work being performed and the parties involved. The emergency response system will be tested annually. [IRC-LPSC-01.120]

- Effects from potential accidents can be minimized or controlled through implementation of the following mitigation measures:

  - Minimization of combustible materials and ignition sources, especially near waste packages
  - Use of overpacking and shielding on higher activity packages
  - Limited number of packages handled in any transfer

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

- Limited equipment speeds
- Fire detection and suppression equipment, such as automatic fire suppression systems on diesel transfer equipment
- Appropriate follow-up measures corresponding to the results of contamination and dose rate monitoring
- Access to refuge stations and safety equipment
- Appropriate worker training and operating procedures
- Emergency communication systems. [EA-227, EA-229, LIC-059, LIC-060, H-08-03, IRC-LPSC-03.05]

- The impact of accidents during the site preparation and construction phase vary. The potential impact on workers depends on the accident and how close the worker is to the accident. Conventional construction accident impacts on workers could be minor or severe.

  No impact on the public is expected from accidents during this phase. This reflects that these are conventional, industrial activities and the nearest public location is the Bruce nuclear site boundary about 1 kilometre distant from the DGR. The nearest normally-occupied public locations are further distant.

  Contingency plans will be in place for accidents during this phase. This includes emergency response plans, in particular, for fires and spills.

  Another example is the placement of portable refuge stations underground near the working face which will provide protection for the workers in case there is an underground accident and they cannot immediately travel to surface. [H-08-02, H-08-03, EA-148, EA-127, EA-132, EA-152, EA-228, EA-251, LIC-061]

- *There* will be a contingency plan for a massive earthquake that results in damage to the pumps and shaft liners. In this case a pump-in piping will be installed down a shaft from surface to provide emergency pumping. [based on H-08-05]

- The contingency plan *[included in the Construction Management Plan]* will be revised and tested as the construction proceeds from surface construction to shaft sinking to underground lateral development. [EA-051]

- If there is a failure of a fresh air supply fan(s) sufficient to affect air quality, notifications will be made to stop work and have personnel egress from the area to the refuge station until such a time as the operation of the fan(s) is restored. [IRC-EIS-04.39, IRC-EIS-04.38]

- If access to the main control is not possible during an emergency, secondary hoist control in the main and ventilation headframes will be available. [IRC-LPSC-01.29]

- In the event of an underground accident involving the release of volatile radionuclides or volatile hazardous substances personnel will follow the same general procedure as for a fire event. [IRC-LPSC-01.41]

- It is recognized that there will be several areas of development that will limit egress to single access (e.g., south panel access tunnel). This type of development is not uncommon in mining operations and appropriate procedural control will be in place to address these situations. [IRC-EIS-03.03]

- Egress routes will be marked by appropriate signage, documented through emergency response procedures and personnel will be trained on egress through use of emergency drills. [IRC-LPSC-03.07]

- Emergency back-up power will be provided [Table 1 in IRC-EIS-06.26]

  - Electrical - Two main power feeds are planned to supply power to the DGR systems, with redundant buses supplying power to critical loads in the event of the loss of either of the main feeds. In addition, there will be two emergency generators (2 x 100%) for the DGR

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

project site in the event that both main feeds are lost. Uninterruptible power supply units are included as needed (see OPG's response to IR-LPSC-01-10 [OPG 2012a]). This will ensure there is communication and emergency services provided for postulated preclosure accident scenarios as described in the Preliminary Safety Report (OPG 2011b, Chapter 7). [IRC-EIS-06.20]

- Class III Emergency Power Distribution System [Note: further details are provided in response to IR-LPSC-01-10] [IRC-LPSC-01.26]
- Class II Power Distribution System [Note: further details are provided in response to IR-LPSC-01-10] [IRC-LPSC-01.27]
- The induction motors will be designed and constructed as per NEMA Standard MG-1, Motors and Generators and CSA Standard C22.2, No. 100, Motors and Generators. [IRC-LPSC-01.24]
- All *[surface]* electrical equipment including distribution panels, control panels and all electrical terminations will be located at the shaft collar elevations or above (determined from the elevation requirements determined from the Maximum Flood Hazard Assessment) to limit the impact of postulated flooding events on the electrical systems. [IRC-LPSC-01.28]
- Preventative maintenance and inspection programs will be implemented to ensure the reliability of the emergency power system. [EA-025, LIC-013]

Operations Phase:

- OPG (operations) will establish preventive measures, contingency plans and emergency procedures to prevent incidents and minimize the effects of a fire or spill. [EA-152, EA-127, EA-132, EA-148, EA-228, EA-251, LIC-061, IRC-EIS-08.23]
- Prior to the DGR receiving its operating licence, OPG will have demonstrated to the CNSC that it has a strong and sustainable emergency management system. This program will not only be reflective of those developed for OPG's safe operations, but will consider the unique potential hazards of being deep underground. OPG has a strong performance history in this area and is confident it will further improve with time as we enter into DGR operations. [IRC-EIS-13.08]
- OPG will have programs in place for the DGR Project similar to those at the WWMF and that comply with the above standards and practices, as well as applicable Canadian standards, such as CSA Z16000-08 Emergency Management and Business Continuity Programs and CSA Z-731-03 Emergency Preparedness and Response. [EA-154, LIC-072 (Section 10.7 of PSR), LIC-090]
  - There will be emergency procedures developed for accidents. These procedures and training will be developed as part of hand-over preparation and more detail will be provided as part of the Operating Licence application. [based on IRC-LPSC-01.114, IRC-EIS-05.48, LIC-146]
  - There will be management systems in place to respond to accidents. Examples of contingency plans for operations phase accidents are listed here. These include emergency response teams, including training and mine rescue; onsite emergency response equipment; underground refuge stations; emergency response plans such as for fires, and spill management plans. [H-08-03]
- Radiological contaminant release will be responded to with a pre-developed plan for rescue of personnel and clean up. [EA-130]
- *[In the event that decontamination underground is required, the following facilities will be provided:]*
  - The maintenance shop will contain materials and equipment that can be used to decontaminate forklifts or other mobile equipment that are discovered to be contaminated underground;

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

- Materials will be provided next to the whole body monitor underground that will be used to contain contamination so that personnel may be transported to surface to the decontamination facility;
- The refuge stations will be equipped with radiation protection equipment for monitoring and decontamination of staff in the event of contamination; and
- Detailed procedures for decontamination underground will be developed. [LIC-034]

- In the unlikely event of a radiological accident involving the DGR Project, unplanned releases will be controlled. [EA-145, EA-225]
- The effects on human and non-human biota from potential accidents at the DGR Project were found to be small; and can be minimized or controlled through implementation of the following mitigation measures:
  - appropriate training and operating procedures;
  - emergency planning and response procedures; and
  - appropriate follow-up measures corresponding to the results of the contamination and dose rate monitoring. [based on EA-147]
- As part of the Operational Readiness Plan for the DGR, OPG will review options for mine rescue capability during the operating phase. [IRC-LPSC-03.10]

Decommissioning Phase:

- Mitigation strategies and emergency procedures for operations will remain in place during decommissioning in case of the occurrence of potential accidents. [EA-146, EA-224, H-08-06]
- Adaptive management will be incorporated into the EA follow-up plan for the decommissioning phase by including contingency procedures and plans to comply with/conform to regulatory standards or guidelines that are applicable at the time of decommissioning. [IRC-EIS-06.04]
- Additional details on the emergency response during the decommissioning phase are provided in Section 10.2, Radiological and Environmental Safety, Section 10. 3, Chemical and Construction Safety, and Section 10.4, Emergency Planning, of the Preliminary Decommissioning Plan (NWMO and CANDESCO 2011). [LIC-153]

MIT-R-21. OPG will, before an operating licence is issued and to the satisfaction of the CNSC, develop and implement a detailed plan on how it would mitigate a scenario where intermediate-level waste containers fail in filled chambers while the DGR is still in operation. The plan should evaluate the anticipated exposures to the workforce if the rooms were completely filled, as well as during the period when the retrieval of containers would still be possible via planned access routes. [based on CEAA 8.5]

MIT-R-22. In the event of an accident or malfunction with the potential to cause adverse environmental effects, OPG will implement measures to minimize any adverse environmental effects associated with the occurrence, in accordance with procedures and protocols established under the CNSC regulations and licencing conditions. [based on CEAA 13.2]

MIT-R-23. OPG will ensure that a mine rescue plan is prepared and implemented for the DGR Project. In addition, OPG will share DGR Project information with local and regional health and safety service providers about timing and large changes in the magnitude of its on-site labour force and training opportunities applicable to each phase of the DGR Project. [based on EA-251, EA-127, EA-132, EA-148, EA-152, EA-228, LIC-061].

- In advance of excavation activities, mine rescue capabilities will be established and the ERP will be updated accordingly. The DGR is not considered to be a mine under the OHSA; however, trained and qualified mine rescue teams will be provided as required by the Mines and Mining Plants

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

Regulations (Reg 854). As required by the Mine Rescue program, a second team is required at site before the first team can go underground and a third team must be on-route. Back-up will be provided by nearby mine rescue teams through mutual assistance agreements. [IRC-LPSC-04.26, IRC-LPSC-03.09]

- During the construction phase, mine rescue capabilities will be a combination of DGR project staff, contractor personnel and Bruce Power Emergency Response (ERT) staff. It is not expected that the project will carry an on-site complement of 2 responding units, but rather will be supported through on-call response. [IRC-LPSC-03.08]
- Trained and qualified mine rescue teams will be provided as required by the Mines and Mining Plants Regulations (Reg. 854). Backup rescue team(s) will be available through mutual assistance agreements with nearby facilities. [EA-067, EA-128, H-08-09, H-23-20, IRC-LPSC-01.121]
- In the event that workers get trapped by a rock fall or other extraordinary event, facility management will coordinate the response and utilize the mine rescue teams to assess the situation and recommend a recovery strategy depending on the circumstances. [EA-129]

MIT-R-24. Fire Protection Programs will be developed for the construction phase and for the operations phase of the facility prior to the start of each phase. They will include required elements such as roles and responsibilities, fire response, fire assessments, managing changes that affect fire protection, work practice and procedures, fire planning, inspection and maintenance of fire protection systems, quality assurance, housekeeping, storage and handling of hazardous goods, control of ignition sources, transient material, reporting and drills. [IRC-LPSC-01.47].

[Note: For fire protection design-related commitments, see MIT-P-04 in Table A9, Human Health Detailed Commitments.]

Site Preparation and Construction Phase

- A detailed Fire Protection Program for site preparation and construction will be prepared in accordance with the National Building Code of Canada-Part 8, the National Fire Code of Canada, the Ontario Health and Safety Act, and guidance from National Fire Protection Association (NFPA) standards 122 and 801, and Ontario Regulation 213/81, which have all been reviewed for their relevance to this project. [IRC-LPSC-01.97]
- In accordance with Section 19.0 of the Project Requirements, which states that 'The latest version of all regulations, standards and codes listed in this section will be used; the newer codes; National Building Code of Canada - 2010 (NBCC) and the National Fire Code of Canada - 2010 (NFCC) will be used for future design of the DGR, along with more stringent applicable requirements in the Ontario *[Occupational]* Health and Safety Act (OHSA) regulations. [IRC-LPSC-01.02, IRC-LPSC-01.01, IRC-LPSC-04.09]
- The Fire Protection Program will be specific to the DGR, due to the unique fire protection requirements associated with the facility, and will include a requirement for a Fire Hazard Analysis (FHA) based on the guidance of NFPA 122 and 801. A consultant specializing in fire protection has been retained to assist in the development of the FHA, Code Compliance report and Fire Protection Program for the DGR. Also, as committed in Section 6.8.1 of the PSR, an independent third party review will be conducted from a fire protection perspective. [IRC-LPSC-01.44, IRC-LPSC-01.50, IRC-LPSC-01.98]
  - The FHA will be performed to assess the consequences of fires that pose a risk to:
    - Release of radioactive or otherwise hazardous material to the environment.
    - Increased radiation dose to site personnel including emergency responders.
    - Non radiation-related injury to site personnel. [IRC-LPSC-01.51]
  - The FHA will:
    - Consider both construction and operation phases of the facility.

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

- Review performance criteria for detection and alarm systems.
- Evaluate inspection, testing and maintenance of fire protection systems.
- Identify where hazards exist which could potentially impact nuclear safety.
- Identify the design basis fires and the fire growth scenarios based on credible operating conditions.
- Analyze the consequences of the design basis fires with respect to nuclear safety, personnel safety, and environment protection.
- Postulate fire protection system impairment scenarios so as to verify available defence-in-depth measures.
- Identify the potential consequences to personnel safety (not related to nuclear safety) and determine if the consequences exceed criteria.
- Evaluate the adequacy of the fire protection measures in mitigating the risk of hazards such that the consequences do not exceed criteria.
- Identify cases where additional fire protection measures are required to ensure that the consequences of the design basis fires do not exceed criteria. [IRC-LPSC-01.52]

- The fire protection goals were developed and embedded in the PSR section 6.8. These include minimizing ignition sources, maintaining multiple egress routes and safe areas of refuge, and using a defence-in-depth principle. Another goal identified was to minimize radiological releases through contaminated run-off by reducing the potential for water to be in contact with radioactive waste. These goals were used in developing fire protection design, configuration, systems, materials specified for use, storage areas and containers for the waste. These goals will also be used in developing the Fire Protection Program. [IRC-LPSC-01.45]
- Unusual demands on local fire, EMS and policing services could reduce the ability to respond to an emergency associated with the DGR and this contingency should be included in the coordination of emergency services planning. [EA-260]
- Emergency response procedures will define the required response by personnel to a fire underground. [IRC-LPSC-01.40]
- The permanent refuge station will have a clean breathing air supply from the surface compressors that is connected to the emergency electrical power. [IRC-LPSC-01.79, LIC-011]
- Once underground personnel are accounted for in refuge stations, plans for addressing the fire will be implemented. [IRC-LPSC-01.42]
- Operating experience from the mining industry and other waste handling facilities is being collected to learn from their designs, their events and their fire protection programs. [IRC-LPSC-01.49]
- DGR personnel will be trained in the use of fire extinguishers for manual fire fighting. [IRC-LPSC-01.67]
- A Mine Rescue Team will be trained in mine fire fighting activities. The firefighting equipment and locations for this response team will be determined as part of detailed Mine Fire Procedures to be developed for the DGR. [IRC-LPSC-01.68]

Operations Phase

- The Fire Protection (FP) Program for the operational phase of the DGR will be developed similarly to the FP Program for the site preparation and construction, as described in the response to IR-LPSC-01-36 *[OPG 2012a]*. To reiterate, the operational FP Program will be specific to the DGR, due to the unique fire protection requirements associated with the facility, and will include a Fire Hazard Analysis based on the guidance of NFPA 122 and 801. [IRC-LPSC-01.115, LIC-072 (Section 10.6 of PSR), LIC-090]
- The DGR will use OPG's Nuclear Waste Management Division (NWMD) Fire Protection Procedure W-PROC-ES-0011 to ensure compliance with the applicable national codes and standards that will be specified in the operating licence issued by the CNSC. [EA-065]

TABLE A5: RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

- The effects on human and non-human biota from potential accidents at the DGR Project were found to be small; and can be minimized or controlled through implementation of the following mitigation measures:
  - appropriate training and operating procedures;
  - minimization of combustible materials and ignition sources, especially near waste packages;
  - installation of suitable fire detection and suppression equipment, such as automatic fire suppression systems on diesel transfer equipment. [based on EA-147]
- The following events will have the same emergency response procedure:
  - Fire;
  - Explosion;
  - CO alarm; and
  - Explosive gas monitor alarm. [LIC-032]
- In the event of an underground fire or waste package drop, the ventilation flows will not be changed until all underground personnel are accounted for in the refuge stations. [IRC-LPSC-01.39]
- Fuel requirements for operations will utilize the existing WWMF fuel station. [EA-027]

MIT-R-25. Following closure of the repository, institutional controls will be put in place as a safety feature to reduce the likelihood of future human actions that could compromise the repository. [based on LIC-091, LIC-165 (Rec #63)]

- During the institutional control period, radioactive decay will reduce the concentrations of radionuclides in the repository, and inadvertent human intrusion will not occur. A period of 300 years is assumed *[for safety assessment purposes]* over which such controls, as well as societal memory, are effective, consistent with current international practice. Beyond this period, there are no expectations in this safety assessment with respect to any ongoing societal control, monitoring or memory of the site. [based on LIC-091, EA-081, EA-082, EA-091, IRC-EIS-05.01, IRC-EIS-06.07, LIC-001, LIC-097]
- Measures will be taken in the near-term to ensure that information regarding the purpose, location, design and contents of the repository is preserved so that future generations are made aware of the consequences of any actions they may choose to take. [LIC-109, IRC-EIS-08.28]
- *[At]* the decommissioning phase, the records will – the records that are important, to be kept after decommissioning will be identified and they will be transferred to a long-term medium, most likely ISO standard permanent paper. [H-17-37]
- Additional details on the institutional controls are provided in Section 5.8, Institutional Control, in the Preliminary Decommissioning Plan (NWMO and CANDESCO 2011) and in Chapter 13 of the PSR (OPG 2011b). [LIC-153, LIC-086]

MONITORING COMMITMENTS:

MON-R-01. OPG will, to the satisfaction of the CNSC, conduct a follow-up program on radiation levels in air, water, soil, sediment, terrestrial and aquatic biota in the Project Area and Local Study Area. [based on CEAA 10.6]

Air Radiation Monitoring:

- Radiological analysis of air during site preparation and construction, operations, and decommissioning will be conducted. [based on EIS, Table 13-1 (OPG 2011a)]

TABLE A5: RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

- The comprehensive radiological monitoring program will be implemented as described in the PSR. [EAFMP-039, H-17-24, LIC-111, LIC-072 (Section 10.4 of PSR), LIC-090]
- Radiation monitoring will be provided at the DGR Facility to ensure radiation levels in air are consistent with regulatory limits. [based on LIC-035, EAFMP-039, H-17-24]
- During site preparation and construction (shaft sinking and excavation of emplacement rooms), and operations, air monitoring underground for radon will ensure that worker exposure to radon is limited. [EAFMP-040, LIC-045, H-06-01, H-17-23]
- Panels projected for closure will be ventilated and the air quality monitored as described in OPG response to IR-LPSC-01-24, until the time of closure. At closure, as stated in PSR 6.13, the underground space behind the closure walls will not be ventilated and all services will be terminated. Once closure walls are erected there would be no need to monitor air quality in the sealed underground space, as no re-entry is intended. [IRC-LPSC-01.80]
- Filled rooms will remain ventilated and accessible until a decision is made to install closure walls and isolate a set of rooms or a panel. [LIC-040]
- During site preparation and construction, there will be no sources of incremental radioactive emissions from the DGR site. Monitoring during this time will provide baseline data. *[Radiological]* monitoring will continue throughout the Operations Phase, including emissions from the vent shaft. The results will be compared with the baseline data to identify any changes. [IRC-EIS-10.01]
- A monitoring program will be established for the operation of the *[ventilation]* system. [based on EA-017]
- The third phase of the DGR is decommissioning. This activity would occur many decades from now and would be subject to a new licensing process. However, it has been qualitatively estimated, or assessed. Radioactivity will be monitored and will be present to some extent as residual contamination on some structures, but is not expected to be significant. [H-08-06]
- Confirm effectiveness of mitigation *[for controlling radiation]*; confirm no residual adverse effects. [EA-170]
- See also detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

External Radiation Monitoring:

- External radiation monitoring during site preparation and construction, operations, and decommissioning will be conducted. [based on EIS, Table 13-1 (OPG 2011a)]
- The comprehensive radiological monitoring program will be implemented as described in the PSR. [EAFMP-039, H-17-24, LIC-072 (Section 10.4 of PSR), LIC-090]
- An external radiation monitoring program will be carried out during the site preparation and construction phase operations phase, and decommissioning phase respectively. The monitoring program during the site preparation and construction phase is to ensure that the exposure of DGR construction workers (non-NEWs) attributable to operations at the WWMF, which is in the vicinity of the DGR site, is properly managed. [EA-242, EAFMP-041]
- The third phase of the DGR is decommissioning. This activity would occur many decades from now and would be subject to a new licensing process. However, it has been qualitatively estimated, or assessed. Radioactivity will be monitored and will be present to some extent as residual contamination on some structures, but is not expected to be significant. [H-08-06]
- Confirm effectiveness of mitigation *[for controlling radiation]*; confirm no residual adverse effects. [EA-170]
- See also detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface

TABLE A5: RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

Water Quality Detailed Commitments

Radiation Monitoring in Groundwater:

- Radiological analysis of groundwater program during site preparation and construction, operations, and decommissioning will be conducted. [based on EIS, Table 13-1 (OPG 2011a)]
- The comprehensive radiological monitoring program will be implemented as described in the PSR. [EAFMP-039, H-17-24, LIC-072 (Section 10.4 of PSR), LIC-090]
- Radiation monitoring will be provided at the DGR Facility to ensure radiation levels in water are consistent with regulatory limits. [based on LIC-035]
- Radiological analysis will be carried out for samples collected from newly-built monitoring wells to monitor any changes to groundwater radionuclide concentrations in the DGR Project Area, namely tritium and gross beta levels. Wells will be sampled quarterly during site preparation and construction, and operations. This program will be consistent with the existing WWMF monitoring program. [EAFMP-042, EA-243, H-17-22, IRC-EIS-05.15]
- Well monitoring includes monitoring of tritium *[in groundwater during construction]* and the results will be documented in an annual report. Verification of assessment results will be achieved through proposed routine groundwater and shaft discharge monitoring programs. An additional 8 downgradient and 2 background shallow groundwater wells are being installed in 2012 and will become part of the monitoring network to provide baseline information and continue to be monitored through construction. Water samples will be taken from the shafts during construction to verify that the tritium concentrations are not of concern. Periodic monitoring of shaft construction water inflow and outflow will be conducted during the initial phases of shaft construction. Routine monitoring frequency will be established following an assessment of initial monitoring results. [IRC-EIS-01.06, IRC-EIS-08.43, LIC-020, LIC-165 (Rec #6)]
- *[Radiological]* monitoring will continue throughout the Operations Phase, including emissions monitoring of sump water from underground. The results will be compared with the baseline data to identify any changes. [IRC-EIS-10.01]
- The third phase of the DGR is decommissioning. This activity would occur many decades from now and would be subject to a new licensing process. However, it has been qualitatively estimated, or assessed. Radioactivity will be monitored and will be present to some extent as residual contamination on some structures, but is not expected to be significant. [H-08-06]
- Confirm effectiveness of mitigation *[for controlling radiation]*; confirm no residual adverse effects. [EA-170]
- See also detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

Radiation Monitoring in Surface Water:

- Radiological analysis of surface water program during site preparation and construction, operations, and decommissioning will be conducted. [based on EIS, Table 13-1 (OPG 2011a)]
- The comprehensive radiological monitoring program will be implemented as described in the PSR. [EAFMP-039, H-17-24, LIC-072 (Section 10.4 of PSR), LIC-090]
- Water samples collected from surface water will be analyzed to determine radionuclide concentrations in surface water during the site preparation and construction phase and the operations phase. Samples will be collected monthly from the SWMP during site preparation and construction to monitor the potential effect resulting from the operations at the WWMF and other nuclear facilities in the Local Study Area and to establish a baseline for the operations phase. Samples will be analyzed for tritium and gross beta. During operations, samples will be collected and analyzed monthly for tritium and gross beta. The operations phase sampling can be

TABLE A5: RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

coordinated with the existing monitoring program at the WWMF. [EAFMP-043, EA-244]

- Samples from the sump discharge will be collected weekly and averaged monthly for tritium and gross beta beginning one year prior to operations (to establish a baseline). [EAFMP-044]
- A sample will also be collected from the sump discharge and from the SWMP quarterly and analyzed for C-14 beginning one year prior to operations, to establish a baseline for the operations phase. During operations, samples will be collected and analyzed annually. [EAFMP-045]
- *[Any condensate water associated with cooling of ventilation air in exhaust plenum will be collected during operations phase.]* Depending on the concentration of tritium or any other radioactive contaminants in the condensate, this water will be periodically removed from the sump and taken to a facility that is licensed to handle this type of material, if required. [IRC-LPSC-01.37]
- Some radionuclide water quality monitoring is planned to be done in the marsh prior to operations. [based on H-24-38]
- The *[Bruce Power]* REMP *[Radiological Environmental Monitoring Program]* will continue to assess the off-site consequences of all Bruce nuclear site operations, including those of the DGR Project, and will continue to report environmental monitoring data and trends. [EA-103]
- The third phase of the DGR is decommissioning. This activity would occur many decades from now and would be subject to a new licensing process. However, it has been qualitatively estimated, or assessed. Radioactivity will be monitored and will be present to some extent as residual contamination on some structures, but is not expected to be significant. [H-08-06]
- Confirm effectiveness of mitigation *[for controlling radiation]*; confirm no residual adverse effects. [EA-170]
- See also detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

Location of Monitoring Equipment and Frequencies of Monitoring:

- Location *[of monitoring equipment]* and frequencies *[of monitoring]* will be as specified in the licence requirements. [based on EIS, Table 13-1 (OPG 2011a)]
- The *[underground air and water radiation]* monitoring equipment will be similar to that used in WWMF, but the specific technology would be selected during the construction phase based on the best available technology at that time. Further information will be described as part of the Operating Licence application. [based on IRC-LPSC-01.73, IRC-LPSC-01.76]
- The underground facility radiation monitoring will include fixed monitors, portable monitors, and sampling locations. A fixed whole body monitor will be placed at the entrance to the refuge station, which also doubles as a lunch room. Portable monitors will be used to maintain appropriate controls around active areas, and for surveying (to ensure the Zone 2 underground facility remains free of loose contamination). The specific locations would depend on the work flow, and would be consistent with current WWMF practice. [IRC-LPSC-01.70]
- There will be fixed continuous air sampling devices located at the surface exhaust from the ventilation shaft (stack monitor), which will collect air samples from a side stream. The air samples will be collected for the purpose of analyzing for tritium, C-14 and particulate (gross beta/gamma). (As with the WWMF incinerator, a separate stack monitor may be needed for C-14.) [IRC-LPSC-01.71]

Table 1: Underground Air and Water Radiation Monitoring - Site Preparation and Construction (see [DGR EA Follow-up Monitoring Program], Table 5a) [IRC-LPSC-01.74]

Reference	Nuclides	Type/Monitoring	Location

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

C-LIC-RAD1 Air	Radon	• 1 measurement /month/location. Radon is not expected to be an issue. It will be monitored for trends and the rate adjusted if appropriate. • Portable monitor, with local readout or off-site analysis.	• Near working faces during excavation. • Exhaust air flow near ventilation shaft.
C-LIC-RAD5 Water	H-3 Gross beta/ gamma	• 1 sample/week, averaged monthly, beginning 1 yr prior to operations. • Off-site analysis.	• Sampled from surface stormceptor at underground sump discharge (for establishing baseline).
C-LIC-RAD5 Water	C-14	• 1 sample/quarter beginning 1 yr prior to operations. • Off-site analysis.	• Sampled from surface stormceptor at underground sump discharge (for establishing baseline).

Table 2: Underground Air and Water Radiation Monitoring - Operations (see [DGR EA Follow-up Monitoring Program], Table 5b) [IRC-LPSC-01.75]

Reference	Nuclides	Type/Monitoring	Location
O-LIC-RAD1 Air	Radon	• Portable monitor with local readout, as per C-LIC-RAD1.	• Radon is not expected to be an issue. Location and frequency to be specified as part of the Operating Licence application based on results of C-LIC-RAD1.
O-LIC-RAD1 Air	H-3 C-14 Particulate (gross beta/ gamma)	• Continuous airflow through sampling device, with samples analyzed weekly off-site. • Equipment similar to WWMF incinerator stack sampler/monitor. • Alarm on system failure (i.e., low air flow) to DGR control room, as with WWMF incinerator monitor. • Class IV power, as with WWMF incinerator monitor.	• Ventilation shaft exhaust
O-LIC-RAD6	H-3 Dose rate Others as required	• Routine survey program • Similar equipment to WWMF. • Hand-carried battery powered monitors, or cart-based monitors connected to local 120 V Class IV power.	• Frequency and location to be specified in the Operating Licence application. Will be consistent with OPG Radiation Protection Requirements and with existing WWMF program.
O-LIC-RAD7	Whole body dose and skin beta dose	• Worker dose monitors, similar to existing WWMF monitors.	• Frequency and location to be specified in the Operating Licence application. Will be consistent with OPG Radiation Protection Requirements and with existing WWMF program.
O-LIC-RAD5 Water	H-3 Gross	• 1 sample/week, averaged monthly.	• Sampled from surface stormceptor at underground sump discharge.

TABLE A5: RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

	beta/ gamma	• Off-site analysis.	
O-LIC-RAD5 Water	C-14	• 1 sample/yr. • Off-site analysis.	• Sampled from surface stormceptor at underground sump discharge.
O-LIC-RAD5 Water	H-3 Gross beta/ gamma C-14	• 1 sample/discharge (frequency may be reviewed based on trending analysis). • Off-site analysis.	• Sampled from exhaust plenum condensate sump.

[Note: Additional details on the above monitoring are provided in Table 2, Table 5a and Table 5b of the EA Follow-up Monitoring Program (NWMO 2011a).]

MON-R-02. OPG will, prior to site preparation and to the satisfaction of the CNSC, develop a follow-up program for radon that includes the establishment of baseline radon levels and ongoing monitoring at locations including within the exhaust air shaft at the surface and near the waste rock management area. Monitoring will continue until the end of operations. [based on CEAA 8.6]

MON-R-03. OPG will, in order to confirm the environmental assessment prediction of no adverse effects for members of the public and Indigenous communities from exposure to radiation, add the collection of soil samples within the Site Study Area and Local Study Area during construction to the Radiological Environmental Monitoring Program. [based on CEAA 8.3]

MON-R-04. OPG will, prior to shaft sinking and to the satisfaction of the CNSC, enhance its capability to detect and monitor the movement of the tritium plume originating from the Western Waste Management Facility by adding an adequate number of monitoring wells up-gradient of the DGR shafts. [based on CEAA 11.7]

- See also LIC-165 (OPG's response to Rec #4).

MON-R-05. OPG will, to the satisfaction of the CNSC, conduct a comprehensive assessment of the migration of the tritium plume originating from the Western Waste Management Facility site. The assessment shall include updated modelling of the tritium plume migration. If groundwater modelling or monitoring indicates that the tritium plume may reach the shaft before the shaft collars are installed, OPG will prepare a contingency plan, to the satisfaction of the CNSC, and implement that plan as required. [based on CEAA 11.8]

- See also LIC-165 (OPG's response to Rec #4).

MON-R-06. OPG will have monitoring programs in place to assure that *[DGR Project]* workers are not exposed to unacceptable doses *[of radiation]*. [EA-010]

- A dose monitoring program will be carried out to determine worker exposure to radiation and radioactivity [EA-245, and in EIS, Table 13-1 (OPG 2011a)]:
  - Measure contact dose on packages
  - Measure ambient dose rate in accessible areas
  - Measure worker dose
- Quarterly dose accumulation in workers will be monitored, consistent with current practice at the WWMF. [EAFMP-046]
- Confirm effectiveness of mitigation *[for controlling radiation]*; confirm no residual adverse effects. [EA-170]
- See also detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

TABLE A5:
RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

1) Humans

MON-R-07. Plans to monitor waste degradation within the repository will be provided as part of submissions supporting the operating licence application. [IRC-EIS-01.23]

- Once all of the emplacement rooms have been filled and closed, the DGR will be monitored to ensure that it is performing as expected prior to decommissioning. [EA-102, EA-234, LIC-111, H-17-38]
- With the closure of the first panel, there is an opportunity over several decades before the closure of the DGR to observe the atmosphere behind the wall, including waste degradation, if there is any release of radionuclides, if there are any changes in the gas composition in the repository or if there is accumulation of water. It is envisaged to observe that through the closure plugs. There could be essentially sampling ports that would allow you to periodically take out gas samples or water samples and then do an analysis of that to then get a measure as to what is going on in the panels behind that. And because the panels are not backfilled, they are well connected. Also, there is a slight slope to the repository. So water would tend to go down towards where the closure plugs are. So that would be an indication if there is water coming into the repository through the panel, through the closed panel. [based on H-07-04]

MON-R-08. The need for follow-up monitoring during abandonment will be discussed with the regulator at the time of applying for the Licence to Abandon and will be based on the results of the decommissioning monitoring. If necessary, the follow-up monitoring will be developed using a systematic approach similar to that described in OPG's response to IR-EIS-06-235 *(OPG 2012f)*. [IRC-EIS-06.05]

- The period of monitoring following DGR closure will be determined in consultation with the community and regulatory authorities many decades from now. [IRC-EIS-08.27]

TABLE A5: RADIATION AND RADIOACTIVITY DETAILED COMMITMENTS

2) Non-human Biota

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-R-01 through MIT-R-25. See the descriptions of the mitigation commitments for the Humans VC in previous table.

- See detailed commitments associated with the Humans VC in previous table.

MIT-T-06. OPG will, prior to site preparation and to the satisfaction of the CNSC, install barriers to prevent turtles and snakes from entering the DGR Project site. The barriers will include, at minimum, the installation of exclusion fencing along the southern and eastern edges of the Project site and shall be maintained throughout site preparation and construction. [based on CEAA 9.1, LIC-165 (OPG's response to Rec #52)]

- See detailed commitments associated with MIT-T-06 in Table A3, Terrestrial Environment Detailed Commitments.

MIT-W-01 through MIT-W-06. See the descriptions of the mitigation commitments in Table 3-4, Aquatic Environment Mitigation and Monitoring Commitments.

- For details, see Table A4, Aquatic Environment Detailed Commitments.

MIT-H-12, MIT-H-13. See the descriptions of the mitigation commitments in Table 3-2, Hydrology and Surface Water Quality Mitigation and Monitoring Commitments.

- See the in-design mitigation measures MIT-H-12 and MIT-H-13 for Surface Water Quality VC in Table A2, Hydrology and Surface Water Quality Detailed Commitments.

Additional mitigation measures:

MIT-H-14 through MIT-H-18. See the descriptions of the mitigation commitments in Table 3-2, Hydrology and Surface Water Quality Mitigation and Monitoring Commitments.

- See additional mitigation measures MIT-H-14 through MIT-H-18 for Surface Water Quality VC in Table A2, Hydrology and Surface Water Quality Detailed Commitments.

MONITORING COMMITMENTS:

MON-R-01. OPG will, to the satisfaction of the CNSC, conduct a follow-up program on radiation levels in air, water, soil, sediment, terrestrial and aquatic biota in the Project Area and Local Study Area. [based on CEAA 10.6]

- See detailed commitments under the Human VC in previous table, associated with each of the monitoring activities listed above

[Note: Additional details on the above monitoring for MON-R-01 are provided in Table 2, Table 5a and Table 5b of the EA Follow-up Monitoring Program (NWMO 2011a).]

MON-R-08. The need for follow-up monitoring during abandonment will be discussed with the regulator at the time of applying for the Licence to Abandon and will be based on the results of the decommissioning monitoring. If necessary, the follow-up monitoring will be developed using a systematic approach similar to that described in OPG's response to IR-EIS-06-235 *(OPG 2012f)*. [IRC-EIS-06.05]

- See detailed commitments under the Human VC in previous table, associated MON-R-08.

TABLE A6: ATMOSPHERIC ENVIRONMENT DETAILED COMMITMENTS
Valued Ecosystem Components
1) Air Quality 2) Noise levels 3) Vibrations

TABLE A6:
ATMOSPHERIC ENVIRONMENT DETAILED COMMITMENTS

1) Air Quality

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-A-01. OPG will, prior to site preparation and to the satisfaction of CNSC, develop a detailed plan to manage air emissions that includes details on the implementation of the identified mitigation measures, frequency of air quality monitoring and site inspections, thresholds for corrective management actions and record keeping. Mitigation measures shall, at minimum, include [based on CEAA 7.1]:

[CEAA] 7.1.1. the use of construction equipment that will meet, at minimum, Tier 2 emission standards;

- On-site vehicles and *[diesel]* equipment engines will meet Tier 2 emission standards. [EA-196, EA-122, EA-197, H-09-01, H-17-40]

[CEAA] 7.1.2. maintenance of equipment in good working order;

- On-site vehicles and equipment engines will be maintained in good working order. [EA-196, EA-122, EA-197, H-09-01, H-17-40]

[CEAA] 7.1.3. watering of roadways for dust suppression;

- The Best management practices will be finalized after detailed construction design is complete but may include the practices listed in Table 1 *[Proposed Mitigation Measures for Dust and Particulate Emissions during Site Preparation and Construction Phase], shown below*. [IRC-EIS-04.26, UT-02-05]
- Best management practices will be used to reduce dust, including watering of roadways (e.g., unpaved roadways), unpaved construction laydown areas, and unpaved construction work areas. [based on EIS, Table 13-1 (OPG 2011a)
- Best management practices, including application of water or misting, will be used to reduce fugitive dust creation from the haulage roads and excavated materials. [EA-042, EA-024, EA-074, IRC-EIS-04.31]
- Dust will be minimized by dust suppression measures as described in the Atmospheric Environment TSD as well as OPG's response to Information Request (IR) EIS-04-137. [UT-02-05, IRC-EIS-04.25, IRC-EIS-04.26]
- If a visible dust plume is observed, watering will be implemented in non-frozen ground conditions. [EAFMP-060]
- Equipment will be available and maintained on-site to water roadways as required. [EA-121, EA-197, EAFMP-060]
- During construction, underground dust control will be through conventional mining practices of washing down and misting muck piles. [EA-023]
- Berms and vegetation along the perimeter of the DGR Project site will be used to control dust. [EA-014, EA-043, EA-182, IRC-EIS-02.03, IRC-EIS-12.13, TIS-03-08]
- An environmental management plan will be implemented for site preparation and construction to control environmental effects associated with above-ground construction activities. The environmental management plan will be similar to that used in other recent construction projects at the WWMF and includes measures such as water spraying to control dust. [based on EA-031, EA-093, H-24-07, H-24-08, H-25-18, IRC-LPSC-04.22]
- *[Air]* source reduction *[will be reviewed]* through the detailed design. [based on H-17-39]

[CEAA] 7.1.4. minimization of drop heights of rock and other material; and

[CEAA] 7.1.5. the use of vehicles meeting the newest emission standards.

TABLE A6:
ATMOSPHERIC ENVIRONMENT DETAILED COMMITMENTS

1) Air Quality

Table 1 Proposed Mitigation Measures for Dust and Particulate Emissions during Site Preparation and Construction Phase

Source	Administrative Controls	Physical Controls	Reactive Controls	
			Control	Trigger
Vehicle movement on untreated roads (road dust)	Establish and enforce speed limits for truck and personnel traffic	Maintain trucks/vehicles clean Use large volume trucks to reduce number of hauls Roads will be watered daily except during frozen conditions Improve road surfaces (addition of large size material or paving where practical) Road watering and sweeping	Increase frequency of road watering Use chemical dust suppressants on frequently used, unpaved roads	Complaints received Results of air monitoring show consistently higher than average results
Material (rock) handling	–	Minimize drop heights Use larger trucks to reduce number of hauls Rock coming from underground will have water content (approximately 5% to 7%)	Limit material transfer during high wind conditions, where practical	Observed dust emissions at higher rate or more frequently
Material (rock) storage	–	Establish berms and plant trees surrounding waste rock management area as vegetative wind break Configure storage pile to minimize wind erosion Overburden, dolostone and shale containing fine material, if stored on-site for more than one year, will be covered with soil and vegetated	Selective watering of waste rock pile, as required	Complaints received Results of air monitoring approach limits Observed dust emissions at higher rate or more frequently
Clearing and grubbing	Prohibit burning of cleared material	Clear the site in phases Improve surface as soon as possible after clearing	Stop clearing and grubbing if resulting in significant dust emissions	Observed dust emissions at higher rate or more frequently
Drilling for shaft excavation	–	Water spray for near surface excavation	Increased water spray	Observed dust emissions at higher rate or more frequently
Blasting for shaft excavation	–	Where practical blast areas will be tamped to reduce dust	Reduce charge size	Complaints received
Cement batch plant	–	The cement batch plant will be constructed for the DGR Project and will include dust management technologies	–	–
Vehicle exhaust	Vehicles on-site will meet minimum Tier 2 standards Idle time will be minimized Require use of low sulphur diesel	Vehicles will be maintained in good running condition including maintaining engines, exhaust systems, catalytic converters	–	–

Additional mitigation measures:

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

- See detailed commitments associated with MIT-H-19 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

TABLE A6: ATMOSPHERIC ENVIRONMENT DETAILED COMMITMENTS

1) Air Quality

MONITORING COMMITMENTS:

MON-A-01. OPG will, during site preparation and construction and to the satisfaction of the CNSC, conduct a monitoring program for nitrogen oxides and particulate matter (PM_{10} and $PM_{2.5}$) with specific consideration given to monitoring any air quality changes that would affect individuals living at or near the critical receptor locations used in the EIS models. [based on CEAA 7.2]

- Continuous monitoring will be conducted during the site preparation and construction for PM_{10}, $PM_{2.5}$, NO_2 and NO_x. [based on EIS, Table 13-1 (OPG 2011a), LIC-165 (Rec #15)]
- Continuous air quality monitors will be installed at the start of the site preparation and construction phase at a secure location in the Project Area near the main access road between the construction activities and the property boundary. Several air quality parameters will be monitored: NO_x, PM_{10}, and $PM_{2.5}$. The monitoring results will be compared with the baseline results and predictions documented in the Atmospheric Environment TSD to confirm that the assessment predictions were reasonable and the integrated mitigation measures are effective. Continuous sampling will be carried out for a minimum of one year beginning at the start of site preparation and construction. [EAFMP-034, EA-171, EA-172, EA-200, EA-201, IRC-EIS-04.28, IRC-EIS-06.08]
- Air quality monitoring described *[in OPG's presentation on EA follow-up monitoring on Oct. 5, 2013]* will be used to verify predicted effects levels. [based on H-17-18]
- The maximum values predicted in the EIS are the proposed criteria *[for surface air quality]* that will be used to evaluate the measured concentrations of the indicator compounds monitored *[$PM_{2.5}$, PM_{10} and NO_x]*, and are listed under activity C-EA-ATM1 of Table 3a in the EA Follow-up Monitoring Program *(NWMO 2011a)*. [IRC-EIS-05.19]
- The quality of air that is exhausted to the atmosphere via the Ventilation Shaft will be monitored to ensure the concentrations of potential contaminants comply with Certification of Approval limits. [EA-101]
- Ozone (O_3) will not be emitted by the DGR Project and, while compounds that could be considered precursors for ozone will be emitted (NO_x and small quantities of VOCs *[volatile organic compounds]*), there is no expectation that the amounts emitted will cause an increase in ozone on either a local or regional scale. [IRC-EIS-05.18]

MON-A-02. Visual inspections for dust emissions will be conducted daily during site preparation and construction, and operations, at the shafts, access roads within the WRMA, and waste rock pile. [EAFMP-035]

- NWMO and OPG are certified to ISO 14001 Environmental Management System. This registration, which requires that programs are in place to prevent pollution and an annual internal environmental management system audit and external registration/maintenance audit, will provide assurance that programs are implemented for the monitoring and reporting of dust emissions from the site preparation and construction phase of the DGR Project. [IRC-EIS-04.30]

MON-A-03. OPG will, during site preparation and construction and operations and to the satisfaction of the CNSC, conduct a follow-up program to monitor acrolein concentrations at air receptor sites for local residents and for Indigenous communities, defined as AR 1, AR 2, AR 3 and AR 5 in the EIS. [based on CEAA 8.1, LIC-165 (Rec #17)]

- OPG will enter into discussions with regulators to identify the potential for monitoring acrolein at *[a point near the Bruce nuclear site fence line]*. [based on H-17-07]

MON-A-04. Certificates of Approval *[air]* will be obtained as required for the DGR. OPG will monitor environmental releases in accordance with these Certificates of Approval and report the results as required. [EA-097, IRC-LPSC-04.30]

- OPG will comply with other *[than Certificates of Approval]* regulatory requirements as well, such as reporting requirements under the National Pollutants Release Inventory and O.Reg. 127/01 [EA-098]

TABLE A6: ATMOSPHERIC ENVIRONMENT DETAILED COMMITMENTS

1) Air Quality

- OPG acknowledges that an Environmental Compliance Approval (ECA *[formerly Certificate of Approval (Air)]*), will be required for the relevant emission sources of the DGR Project, and that approval by the Ministry of Environment (MOE) to use local meteorological data is required under section 13 of O. Reg. 419/05. The ECA application for air emissions from the project will be completed in accordance with O. Reg. 419/05 and/or regulations relevant at the time of submission. [IRC-EIS-08.03, IRC-EIS-08.01, IRC-EIS-08.02]

- OPG would need to apply to the Ontario Minister of Environment for an environmental compliance approval or ECA. The MOE has specific defined guidelines for making such an application. OPG will follow these guidelines. In addition, the specific sources and activities for which the ECA will be required will be agreed with the MOE prior to filing any applications. *[repeated a few times during the hearing]* [H-09-02]

- It is not expected that notification will be required under the *[Canada-U.S. Air Quality Agreement]*; however, the Certificate of Approval for air/noise required for the DGR Project will confirm whether the project meets the notification criteria and that no submission is required. [EA-004]

MON-R-01. OPG will, to the satisfaction of the CNSC, conduct a follow-up program on radiation levels in air, water, soil, sediment, terrestrial and aquatic biota in the Project Area and Local Study Area. [based on CEAA 10.6]

- See also commitments listed in Table A5, Radiation and Radioactivity Detailed Commitments, for monitoring of radiation levels in air.

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

- See detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

[Note: Additional details on the above monitoring are provided in Table 3a, Table 4a, Table 4b, Table 5a, Table 5b, and Table 6 of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A6:
ATMOSPHERIC ENVIRONMENT DETAILED COMMITMENTS

2) Noise Levels

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-A-02. On-site vehicles and equipment will be equipped with appropriate silencers *[to control noise]* and maintained in good working order. [EA-123, EA-198, H-09-08, IRC-EIS-09.19, IRC-EIS-09.20, TIS-03-09, H-09-03]

- *[Noise]* source reduction *[will be reviewed]* through the detailed design. [based on H-17-39]

MIT-A-03. A compact DGR Project site will be maintained. [based on EIS, Table 13-1 (OPG 2011a)]

- The assessment of noise incorporated in design mitigation measures, will include location of construction areas near to the project footprint to minimize vehicle travel distance. *[repeated a few times during the hearing]* [H-09-03]
- The waste rock management pile will be constructed in such a way as to minimize the noise impacts on the closest receptors. [based on IRC-EIS-09.21]

MIT-A-04. Noise Screening – Natural vegetation will be retained as much as possible. OPG also plans to plant additional trees for visual screening of the rock pile and these will also provide additional noise screening. Finally, the design of the DGR Project includes the use of low material berms at selected areas along the perimeter of the site. These aspects will collectively assist in reducing off-site noise. [IRC-EIS-09.20, EA-123, EA-198, IRC-EIS-09.19, TIS-03-09, H-09-04, EAFMP-038, EA-014, EA-043, EA-182, IRC-EIS-02.03, IRC-EIS-12.13, TIS-03-08]

MIT-A-05. Near-surface blasting during only daylight hours – The Project will use best practices for blasting and has already made a commitment to day-time blasting for near surface use. However, this represents a limited amount of blasting as the first 10 to 15 m of the shafts will be opened mechanically (i.e., without explosives). The next 15 to 20 m will be developed using explosives only during daytime hours. Once shaft development is beyond this point, and the headframe is in place, noise effects at off-site receptors due to shaft sinking are not anticipated. Near-surface blasting will not be conducted on Sundays. [IRC-EIS-09.20, H-09-04, EA-123, EA-198, IRC-EIS-09.19, TIS-03-09, EAFMP-038]

- An environmental management plan will be implemented for site preparation and construction to control environmental effects associated with above-ground construction activities. The environmental management plan will be similar to that used in other recent construction projects at the WWMF and includes measures such as vehicle maintenance standards to reduce noise and emissions, and scheduling of certain activities during daylight hours. [based on EA-031, EA-093, H-24-07, H-24-08, H-25-18, IRC-LPSC-04.22]

MIT-A-06. Fresh air and return air raise fans will be maintained in good working order *[to control noise]* [based on EA-124, EA-199, EAFMP-037, and EIS, Table 13-1 (OPG 2011a)]

- Two fans of equal specification are located at the intake of the heater house and will include silencers as required. [LIC-012]
- Conduct ventilation inspection [based on Table 4b in DGR EA Follow-up Monitoring Program (NWMO 2011a)]

Additional mitigation measures:

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

- See detailed commitments associated with MIT-H-19 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

TABLE A6:
ATMOSPHERIC ENVIRONMENT DETAILED COMMITMENTS

2) Noise Levels

MONITORING COMMITMENTS:

MON-A-05. OPG will, throughout the preclosure phases of the project and to the satisfaction of the CNSC, implement noise and vibration monitoring at noise receptor sites defined as R1, R2 and R3 in the EIS and at additional monitoring locations identified in consultation with regulatory authorities, Aboriginal groups and permanent and seasonal residents in the Local Study Area. OPG will develop explicit action levels for additional noise mitigation, acceptable to the CNSC, taking into consideration input from Aboriginal groups and permanent and seasonal residents in the Local Study Area. [based on CEAA 8.2]

- Continuous noise monitoring campaign will be conducted during site preparation and construction phase of sufficient duration to confirm predictions in the assessment. [based on EIS, Table 13-1 (OPG 2011a)]
- The DGR Project will comply with relevant Ministry of Environment *[noise]* criteria, and Health Canada and World Health Organization standards and guidelines. In addition, the DGR Project will meet the requirements of the Municipality of Kincardine Noise By-law. [IRC-EIS-12.09, IRC-EIS-09.22, IRC-EIS-11.01, H-01-05, H-09-06]
- OPG does not believe people at R2 will be disturbed at night due to project activities. This happens during the quietest hours at night, typically 4 o'clock in the morning when people are indoors. The level still ensures that World Health Organization limits outside of the bedroom window are met. The indoor noise level will not exceed 30 dBA. [based on H-09-09]
- As OPG would move into a contractual arrangement with the supplier, there would be restrictions placed in that contract that the contractor would be required to meet with respect to meeting the noise emission limits. OPG would expect an environmental plan which would address any of the limits that are identified through this process so that we would ensure that those would be met. [based on H-09-07]
- Integrated sound level meters will be stationed at the three noise receptor locations monitored during the EA field studies (R1, R2, and R3) during the site preparation and construction phase. The results will be compared with the baseline results and predictions documented in the Atmospheric Environment TSD. [EAFMP-036, EA-202, EA-173, H-17-08, H-17-18, H-17-30]
- Noise monitoring will be carried out at two of the closest dwellings and at the closest campsite within Inverhuron Provincial Park. [H-09-05]
- Noise monitoring will be adapted to the activities be able to understand the impacts of changes in that construction. [based on H-24-01]

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

- See detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

[Note: Additional details on the above monitoring are provided in Table 3a, Table 4a, and Table 4b of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A6:
ATMOSPHERIC ENVIRONMENT DETAILED COMMITMENTS

3) Vibrations

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-A-05. Near-surface blasting during only daylight hours – The Project will use best practices for blasting and has already made a commitment to day-time blasting for near surface use. However, this represents a limited amount of blasting as the first 10 to 15 m of the shafts will be opened mechanically (i.e., without explosives). The next 15 to 20 m will be developed using explosives only during daytime hours. Once shaft development is beyond this point, and the headframe is in place, noise effects at off-site receptors due to shaft sinking are not anticipated. Near-surface blasting will not be conducted on Sundays. [IRC-EIS-09.20, H-09-04, EA-123, EA-198, IRC-EIS-09.19, TIS-03-09, EAFMP-038]

Additional mitigation measures:

MIT-A-07. Explosive weights will be reduced during spawning season, if necessary. [based on EIS, Table 13-1 (OPG 2011a)]

- Department of Fisheries and Oceans Canada's Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters set out that "No explosive may be used that produces or is likely to produce, a peak particle velocity greater than 13 mm/s in a spawning bed during egg incubation". If the monitoring program detects exceedances of this peak particle velocity and spawning is observed, a mitigation plan will be prepared outlining additional procedures for protecting fish and their habitat, as described in the guidelines. *[This would allow blasting to continue while meeting the guideline ground vibration limit set out by the Department of Fisheries and Oceans.]* [based on EA-203, and EAFMP-061]

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

- See detailed commitments associated with MIT-H-19 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MONITORING COMMITMENTS:

MON-A-05. OPG will, throughout the preclosure phases of the project and to the satisfaction of the CNSC, implement noise and vibration monitoring at noise receptor sites defined as R1, R2 and R3 in the EIS and at additional monitoring locations identified in consultation with regulatory authorities, Aboriginal groups and permanent and seasonal residents in the Local Study Area. OPG will develop explicit action levels for additional noise mitigation, acceptable to the CNSC, taking into consideration input from Aboriginal groups and permanent and seasonal residents in the Local Study Area. [based on CEAA 8.2]

- The initial series of regular production blasts shall be monitored at several locations at varying distances from each blast to characterize the site specific ground vibration attenuation rates. This will entail establishing monitoring stations between the blast site and adjacent receptors during the initial series of shaft blasts. The site specific attenuation data developed during this monitoring period will then be used to better define ground vibration effects at the closest sensitive receptors. [EAFMP-038, EA-204, EA-205, and in EIS, Table 13-1 (OPG 2011a)]
- A detailed *[vibrations]* monitoring program will be developed with the shaft sinking contractor, and in consultation with Bruce Power, after the contract has been awarded and the blasting design finalized. [IRC-EIS-07.30]
- Routine monitoring of all blasting operations will be carried out in the vicinity of the closest receptors to the blasting operations. As excavation continues within the shaft and underground development, the actual monitoring locations will be routinely and regularly reviewed so that the closest receptors are always being monitored for ground vibration effects. [EAFMP-038, EA-204, EA-205, and in EIS, Table 13-1 (OPG 2011a)]

TABLE A6:
ATMOSPHERIC ENVIRONMENT DETAILED COMMITMENTS

3) Vibrations

- The *[monitoring]* program may be discontinued based on consistently low vibration measurements once the shaft is advanced below 180 mBGS. [EAFMP-038, EA-204, EA-205]

MON-A-06. Identification of spawning depressions in the North Railway Ditch will be conducted. [based on Table 3a in NWMO (2011a)]

- Blast vibration will also be monitored to confirm that DFO *[Fisheries and Oceans Canada]* guideline levels are met. [H-17-09]
- Vibrations monitoring *[follow-up monitoring of Valued Ecosystem Components in the South Railway Ditch (redbelly dace, creek chub, variable leaf pondweed, burrowing crayfish, benthic invertebrates)]* [based on EA-167, EA-190]

MON-A-07. A communications program will be implemented to keep neighbours informed of the status of *[the blasting]* activity. [EAFMP-038]

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

- See detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

[Note: Additional details on the above monitoring are provided in Table 3a of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A7: INDIGENOUS INTERESTS DETAILED COMMITMENTS
Valued Ecosystem Components
1) Indigenous Communities 2) Indigenous Heritage Resources 3) Traditional Use of Lands and Resources

TABLE A7:
INDIGENOUS INTERESTS DETAILED COMMITMENTS

1) Indigenous Communities

MITIGATION COMMITMENTS:

In-design mitigation measures:

- None identified [EIS, Table 13-1 (OPG 2011a)]

Additional mitigation measures:

MIT-I-01. OPG will continue to engage Indigenous organizations on a variety of DGR Project-related opportunities, including employment, business, sponsorship, and contracting [based on community (non-regulatory) commitments].

- OPG continues to seek avenues for sponsorship opportunities with the Saugeen Ojibway Nation. [EA-006] *(community [non-regulatory] commitment)*
- OPG continues to seek avenues for sponsorship opportunities with the Historic Saugeen Métis Community. [EA-007] *(community [non-regulatory] commitment)*
- OPG will continue to engage Indigenous organizations on a variety of DGR Project-related issues, including employment, business, and contracting opportunities. As the DGR Project is implemented, information regarding employment and business opportunities for Indigenous communities will be made available through established liaison mechanisms, special events (e.g., meetings, workshops) and other communications. OPG will continue to work with SON, HSM *[Historic Saugeen Métis]* and MNO *[Métis Nation of Ontario]* to identify how we may best maximize these opportunities. [EA-181, H-18-03] *(community [non-regulatory] commitment)*

MONITORING COMMITMENTS:

- None proposed [EIS, Table 13-1 (OPG 2011a)]

TABLE A7: INDIGENOUS INTERESTS DETAILED COMMITMENTS

2) Indigenous Heritage Resources

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-I-02. The *[Jiibegmegoong]* burial site itself will not be physically altered by the DGR Project. [IRC-EIS-12.10, IRC-EIS-12.12]

MIT-I-03. OPG will, in order to mitigate the visual effect of the project, establish a 200 metre buffer area from the Interconnecting Road to the long-term waste rock management area. OPG will provide screening via the construction of berms and/or planting of trees. [based on CEAA 6.2, EA-182, EA-014, EA-043, IRC-EIS-02.03, IRC-EIS-12.13, TIS-03-08, LIC-071 (Section 9.3.3 of PSR), and in EIS, Table 13-1 (OPG 2011a)]

MIT-A-01. OPG will, prior to site preparation and to the satisfaction of CNSC, develop a detailed plan to manage air emissions that includes details on the implementation of the identified mitigation measures, frequency of air quality monitoring and site inspections, thresholds for corrective management actions and record keeping. Mitigation measures shall, at minimum, include [based on CEAA 7.1]:

[CEAA] 7.1.1. the use of construction equipment that will meet, at minimum, Tier 2 emission standards;

[CEAA] 7.1.2. maintenance of equipment in good working order;

[CEAA] 7.1.3. watering of roadways for dust suppression;

[CEAA] 7.1.4. minimization of drop heights of rock and other material; and

[CEAA] 7.1.5. the use of vehicles meeting the newest emission standards.

- See detailed commitments under Air Quality VC in Table A6, Atmospheric Environment Detailed Commitments.

Additional mitigation measures:

MIT-S-10. In the unlikely event that site preparation, construction or decommissioning activities encounter artifacts that could be associated with a cultural or heritage resource, the activities will be curtailed until further assessment (i.e., a Stage 3 and/or 4 archaeological assessments) can be undertaken to protect the resource from further disturbance and conserve its cultural heritage value. [EA-139, EA-256, EAFMP-064, and in EIS, Table 13-1 (OPG 2011a)]

- See detailed commitments associated with MIT-S-10 in Table A8, Socio-economic Environment Detailed Commitments.

MONITORING COMMITMENTS:

MON-A-01. OPG will, during site preparation and construction and to the satisfaction of the CNSC, conduct a monitoring program for nitrogen oxides and particulate matter (PM_{10} and $PM_{2.5}$) with specific consideration given to monitoring any air quality changes that would affect individuals living at or near the critical receptor locations used in the EIS models. [based on CEAA 7.2]

- See detailed commitments associated with MON-A-01 in Table A6, Atmospheric Environment Detailed Commitments.

MON-A-02. Visual inspections for dust emissions will be conducted daily during site preparation and construction, and operations, at the shafts, access roads within the WRMA, and waste rock pile. [EAFMP-035]

- See detailed commitments associated with MON-A-02 in Table A6, Atmospheric Environment Detailed Commitments.

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and

TABLE A7: INDIGENOUS INTERESTS DETAILED COMMITMENTS	
2) Indigenous Heritage Resources	
	H-17-05] • See detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments
MON-S-01.	OPG will continue to monitor public attitudes toward the DGR Project. [based on EIS, Table 13-1 (OPG 2011a)] • See detailed commitments associated with MON-S-01 in Table A8, Socio-economic Environment Detailed Commitments.

TABLE A7:
INDIGENOUS INTERESTS DETAILED COMMITMENTS

3) Traditional Use of Lands and Resources

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-I-02. The *[Jiibegmegoong]* burial site itself will not be physically altered by the DGR Project. [IRC-EIS-12.10, IRC-EIS-12.12]

Additional mitigation measures:

MIT-I-04. OPG will ensure that the Saugeen Ojibway Nation have continued access to the Jiibegmegoong burial grounds. [based on CEAA 6.1, EA-183, EA-125, IRC-EIS-12.10, IRC-EIS-12.12]

- SON visits have been somewhat infrequent maybe once or twice a year. OPG will know well ahead of time before the SON proposed the visit, so can make arrangements if necessary to mitigate. These arrangements may include stopping dumping for a period of time on the waste rock pile and other similar measures. OPG would adjust the construction activities during the *[SON]* ceremonies, if noise or dust would interfere with the ceremonies. [based on H-18-05 and H-30-01]

MONITORING COMMITMENTS:

- None proposed [EIS, Table 13-1 (OPG 2011a)]

TABLE A8:
SOCIO-ECONOMIC ENVIRONMENT DETAILED COMMITMENTS

Valued Ecosystem Components
1) Human Assets (Population and Demographics, Other Human Assets: Skills and labour supply; Education; Health and safety facilities and services; Social services) 2) Physical Assets (Housing, Municipal infrastructure and services, Land use, Transportation infrastructure, Community character) 3) Social Assets (Inverhuron Provincial Park, Cultural and heritage resources, Community recreational facilities and programs, Use and enjoyment of private property, Community cohesion) 4) Financial Assets (Employment, Business Activity, Tourism, Residential property values, Municipal finance and administration, Other financial assets: Income, Renewable and non-renewable resource use, Agriculture, Economic development services) 5) Natural Assets (Noise levels)

TABLE A8:
SOCIO-ECONOMIC ENVIRONMENT DETAILED COMMITMENTS

1) Human Assets

MITIGATION COMMITMENTS:

In-design mitigation measures:

- None identified [EIS, Table 13-1 (OPG 2011a)]

Additional mitigation measures:

MIT-S-01. OPG will share information with local and regional land use planners and economic development officials as well as local and regional health and safety service providers regarding the timing and magnitude of meaningful changes to its on-site labour and skills requirements for each phase of the DGR Project. [EA-126, EA-249, and in EIS, Table 13-1 (OPG 2011a)] *(community [non-regulatory] commitment)*

- In terms of making sure that that information is available, OPG will continue to work with local municipalities, health and safety providers, local police, emergency medical services and other officials to mitigate any effects related to the DGR workforce. *[The potential measures could include: working with DGR contractors to minimize reliance on transient workforce, if this becomes an issue; conduct the orientation programmes for incoming workers.]* [based on TIS-03-04] *(community [non-regulatory] commitment)*
- It will be part of the program to make sure those Chambers of Commerce *[Kincardine and other Chambers of Commerce in the local area]*, which are the local businesses, are aware of the opportunities, not just the year ahead, but multiple years ahead on what's coming up. [H-20-08] *(community [non-regulatory] commitment)*
- OPG will also continue to work with various stakeholders to deliver its educational initiatives. [based on EA-140, EA-138, EA-177, EA-257, EA-258] *(community [non-regulatory] commitment)*
- OPG is also working with Kincardine on the Lake Huron Learning Centre. We provide funding to the centre and have been working with the municipality on helping them develop learning programs that are in line with - not only the needs of the community - but needs of the industry moving forward. [H-20-07] *(community [non-regulatory] commitment)*

MIT-R-20. OPG will, throughout all preclosure phases, undertake all reasonable measures to prevent accidents and malfunctions that may result in adverse human and/or environmental effects and effectively implement appropriate emergency response procedures and contingencies developed in relation to the Designated Project. [based on CEAA 13.1, EA-148, EA-127, EA-132, EA-152, EA-228, EA-251, LIC-061]

[Note: The detailed mitigation commitments listed below are those strictly relevant to the likely environmental effects on the socio-economic environment. Additional detailed commitments pertaining to the technical aspects of the emergency preparedness and planning, mine rescue and fire protection programs are provided under MIT-R-20, MIT-R-23, and MIT-R-24.]

- Bruce Power and OPG will work co-operatively with Emergency Management Ontario and other local emergency responders to assist in the development and testing of emergency plans throughout the life of the DGR Project. Local fire departments may require additional orientation and training of their staff regarding the presence of new above-ground and below-ground facilities and equipment. Some may require specialized training and resources to respond to emergencies, especially below-ground emergencies, which are likely to be new and unfamiliar to emergency response staff, should they be called upon to assist. [EA-250, EA-131, IRC-LPSC-01.114]
- OPG will ensure that an emergency and fire response plan is prepared and implemented for the DGR Project, including plans for mine rescue. In addition, OPG will share DGR Project information with local and regional health and safety service providers about timing and large changes in the magnitude of its on-site labour force and training opportunities applicable to each phase of the DGR Project. [EA-251, EA-127, EA-132, EA-148, EA-152, EA-228, LIC-061]
- Contingency plans have yet to be developed for the project to reflect the potential for simultaneous emergencies and expected response. Selected contractor capabilities could have an effect on the

TABLE A8:
SOCIO-ECONOMIC ENVIRONMENT DETAILED COMMITMENTS

1) Human Assets

requirements of external support. This area will require future consideration and will be reflected in the DGR Response Plan as appropriate. [IRC-LPSC-01.122]

- The site emergency response requirements will be modified through the project phases to reflect the nature of the work being performed and the parties involved. The emergency response system will be tested annually. [IRC-LPSC-01.120]

MONITORING COMMITMENTS:

MON-S-01. OPG will continue to monitor public attitudes toward the DGR Project. [based on EIS, Table 13-1 (OPG 2011a)]

- Public attitude research (PAR) will be completed *one time* during the peak year of employment, when the magnitude of effects of the site preparation and construction phase workers are predicted to be greatest, *one time during the decommissioning phase,* and subsequent to any accidents or malfunctions resulting in a release of radioactive contamination to the environment. *OPG will assess the need for PAR during the operations phase, and* this activity will be integrated with the PAR activities conducted for its operating facilities at the Western Waste Management Facility. [based on IRC-EIS-08.30, and EA-248, EA-174, LIC-081, EAFMP-048, H-17-20, H-17-49]
- Public attitude research will be conducted in the same area as it was conducted previously in 2003 and 2009. That would be within the regional study area. [H-17-33]
- Further public attitude research will be conducted to inform the proposed Community Advisory Committee (CAC) on public attitudes at the time. OPG will seek the CAC's advice regarding survey design and implementation issues such as timing. [H-20-01, H-20-05, H-25-22, H-25-32]
- In terms of making sure that that information is available, OPG will continue to work with local municipalities, health and safety providers, local police, emergency medical services and other officials to mitigate any effects related to the DGR workforce. *[The potential measures could include: to follow public attitude research to inform [OPG] of what those issues are and to trigger discussions and ongoing problem solving.]* [based on TIS-03-04] *(community [non-regulatory] commitment)*

[Note: Additional details on the above monitoring are provided in Table 3a of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A8:
SOCIO-ECONOMIC ENVIRONMENT DETAILED COMMITMENTS

2) Physical Assets

MITIGATION COMMITMENTS:

In-design mitigation measures:

- None identified [EIS, Table 13-1 (OPG 2011a)]

Additional mitigation measures:

MIT-S-02. OPG will review available information respecting rental housing, lodging and tourist accommodations during the construction period in collaboration with planning and economic development officials. [H-20-02, H-20-06] *(community [non-regulatory] commitment)*

- See also LIC-165 (OPG's response to Rec #18).

MIT-S-03. The *[property protection plan in the DGR Hosting Agreement]* will be operationalized prior to the licence to operate. [H-20-03] *(community [non-regulatory] commitment)*

MIT-S-04. A traffic management plan will be developed and implemented to minimize DGR Project related peak hour volumes (e.g., staggering of shifts, encouraging ride sharing and the use of shuttle buses, and off-peak timing of shipments of materials and wastes on and off the DGR Project site) [based on EIS, Table 13-1 (OPG 2011a)]

- In collaboration with relevant stakeholders*, [including local municipalities, health and safety providers, local police, emergency medical services and other officials],* OPG will develop and implement a traffic management plan that will serve to minimize DGR Project related peak hour volumes. Specific measures may include: staggering of shifts, encouraging ride sharing and the use of shuttle buses, and off-peak timing of shipments of materials and wastes on and off the DGR Project site. [EA-254, TIS-03-04, EA-136, TIS-03-10] *(community [non-regulatory] commitment)*
- *[The trucks]* will not materially adversely affect the flow of traffic in and out of the site and will not result in changes to Levels of Service of roads/intersections within the study area. [IRC-EIS-05.36] *(community [non-regulatory] commitment)*
- When possible, services of water delivery and septage pumping will be coordinated for the DGR Project site with other similar services provided on-site to reduce the number of trucks. [IRC-EIS-05.35] *(community [non-regulatory] commitment)*
- All on-site transportation will be done in accordance with Part VI of the Occupational Health and Safety Act and Regulation for Mines and Mining Plants – R.R.O. 1990, Reg. 854, as well as, with the Transportation of Dangerous Goods Act. [IRC-EIS-09.03]
- Farmers in the Local Study Area along the transportation route should be informed if and when oversize or slow-moving project-related vehicles will be on local or municipal are roads during the planning or harvesting season. [EA-134, EA-137, EA-176, EA-255]

MONITORING COMMITMENTS:

MON-S-01. OPG will continue to monitor public attitudes toward the DGR Project. [based on EIS, Table 13-1 (OPG 2011a)]

- See detailed commitments associated with MON-S-01 under the Human Assets VC.

TABLE A8:
SOCIO-ECONOMIC ENVIRONMENT DETAILED COMMITMENTS

3) Social Assets

MITIGATION COMMITMENTS:

In-design mitigation measures:

- None identified [EIS, Table 13-1 (OPG 2011a)]

Additional mitigation measures:

MIT-S-05. OPG will keep neighbours and the broader public informed concerning DGR Project activities at the Bruce nuclear site, and will continue to make contributions to the community through its Corporate Citizenship Program. [EIS, Table 13-1 (OPG 2011a)]

General:

- OPG will continue to keep its neighbours, and the broader public informed concerning the activities at the Bruce nuclear site as appropriate to each phase of the DGR Project. [EA-175, EA-140, EA-137, EA-176, EA-255, H-20-09] *(community [non-regulatory] commitment)*
- OPG will make every effort to include citizens that may not have been included in the past. [H-17-43, H-18-11]
- OPG will work to keep *[Department of Foreign and International Affairs]*, NRCan and interested American stakeholders informed *[about the DGR Project]*. [EA-008, H-17-48]
- OPG is committed to sharing information on performance and nuclear operations through open and transparent communication, as guided by the nuclear public information disclosure and transparency protocol which sets forth OPG's commitment to high standards of information, disclosure, and reporting. [H-17-27]
- OPG plans to go above and beyond the guidelines set out in *[CNSC Regulatory Document]* 99.3. It sets out the minimum requirements for public disclosure. OPG believes that more needs to be done to maintain our social licence than just one-way information flow. To that end, OPG plans to build on its existing communications and consultation program to increase the opportunities for two-way dialogue. [H-23-15]
- Communications will continue to be developed in a manner that "ensures citizens are apprised of the general nature and characteristics of the anticipated effects on the environment and health and safety of persons during site preparation and consruction and subsequent phases of the project." [IRC-EIS-09.27]

Content of Communication Activities:

[Note: The list of commitments shown below is not intended to be exhaustive, these are examples of information that would be included in the content of OPG's communication activities, as committed by OPG in its formal submissions, during the public review and public hearings.]

- The annual reporting will include a review of the results of the monitoring program and performance of the monitoring program relative to the objectives. It will include, if required, recommendations for actions to change the program to improve effectiveness of the program and may include recommendations to discontinue some monitoring activities if the EA predictions or effectiveness of mitigation measures have been verified. [H-24-23]
- Annual reports will be prepared until all EA follow-up monitoring activities have been satisfactorily concluded, with the approval of the CNSC and the CEAA. [based on EAFMP-067, H-17-03, H-17-25, IRC-EIS-08.25, TIS-03-03]
- Documentation of all monitoring events, including analytical results and mitigation actions will be recorded, documented and incorporated as described in the DGR Environmental Management Plan to ensure that all regulatory reporting requirements are met, and that the results of the EA are carried over through the life of the project. Reporting will continue

TABLE A8:
SOCIO-ECONOMIC ENVIRONMENT DETAILED COMMITMENTS

3) Social Assets

through the site preparation and construction phase and the operations phase. These reports will be retained by OPG. [EAFMP-068]

- OPG will make the annual report available to the public, including providing opportunities to discuss the results with interested members of the public and Indigenous communities and will present the results to the community advisory council. [H-24-24]
- OPG will continue to implement a public information program following the submission of the EIS. Additional targeted communications would be initiated in the event of a proposal to modify the DGR Project in ways which would result in a meaningful change. These include, but are not limited to changes to the:
  - layout of the DGR facility;
  - characteristics or sources of waste to be emplaced in the DGR;
  - capacity of the DGR;
  - life cycle schedule for the DGR Project;
  - monitoring program for the DGR Project; and
  - socio-economic considerations (e.g., employment or spending). [EA-079, H-25-27]
- The content of the communication activities planned during site preparation and construction will reflect project activities and progress, mitigation efforts and their effectiveness, and the results of monitoring activities undertaken to confirm predicted effects. [IRC-EIS-09.29, IRC-EIS-11.04, IRC-EIS-11.05]
- The *[stakeholder briefings in the]* post-submission communications program will include information on construction activities and scheduling. [EA-009, EA-206]
- OPG are establishing processes now for the ongoing discussion on *[baseline and monitoring activities]*, and if baseline is part of that, OPG is committed to have a dialogue on baseline activities. [H-18-08]
- OPG has committed to engaging members of the community in discussing monitoring results and certainly engaging nearby residents in understanding the locations, the monitoring requirements and how it's done could be a part of that program. [H-17-31]
- The results of follow-up monitoring for conventional air quality, surface water quality, aquatic habitat, groundwater quality, the results of public attitude research, and the results of any other undertakings as a result of the regulatory approvals process will also be communicated. [IRC-EIS-09.30]
- Through continuation of its engagement programs, described in the Preliminary Safety Report (OPG 2011b, Section 12), OPG will maintain an awareness of stakeholder and public concerns that might relate to effects on the socio-economic environment. [IRC-EIS-08.31]
- With respect to the repository of information, OPG is currently looking at ways to make that data *[on the project]* available and accessible but the data for the project itself will be maintained at the project *[site]* and with the project. [H-17-35, H-12-01]
- The *[mitigation]* measures that were outlined for the stigma on Slide 74 *[of OPG's presentation to JRP, Socio-economic Technical Information Session]* have been and will continue to be provided or addressed on an ongoing basis. A publication disclosure of facility performance and monitoring results are occurring currently and will continue to occur. [based on TIS-03-05]

  [Note: The measures referred to by this commitment are reproduced below:
  - *Publication disclosure of facility performance and monitoring results*
  - *Central information centre*
  - *Ongoing stakeholder engagement*
  - *Explicit consideration of stigma*
  - *Build trust, informing publics and educating scientists*

TABLE A8:
SOCIO-ECONOMIC ENVIRONMENT DETAILED COMMITMENTS

3) Social Assets

- *Knowledgeable media*
- *Undertake impact reduction through such mechanisms as property value protection programs]*

MIT-S-06. OPG will make the annual report and the executive summary referred to in *[CEAA]* condition 2.5, as well as the implementation schedule referred to in *[CEAA]* condition 15, available on its website upon submission to the CNSC. OPG will, unless otherwise specified by the CNSC, keep these documents available on its website for twenty-five years following the end of operations or until the end of decommissioning of the Designated Project, whichever comes first. [based on CEAA 2.6]

MIT-S-07. OPG will, where consultation is required [based on CEAA 2.2]:

[CEAA] 2.2.1 provide written notice of the opportunity for the party or parties to present their views on the subject of the consultation;

[CEAA] 2.2.2 provide sufficient information and a reasonable period of time to permit the party or parties to prepare their views; and

[CEAA] 2.2.3 provide a full and impartial consideration of any views presented.

- The DGR Community Engagement Plan will be prepared to ensure that appropriate communications and engagement with the communities surrounding the DGR Project site are planned. [EA-047]
- OPG is committed to continuing its Public Participation and Indigenous Engagement Program throughout the regulatory approvals process and beyond, including (pending regulatory approval) the DGR Project site preparation and construction. Once the DGR is operating communications are expected to be integrated with OPG communications. *[Note: Integration with OPG communications was completed.]* Consistent with public communications undertaken throughout the course of the DGR Project, specific engagement strategies will continue to use a multitude of communication methods and tools to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment, health and safety of persons during site preparation and construction.
  - Stakeholder Briefings and Presentations – Briefings and presentations will continue to be conducted to present information and provide an opportunity to have questions and comments addressed. Regular updates will be presented to elected officials, the DGR Community Consultation Advisory Group and Kincardine Community Consultation Advisory Committee; and other key stakeholders. *[Note: The DGR Community Consultation Advisory Group and the Kincardine Community Consultation Advisory Committee are no longer active.]*
  - DGR Website – The DGR website will continue to be updated.
  - DGR Newsletter – The DGR Project newsletter will continue to be issued. [Note: The DGR project news and updates are currently included in OPG's WWMF Neighbours Newsletter. The DGR Newsletter is no longer issued separately.]
  - DGR Open Houses – Open houses may occur throughout this period to share information, describe key activities and communicate progress.
  - Media Relations – Ongoing media relations about the EA will be initiated and maintained by OPG.
  - Telephone Communication - Contact information for OPG/NWMO public affairs will continue to be advertised to the public on all written and electronic materials and on the DGR website.
  - Employee Communication – OPG and NWMO employee communication will continue with articles appearing in electronic and print publications. Staff presentations and lunch and learn

TABLE A8:
SOCIO-ECONOMIC ENVIRONMENT DETAILED COMMITMENTS

3) Social Assets

sessions will be held.

- Issues Management and Tracking – A comment database will continue to be maintained to record and monitor all comments, correspondence and communications with the public and stakeholders. [EA-012, IRC-EIS-09.28, EA-005, EA-079, H-01-07, H-17-19, H-17-26, H-17-45, H-17-46, H-23-14, H-25-27, H-25-33, LIC-082, LIC-083, LIC-084, LIC-085, TIS-03-01, TIS-03-04, TIS-03-06]

- With respect to engagement strategies going forward, OPG will continue at a very intense level to provide two-way opportunities for dialogue with our local communities and stakeholders and interested parties both within and without Bruce County. OPG will continue to use a multitude of communication tools and will also continue to offer tours and briefings of this Western Waste Management Facility and the DGR site.

  With respect to engagement strategies going forward with the site preparation and construction and operation phases, OPG continue to provide those very important opportunities for discussion with the public where they have opportunities to ask questions, provide comments. Some of those opportunities will focus on follow-up monitoring program and any undertakings from the regulatory approvals process.

  OPG will also engage those living within close proximity of the Bruce Nuclear site regarding any anticipated effects on the environment and health and safety of persons and advise them of upcoming events such as the beginning of blasting during construction or if there was going to be any large equipment on the roads during harvesting. [TIS-03-02, IRC-EIS-09.30]

- OPG will provide an opportunity for government officials and the public to go underground to see firsthand the integrity of the DGR host rock prior to the DGR going operational. [H-14-04]

- The DGR Public Information and Involvement Program will continue to be evaluated throughout to ensure the objectives of the program are being met. [based on LIC-085, LIC-083]

MIT-S-08. OPG will, where consultation with Indigenous communities is a requirement of the conditions set out in this *[CEAA 2015]* document, first consult each Indigenous group on the most appropriate manner to conduct the consultation. [based on CEAA 2.3]

- OPG will continue to keep Indigenous communities informed concerning the activities at the Bruce nuclear site as appropriate to each phase of the DGR Project. [EA-175, EA-137, EA-140, EA-176, EA-255, H-20-09]

- OPG will continue to provide engagement opportunities for Indigenous communities where they can become informed and updated, ask questions, provide meaningful comment and raise issues and concerns about key DGR activities, milestones and decisions. Indigenous communities will be kept apprised of any significant environmental, safety or health issues, any significant changes to the DGR, and the results of any follow-up monitoring. [LIC-080]

- OPG is committed to ongoing, meaningful engagement and dialogue with Municipal, *[and]* Indigenous communities regarding the DGR and OPG's nuclear waste management operations. The avenue for these conversations could include community councils, or some other form of mutually agreeable structure. [LIC-162, LIC-163, H-01-11]

- OPG has and will continue to engage with other Indigenous communities who have expressed an interest in the project. OPG meets with these communities to offer briefings on the DGR Project, to provide results of the EA and to offer tours of our waste facility. [H-18-01]

- With respect to OPG and traditional ecological knowledge, certainly as we receive that knowledge and when the - whether it is the SON or the HSM or MNO, provide that, certainly OPG will incorporate it into our operations procedures as they come available. [H-24-35]

MIT-S-09. OPG will continue to work with various stakeholders to deliver its community, recreational and educational

TABLE A8:
SOCIO-ECONOMIC ENVIRONMENT DETAILED COMMITMENTS

3) Social Assets

initiatives. [based on EIS, Table 13-1 (OPG 2011a)]

- OPG will continue to work with various stakeholders to deliver its community, recreational *[and educational]* initiatives through existing community liaison measures. In addition, OPG will continue to maintain its contribution to the community through its Community Partnership Program. [EA-175, EA-140, EA-138, EA-177, EA-257, EA-258] *(community [non-regulatory] commitment)*
- OPG plans to establish a community advisory council related to OPG nuclear waste management facilities at the Bruce nuclear site. This community advisory council will be modelled on the community advisory council's currently established for the Pickering and Darlington sites. The purpose of the community advisory council will be to identify community issues and concerns related to OPG nuclear waste facilities, provide advice in identifying and implementing community outreach activities and in conducting future public attitude research and provide advice on communication activities and performance reports to the community on the environmental, economic and social effects of the operation of OPG nuclear waste facilities at the Bruce nuclear site on the community. The community advisory council initiatives will be in addition to public information programs discussed in OPG's presentation to the hearing session on October 28, 2013 week [H-25-19, H-17-47, H-19-01, H-20-04] *(community [non-regulatory] commitment)*
- OPG will engage the planned community advisory council as it develops the final EA follow-up monitoring program. [H-24-18] *(community [non-regulatory] commitment)*
- OPG plans to have a protocol for determining the composition of community advisory council in order to have transparency while the process takes place. [H-25-21] *(community [non-regulatory] commitment)*
- OPG has committed in previous sessions that any session *[of community consultation advisory committee]* would have comprehensive minutes for that. *[repeated a few times during the hearing]* [based on H-25-30] *(community [non-regulatory] commitment)*
- One of the important parts of identifying who will have input into the community consultation advisory committee protocol is identifying who the facilitator will be for this work. And the facilitator will help OPG with how to set this up to make sure that it is done in a very transparent way. [based on H-25-31] *(community [non-regulatory] commitment)*
- The DGR Project will provide OPG with opportunities to continue its presence as an economic driver and corporate citizen in the Local Study Area. OPG is and will continue to be an employer that promotes community cohesion through its Corporate Citizenship Program and the community initiatives of its employees. Through the ongoing delivery of such programs and activities and the opportunities for their expansion, OPG and its partners will continue to foster socially meaningful interactions within the community, thereby strengthening its positive influence on community cohesion. This will benefit not only those who directly engage in these programs and activities, but also all residents living in the Local and Regional Study Area. [EA-259, EA-140, EA-138, EA-177, EA-257, EA-258] *(community [non-regulatory] commitment)*

MIT-S-10. In the unlikely event that site preparation, construction or decommissioning activities encounter artifacts that could be associated with a cultural or heritage resource, the activities will be curtailed until further assessment (i.e., a Stage 3 and/or 4 archaeological assessments) can be undertaken to protect the resource from further disturbance and conserve its cultural heritage value. [EA-139, EA-256, EAFMP-064, and in EIS, Table 13-1 (OPG 2011a)]

- In the unlikely event that site preparation, construction or decommissioning activities encounter artifacts that could be associated with a cultural or heritage resource, the activities will be curtailed until further assessment (i.e., a Stage 3 and/or 4 archaeological assessments) can be undertaken to protect the resource from further disturbance and conserve its cultural heritage value. [EA-139, EA-256, EAFMP-064]
- In the event that human remains are encountered in *[the]* portion of CSA-B *[that occurs within the Project Area]* or elsewhere in the Project Area, OPG will ensure that all activity in the vicinity of the

TABLE A8:
SOCIO-ECONOMIC ENVIRONMENT DETAILED COMMITMENTS

3) Social Assets

discovery is temporarily suspended and that the Ministry of Tourism and Culture, the Registrar of Cemeteries, the SON Environmental Office, HSMC *[Historic Saugeen Métis Community]* and MNO headquarters, the South Bruce detachment of the Ontario Provincial Police and the local coroner be contacted immediately. *[OPG would work with relevant parties to develop a plan that mitigates project-related effects on the discovered remains].* [EA-179, EAFMP-062, EAFMP-063, IRC-EIS-06.25, H-17-04]

- No *[heritage]* buildings, in the Site or Local Study Areas, will be removed or demolished for the Project. [IRC-EIS-08.05]
- The *[Jiibegmegoong]* burial site itself will not be physically altered by the DGR Project. [IRC-EIS-12.10, IRC-EIS-12.12]

MONITORING COMMITMENTS:

MON-S-01. OPG will continue to monitor public attitudes toward the DGR Project [based on EIS, Table 13-1 (OPG 2011a)]

- Same monitoring commitments as shown under the Human Assets VC.
- The air and noise monitoring programs will be part of the program that is used in monitoring those *[socio-economic]* effects on members of the public. [H-17-32]
- Nuisance complaints due to fugitive source emissions will be recorded along with the corrective/preventive action taken and the response. [IRC-EIS-04.29]

TABLE A8:
SOCIO-ECONOMIC ENVIRONMENT DETAILED COMMITMENTS

4) Financial Assets

MITIGATION COMMITMENTS:

In-design mitigation measures:

- None identified [EIS, Table 13-1 (OPG 2011a)]

Additional mitigation measures:

MIT-S-03. The *[property protection plan in the DGR Hosting Agreement]* will be operationalized prior to the licence to operate. [H-20-03] *(community [non-regulatory] commitment)*

MIT-S-11. Information will be shared with local and regional economic development officials (i.e., the timing and magnitude of meaningful changes to its on-site labour requirements). [based on EIS, Table 13-1 (OPG 2011a)]

- Same mitigation commitments as above related to sharing information (shown under Human Assets VC)

MIT-S-12. Non-salary expenditures will be sourced locally wherever practical and in accordance with relevant supply chain policies, procedures and standards for competitive purchasing. [EIS, Table 13-1 (OPG 2011a)]

- To enhance the potential for beneficial effects on local and regional business activity, the DGR Project non-salary expenditures will be sourced locally wherever practical and in accordance with relevant supply chain policies, procedures and standards for competitive purchasing. [EA-252, EA-133] *(community [non-regulatory] commitment)*

MIT-S-13. Farmers in the Local Study Area along the transportation route should be informed if and when oversize or slow-moving project-related vehicles will be on local or municipal area roads during the planting or harvesting season [EIS, Table 13-1 (OPG 2011a), EA-253] *(community [non-regulatory] commitment)*

MONITORING COMMITMENTS:

MON-S-01. OPG will continue to monitor public attitudes toward the DGR Project. [based on EIS, Table 13-1 (OPG 2011a)]

- See detailed commitments associated with MON-S-01 under the Human Assets VC.

TABLE A8: SOCIO-ECONOMIC ENVIRONMENT DETAILED COMMITMENTS

5) Natural Assets: Noise Levels

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-A-02 through MIT-A-06. See in-design mitigation measures for Noise Levels VC in Table 3-6, Atmospheric Environment Mitigation and Monitoring Commitments.

- See detailed commitments under Noise Levels VC in Table A6, Atmospheric Environment Detailed Commitments.

Additional mitigation measures:

- None identified [EIS, Table 13-1 (OPG 2011a)]

MONITORING COMMITMENTS:

MON-S-01. OPG will continue to monitor public attitudes toward the DGR Project [based on EIS, Table 13-1 (OPG 2011a)]

- See detailed commitments associated with MON-S-01 under the Human Assets VC.
- Nuisance complaints due to fugitive source emissions will be recorded along with the corrective/preventive action taken and the response. [IRC-EIS-04.29]

MON-S-02. OPG will, prior to site preparation and to the satisfaction of the CNSC, develop a dust and noise follow-up program to examine social and economic effects of offsite dust and noise levels due to the Designated Project. [based on CEAA 8.7]

- The air and noise monitoring programs will be part of the program that is used in monitoring those *[socio-economic]* effects on members of the public. [H-17-32]

MON-A-05. OPG will, throughout the preclosure phases of the project and to the satisfaction of the CNSC, implement noise and vibration monitoring at noise receptor sites defined as R1, R2 and R3 in the EIS and at additional monitoring locations identified in consultation with regulatory authorities, Aboriginal groups and permanent and seasonal residents in the Local Study Area. OPG will develop explicit action levels for additional noise mitigation, acceptable to the CNSC, taking into consideration input from Aboriginal groups and permanent and seasonal residents in the Local Study Area. [based on CEAA 8.2]

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

- See detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

TABLE A9: HUMAN HEALTH DETAILED COMMITMENTS
Valued Ecosystem Components
1) Overall Health of Local Residents 2) Overall Health of Members of Indigenous Communities 3) Overall Health of Seasonal Users 4) Health of Workers

TABLE A9:
HUMAN HEALTH DETAILED COMMITMENTS

1) – 3) Overall Health of Local Residents / Members of Indigenous Communities / Seasonal Users

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-A-01. OPG will, prior to site preparation and to the satisfaction of CNSC, develop a detailed plan to manage air emissions that includes details on the implementation of the identified mitigation measures, frequency of air quality monitoring and site inspections, thresholds for corrective management actions and record keeping. Mitigation measures shall, at minimum, include [based on CEAA 7.1]:

[CEAA] 7.1.1. the use of construction equipment that will meet, at minimum, Tier 2 emission standards;

[CEAA] 7.1.2. maintenance of equipment in good working order;

[CEAA] 7.1.3. watering of roadways for dust suppression;

[CEAA] 7.1.4. minimization of drop heights of rock and other material; and

[CEAA] 7.1.5. the use of vehicles meeting the newest emission standards.

- See detailed commitments under Air Quality VC in Table A6, Atmospheric Environment Detailed Commitments.

MIT-A-02 through MIT-A-06. See the descriptions of the mitigations commitments for the Noise, and Vibrations VCs in Table 3-6, Atmospheric Environment Mitigation and Monitoring Commitments.

- See detailed commitments under Noise Levels, and Vibrations VCs in Table A6, Atmospheric Environment Detailed Commitments.

Additional mitigation measures:

MIT-H-19. Operational programs and procedures are developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]

- See detailed commitments associated with MIT-H-19 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MONITORING COMMITMENTS:

MON-A-03. OPG will, during site preparation and construction and operations and to the satisfaction of the CNSC, conduct a follow-up program to monitor acrolein concentrations at air receptor sites for local residents and for Indigenous communities, defined as AR 1, AR 2, AR 3 and AR 5 in the EIS. [based on CEAA 8.1, LIC-165 (Rec #17)]

- OPG will enter into discussions with regulators to identify the potential for monitoring acrolein at *[a point near the Bruce nuclear site fence line]*. [H-17-07]

MON-A-01, MON-A-02, MON-A-05 through MON-A-07. See the descriptions of the monitoring commitments for the atmospheric environment VCs in Table 3-6, Atmospheric Environment Mitigation and Monitoring Commitments.

- See detailed commitments under Air Quality, Noise Levels, and Vibrations VCs in Table A6, Atmospheric Environment Detailed Commitments.

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

- See detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

TABLE A9:
HUMAN HEALTH DETAILED COMMITMENTS

4) Health of Workers

MITIGATION COMMITMENTS:

In-design mitigation measures:

MIT-P-01. The underground repository is designed for mechanical stability (competent rock formation, alignment with in-situ stresses, ground support).

Competent rock formation:

- The rock mass in which the repository will be constructed is geomechanically stable. [based on H-14-03]

Alignment with in-situ stresses:

- The underground layout will have a slight grade, and its depth will vary slightly also with local surface topography. The emplacement rooms are all aligned with the assumed direction of the major principal horizontal stresses of the rock mass in the Cobourg formation (i.e., east-north-east) to minimize the risks of rockfall, especially during the period in which the repository is open but also postclosure. [LIC-121, LIC-093]
- *[In-situ]* stress direction will be confirmed following shaft sinking. [LIC-015]

Ground support:

- At the repository level (access tunnels and emplacement rooms), the rock support will be provided through combinations of the following materials: 25-mm-diameter galvanized hollow-core mechanical rock bolts, 15.2-mm-diameter cable bolts, fibre-reinforced shotcrete, plain (or un-reinforced) shotcrete, and welded wire mesh. In the emplacement rooms it is planned to install 3-m-long bolts on 2.05 m × 2.05 m spacing. A spacing pattern of 1.68 m × 1.68 m and 2.4-m-long bolts will likely be used in the access tunnels. Supplementary cable bolts will be installed in selected areas such as shaft stations, maintenance areas and locations with wide intersections. [IRC-EIS-05.28]
- Groutable mechanical bolts will be installed and initially pre-stressed to about 2 tonnes. In addition to bolting, wire mesh or fibre-reinforced shotcrete will be applied after each round to prevent small “loose rock” from falling and jeopardizing the safety of the workers. When wire mesh is used, then plain shotcrete will be applied over the mesh at a later time when it is most convenient in the construction cycle. As the rooms and tunnels are advanced, grouting of the rock bolts will be performed through their hollow cores. The grout will provide an additional corrosion protective layer around outside of bolts to ensure longevity of the rock support system. [IRC-EIS-05.29]
- The ground support design will incorporate rock bolts and welded-wire mesh and/or shotcrete to prevent spalled or “loose rock” from falling from the tunnel roof (refer to IR response EIS-05-187). [Table 2: - Engineering in IRC-EIS-05.39, IRC-EIS-10.03]
- During operations there will be on-going visual inspection of the ground support systems. After approximately 20 years of operation (or sooner if visual inspection indicates problem bolts), there will be non-destructive testing of selected rock bolts and cable bolts to confirm integrity of bolts. Systematic testing would be performed in accordance with a recognized standard or procedure. [IRC-EIS-12.32]
- Rock deformation/movement (e.g. by extensometers and other instruments) will be performed throughout the operations phase as per the Geoscientific Verification Plan (NWMO 2014c) to detect excessive rock deformation and possible overloading of rock bolts or cable bolts. Additional rock support will be installed, as required, in the event that rock deformation exceeds a predefined allowable amount of deformation. [IRC-EIS-12.33]
- Structural concrete will be used for the waste packaging, the shaft lining, the floors, walls and ceilings of tunnels/emplacement rooms, and the closure and room walls. [LIC-131, H-05-02]
- Results and recommendations from the 2D and 3D *[geomechanical]* modeling will be incorporated

TABLE A9:
HUMAN HEALTH DETAILED COMMITMENTS

4) Health of Workers

into the design basis and will support the design of the rock support system for various underground openings. The modeling will also support the development of the geotechnical investigation and monitoring plan as described in OPG's response to Information Request EIS-07-302 (OPG 2012i). [IRC-EIS-08.34]

MIT-P-02. Seismic, severe wind, and lightning protection is incorporated into the DGR design.

- All underground facilities (office, tunnel, emplacement room) will be constructed in accordance with the seismic requirements of the latest edition of the National Building Code at the time of the construction. [EA-142, IRC-LPSC-01.01, IRC-LPSC-01.02, IRC-LPSC-04.09]
- All above-ground structures (access building, ventilation shaft headframe building and HVAC and mechanical building) will be constructed in accordance with the seismic requirements of the latest edition of the National Building Code at the time of the construction. [EA-142, IRC-LPSC-01.06, LIC-053, IRC-LPSC-01.01, IRC-LPSC-01.02, IRC-LPSC-04.09]
- Above ground structures constructed at the site will meet all building code requirements including those for wind load. [LIC-054]
- The above ground structures will be designed with lightning protection. [LIC-055, EA-143, IRC-EIS-06.19]

MIT-P-03. The ventilation system is designed for safe working conditions for the DGR personnel. (non-radiological hazards)

- Air quality of the underground DGR will be monitored under the EMP *[Environmental Management Plan]* to ensure that the health and safety of personnel within the DGR is not compromised during underground construction and operations. The monitoring system will verify:
  - Levels of noxious gases do not exceed regulatory limits;
  - Levels of explosive gases do not exceed explosive limits;
  - Temperature and humidity of the DGR remain acceptable for both personnel health and infrastructure integrity; and
  - Airflows remain adequate in active work areas. [based on EAFMP-033, EA-018, EA-020, EA-100, LIC-036, LIC-037]
- A maintenance program will be established for the operation of the *[ventilation]* system. [based on EA-017]

MIT-P-04. Fire prevention, detection and protection is incorporated into the DGR design.

- A Fire Protection specific Design Requirements document will capture all the applicable codes and other requirements to be used in the fire protection system detailed design. Prior to the construction of each phase of the facility, a Code Compliance Report will be prepared on completion of detailed design of that phase, to confirm that the design meets applicable code requirements. [IRC-LPSC-01.46]
- All DGR surface facilities will be equipped with fire detection and protection systems in accordance with the National Building Code of Canada and the National Fire Code of Canada requirements. Smoke detectors and heat detectors will be located throughout the buildings to provide means for early detection of fire. A number of fire hydrants will be located near main entrances to the buildings. Office, maintenance and locker room areas will be protected with large volume Class ABC fire extinguishers consistent with National Fire Code requirements. [EA-108, EA-237, LIC-028]
- In accordance with Section 19.0 of the Project Requirements, which states that 'The latest version of all regulations, standards and codes listed in this section will be used; the newer codes; National Building Code of Canada - 2010 (NBCC) and the National Fire Code of Canada - 2010 (NFCC) will

TABLE A9:
HUMAN HEALTH DETAILED COMMITMENTS

4) Health of Workers

be used for future design of the DGR, along with more stringent applicable requirements in the Ontario *[Occupational]* Health and Safety Act (OHSA) regulations. [IRC-LPSC-01.02, IRC-LPSC-01.01, IRC-LPSC-04.09]

- A defence-in-depth principle is being used in the development of the Design Requirements and Fire Protection Program documents. [IRC-LPSC-01.48]
- During construction and operations a "stench gas" system will be employed as the prime notification system for fire. [EA-109, IRC-EIS-06.21]
- An underground fire detection system will consist of smoke and carbon monoxide detectors located throughout the underground workings (i.e., intake plenum, underground working areas and emplacement rooms through all stages and the main exhaust ventilation ducts). [EA-110, LIC-029]
- Underground fire suppression systems will be chemical-based as opposed to water-based. The following suppression methods are included:
  - handheld foam-based extinguishers located at clearly marked locations in high traffic areas (i.e., diesel fuel bay, mechanical shop) as well as on mobile equipment;
  - a mobile foam generator will be based underground for use in open emplacement rooms; and
  - diesel equipment will be equipped with on-board foam suppression systems that are heat triggered (i.e., automatic system), and could also be manually activated by the operator in the event of a fire. [EA-111, IRC-LPSC-01.53, IRC-LPSC-01.64]
- During detailed design, each building will be evaluated and zoned such that areas within each building may have different fire suppression requirements due to the potential fire hazard or to protect equipment and personnel. [LIC-030]
- At any workplace that is not a fixed location (e.g., maintenance shop) workers must have a fire extinguisher available and close at hand. [LIC-031]
- There will be full redundancy in fire detection, alarms and suppression systems and redundancy in local suppression systems (e.g., sprinklers or ansul systems). [IRC-EIS-06.22]
- NFCC *[National Fire Code of Canada]* will be followed and alternative solutions (Ref. NFCC A.1.2.1.1.(1)(b)) will be pursued if needed. As well, for the underground portions of the facility, the inspection, testing, and maintenance of the fire protection. [IRC-LPSC-01.03]
  - Reference to the inspection, testing, and maintenance requirements of the NFCC will be included in the inspection program for the underground portion of the facility to provide added assurance that the inspections required by the OHSA Mines and Mining Plants Regulations are being carried out in accordance with all recognized and accepted practices. [IRC-LPSC-01.05]
- In locations of fire hazards, local dry type suppression systems will be used, as well as fire detection systems. [IRC-LPSC-01.04]
- In addition to portable fire extinguishers underground as required by the Ontario mining regulations, a portable dry chemical fire suppression system will be available to the mine rescue team at a surface storage location and it could be taken underground by the team to suppress a fire. [IRC-LPSC-01.43]
- The DGR fire water main(s) will be buried and the fire water main loops will distribute fire water around the DGR surface facilities site. The fire water main(s) will meet the requirements of the latest National Building Code of Canada (NBCC), National Fire Code of Canada (NFCC), National Fire Protection Association (NFPA), NFPA 24, the Ontario Provincial Standard Drawings (OPSD) and Specification (OPSS). [IRC-LPSC-01.60, IRC-LPSC-04.09]
- Fire water will be supplied through tie-ins to existing fire water lines on the Bruce nuclear site. There are existing fire water lines located immediately to the south and west of the DGR project

TABLE A9:
HUMAN HEALTH DETAILED COMMITMENTS

4) Health of Workers

site. Exact tie-in or connection locations are being discussed with Bruce Power who will be the provider of the service. [IRC-LPSC-01.87]

  - Once the tie-in location(s) to the Bruce Power fire system are set, an assessment of supply disruption will be completed and actions taken to ensure a highly-reliable supply. The assessment will include the assessment of the supply, the DGR fire water system and any on-site and off-site support provided through Emergency Response. [IRC-LPSC-01.59]

- Post indicator valves will be provided to allow isolation of the fire water main if required for maintenance purposes. Hydrants will be located throughout the DGR surface facilities site along roadways to provide access for emergency response crews. The fire main system will be installed below the frost line to prevent freezing. Metallic components of the fire main will be equipped with cathodic protection and freeze protection will be provided in specific locations where deemed necessary. The fire water main will be connected to the water-based fire suppression systems. [IRC-LPSC-01.61]
- Fixed non-water fire suppression systems will be provided in areas of the DGR which contain storage of more than 500 L of oil, grease, or flammable liquids, service garages, and fueling stations in accordance with the OHSA Mines and Mining Plants Regulations (O.Reg. 854/90). This includes the Service Garage, Lube Bay, and Fuel Bay. One system will be provided for each area. [IRC-LPSC-01.62]
- The main and ventilation shaft hoisting equipment will be equipped with fixed fire suppression systems. These systems will be local application, protecting equipment deemed to be a potential fire hazard. [IRC-LPSC-01.63]
- Both fixed and mobile equipment (i.e., forklifts) located in the DGR will be provided with fixed local application fire suppression systems. [IRC-LPSC-01.65]
- Fire protection equipment stations will be located in all access and service drifts, as well as, specified locations as per the Ontario mining regulations (e.g., shaft stations, electrical rooms, etc.). These stations will be strategically located throughout the DGR. Each station will contain dry chemical fire extinguishers, self-contained breathing apparatus, personal protective equipment, tools, etc. The equipment at each station will be determined based on the potential type and size fires in the vicinity of the station. [IRC-LPSC-01.66]
- Combustible materials are avoided or minimized in waste package handling areas. [based on LIC-058]
- Underground fuel storage will be kept in limited quantities, in a dedicated area separated from the waste packages transfer route and the rooms. [based on LIC-058, and EA-235]
- Diesel fuel will not be moved simultaneously with waste packages. [LIC-058, EA-236]
- The underground Maintenance Shop and Diesel Fuelling Station will each have their own isolated containment sumps to capture fluids from accidents/spills. Similar to surficial accidents or malfunctions, emergency procedures are designed to ensure that malfunctions and/or accidents will be addressed in a timely manner. [IRC-EIS-05.27]

MIT-P-05. Flood protection is incorporated into the DGR design.

- The WPRB floor will be above the maximum flood level. [LIC-056]
- The preliminary design work indicated that the stormwater management system required a higher ground elevation at the DGR surface facilities to facilitate site drainage. The interim finished ground surface elevation around the surface facilities has been increased to 188 mASL. This will be finalized as part of detailed design. [IRC-EIS-07.08]

  - The shaft collar will be placed higher than the flood level calculated for an extreme storm event, referred to as a probable maximum precipitation. [H-08-04]

TABLE A9:
HUMAN HEALTH DETAILED COMMITMENTS

4) Health of Workers

  - There is a large margin in the current design *[of the height of the shaft collar and other intake/exhaust structures providing access underground]* relative to the risk of flooding. This will be reaffirmed as part of the detailed design process. [IRC-EIS-07.09]
  - All *[surface]* electrical equipment including distribution panels, control panels and all electrical terminations will be located at the shaft collar elevations or above (determined from the elevation requirements determined from the Maximum Flood Hazard Assessment) to limit the impact of postulated flooding events on the electrical systems. [IRC-LPSC-01.28]

- Measures will need to be taken to control ground water inflow into the excavation from the underlying permeable bedrock. [IRC-EIS-01.01]
- Water will be removed from the shaft excavations by pumping to ground surface. [IRC-EIS-01.04]
  - *[Sumps are required in the access tunnels in each of the panels during the construction phase to collect service water used by drilling jumbo and for dust control.]* These sump locations will be available for use in the operations phase, if required. [IRC-LPSC-01.58]
  - There will be a sump at the bottom of the ramp near the ventilation shaft. [IRC-LPSC-04.01]
  - The underground dewatering system used for operations will be sized to handle both the normal inflow plus additional groundwater inflow that might occur during a postulated abnormal operations event. [IRC-EIS-04.35]
  - For purposes of preliminary sizing of the operations' phase dewatering system, it was assumed that up to 15 L/s of additional groundwater inflow could occur in the failed liner scenario (see PSR, Section 6.3.10.4). This estimate is considered to be conservative and will be updated as new information becomes available about hydrogeologic conditions in upper bedrock formations (to depth of about 180 m), ground treatment to be used in the upper permeable bedrock formations (see response to IR-LPSC-01-31 [OPG 2012a]) and how the shaft liners might behave during a postulated seismic event. [IRC-LPSC-01.56]
  - The maximum pumping capacity of the dewatering system is currently set at 22 L/s (see PSR, Section 6.3.10.4). As new information about estimated rates of water flow to main sump become available under both normal and abnormal conditions, the design pumping capacity will be adjusted accordingly. [IRC-LPSC-01.57]
- See also MIT-H-06, and MIT-H-08 detailed commitments in Table A2, Hydrology and Surface Water Quality Detailed Commitments

MIT-P-06. Construction of all the emplacement rooms and access tunnels will be carried out prior to, not concurrently with, operations. [LIC-089]

- Nuclear waste materials will not be handled under this *[Site Preparation and Construction]* licence. [H-01-04]
- There will be no radioactive waste present during the site preparation and construction phase. [IRC-EIS-04.20]

MIT-P-07. The underground repository design includes refuge stations.

- In addition to the permanent Refuge Station, there will be portable refuge stations positioned closer to the emplacement rooms as they are filled during operations. [IRC-LPSC-01.22, H-08-02, H-08-03]
- The portable refuge stations will be supplied with breathing air from the surface-based compressors, as well as contained in compressed air bottles. [IRC-LPSC-01.23]
- To ensure *[workers reach safe breathing space within five minutes]* training, appropriate placement of equipment and underground refuge stations, adequate fire detection and warning systems, and appropriate site monitoring and communication systems will be implemented. [EA-226, IRC-LPSC-

TABLE A9:
HUMAN HEALTH DETAILED COMMITMENTS

4) Health of Workers

03.05]

MIT-P-08. Mitigation and control measures for non-radiological hazards to workers will be implemented as part of the DGR Project. Examples of these measures are provided in Section 8.3.2.4, Effects on Workers, of the EIS [OPG 2011a].

[Note: For each hazardous activity or condition identified in the EIS, recommended detailed control/mitigation measures are listed in EIS, Table C3.9.1-1, Effects on Health of Workers, and Table C3.9.1-2, Effects on Health of Workers related to General Safety Management.]

- The mitigation and control measures identified for non-radiological hazards to workers are as follows [EA-151]:
  - use only qualified workers, work permits, worker awareness, personal protective equipment and operator training;
  - hoisting logbooks/records;
  - critical lift procedure and lift planning;
  - equipment planned/preventative maintenance;
  - equipment design installation and operation to meet established crane and hoisting safety permits;
  - safe work code practice;
  - live electrical line work procedures;
  - lock-out/tag-out procedure;
  - emergency response capability;
  - fire extinguishers, fuel dispensing procedure, good housekeeping and hot work permit;
  - ground disturbance permits; pre-excavation ground survey;
  - shaft sinking safe work practices;
  - ground control standards, loose rock scaling work instruction, inspection protocol;
  - machine guarding, spotters for mobile equipment, barricading off of work areas and controlled access;
  - flash back arrestors;
  - slow rates of gas generation expected, ventilation, monitoring and end walls;
  - confined space entry program; and
  - WHMIS.
  - OPG has an active maintenance program and will apply this to the DGR. [IRC-EIS-13.10]
- The third phase of the DGR is decommissioning. This activity would occur many decades from now and would be subject to a new licensing process. However, it has been qualitatively estimated, or assessed. During this phase, the hazards are primarily conventional mining and construction hazards. The wastes will have been isolated in their rooms behind access tunnel closure walls. [based on H-08-06]

Additional mitigation measures:

MIT-P-09. OPG will meet all regulatory requirements associated with being a licensee, including the following:

- take all reasonable precautions to protect the environment and the health and safety of persons; and
- take all reasonable precautions to control the release of hazardous substances within the site and into the environment as a result of the licensed activity. [based on H-23-01, LIC-002]

Site Preparation and Construction:

- OPG will ensure that all of the applicable requirements of these Acts *(Occupational Health and Safety)* will be met. There are other requirements that OPG will implement for the project, as they are applicable to project activities, such as the mining regulations. [H-23-12, IRC-LPSC-01.99]
- To provide confidence that the environment and the public and occupational health and safety will

TABLE A9:
HUMAN HEALTH DETAILED COMMITMENTS

4) Health of Workers

be protected during site preparation and construction activities conducted under the DGR project, the following components need to be in place:

- Objectives and criteria
- Identification of risks and hazards
- Assessment of risks and hazards
- Mitigation measures where required
- Management of health and safety of the public and the workers
- Environmental management
- Emergency response. [IRC-LPSC-04.07]

- With respect to health, safety, the DGR Project health and safety management plan will further describe roles, responsibilities and accountabilities for the execution of work. These areas would be registered/certified to the CSA Z1000 standard, and will be externally audited for compliance. Event identification, notification and follow-up requirements and accountabilities will be detailed in the plans and associated procedures. [IRC-EIS-05.43, IRC-EIS-05.42, H-08-01, H-18-10, IRC-EIS-05.44, IRC-LPSC-01.106]

- The following illustrates how the Health, Safety and Environment (HSE) Manager will communicate to ensure that there is sufficient planning and training, awareness of issues as they arise, appropriate responses and documentation are made as per applicable policies and procedures, and follow-up is done to ensure the effectiveness of the responses.

  - Participation at planned project team meetings (i.e., daily, weekly and monthly),
  - Participation in HSE risk assessment and hazard identification planning,
  - Reviews and provides input to the development and implementation of safe work plans and work instructions,
  - Provides training to project staff and contractors of the requirements of the HSE plans and procedures,
  - Conducts audits and assessments of HSE performance at the project site,
  - Communicates to all levels of the organization on the project HSE performance,
  - Monitoring and tracking HSE non-conformances and corrective actions,
  - Reports, e-mail and correspondence pertaining to the HSE of the project. [IRC-EIS-09.25, IRC-LPSC-04.27]

- The procedures *[associated with Health and Safety Management Plan]* will be reviewed and updated, as required, to reflect the specific work being performed. This includes incorporating best work practices and task-specific procedures provided by the various contractors. [based on IRC-LPSC-01.100, IRC-LPSC-01.103, H-25-14]

  - The current HSEMP [Health, Safety and Environment Management Plan] and procedures adequately address all items with respect to the site preparation and construction activities that are to be undertaken at surface. Nevertheless, these will be reviewed prior to the commencement of work as part of the job safety analysis that must be carried out to develop the required safe work plan for each phase of that work. [IRC-LPSC-01.103]

  - If the nature of the work changes, or new workers are introduced, the safe work plan will be reviewed, and any and all new risks associated with the revised work will be mitigated. [IRC-LPSC-01.102]

  - Further development of procedures is required for the shaft sinking and lateral development activities. These procedures are planned to be developed in conjunction with the contractor(s) that will be retainedfor this work and these procedures will be in place prior to the start of that work. [IRC-LPSC-01.104]

  - *[The]* project plans and procedures are reviewed annually and are updated at any time that there is a revision to the governing Acts or Regulations. [IRC-LPSC-01.105, IRC-LPSC-04.27]

TABLE A9:
HUMAN HEALTH DETAILED COMMITMENTS

4) Health of Workers

- In the event of a reportable incident on-site, the requirements for notification, investigation, reporting and follow-up will be clearly described. Such an event would also be tracked through NWMO's non-conformance and corrective action processes and communicated through all levels of the organization. [IRC-EIS-05.44, H-08-01, H-18-10, IRC-EIS-05.43, IRC-LPSC-01.106]

Operations:

- *[During operations,]* OPG and its contractors will meet all applicable health and safety legislative requirements. OPG will also meet other associated standards to which it subscribes with the objective of moving beyond compliance. OPG will require that contractors and their subcontractors maintain a level of safety equivalent to that of OPG employees while at OPG workplaces. [EA-104]
- Operational programs and procedures will be developed to protect the environment, and health and safety of the public and the workers. [based on EA-056, H-16-02]
  - The conventional occupational health and safety program will ensure worker safety through effective risk assessment and safe work planning. [LIC-088]
  - An overall Occupational Health and Safety Program will be implemented for the DGR that will meet the requirements of OPG's Environmental, Health and Safety Management Program W-PROG-ES-0001 applicable to its nuclear facilities. The program will also be consistent with the OPG Health and Safety Policy OPG-POL-0001 and the OPG Nuclear Safety Policy N-POL-0001. [EA-058, LIC-072 (Section 10.2 of PSR), LIC-090]
    [Note: OPG's Environmental, Health and Safety Management Program W-PROG-ES-0001 has been replaced by OPG's Environmental Policy, OPG-POL-0021].
  - The selection, use and maintenance of personal protective equipment for the above-ground portion of the DGR will be governed by OPG's existing Safety Management System Program OPG-HR-SFTY-PROG-0001. For radiological hazards above-ground, OPG's procedure N-PROC-RA-0025 will be applied. The requirements for personal protective equipment under the Mines and Mining Plants Regulations (Reg. 854) will be complied with for underground operations. [EA-060]
    [Note: OPG's procedure N-PROC-RA-0025 has been replaced by OPG's Radiation Protection Program, N-PROG-RA-0013.]

Decommissioning:

- The potential impacts of accidents during decommissioning are also similar to those during construction. In particular, there is a conventional safety hazard to workers that will be managed through following best practices and proper equipment. [H-08-07]

MIT-P-10. The Explosives and Blasts procedure will be implemented.

- Explosives will not be on-site until excavation activities are initiated. [EA-032]
- Fuel totes will never be transferred in the main shaft cage at the same time explosives or waste packages are delivered underground. [LIC-019]
- It should be noted that there will be no facilities for the production of explosives at the Bruce nuclear site, only storage. [IRC-EIS-01.07]
- Should on-site storage be found practical for storage of explosives and initiating devices, the storage magazines will be installed to meet the above NRCan requirements. [IRC-EIS-01.08]
- There will be explosives other than ANFO used in the development of the DGR. Emulsion blends and packaged products will be used in the shafts and it is expected that emulsion blends will also be used in lateral development. The types and quantities of explosives will not be determined until the development contractor(s) are identified. [IRC-EIS-04.24]
- Receipt of explosives at the Bruce nuclear site will be coordinated with Bruce Power security and maintain established transportation routes. The equipment used for the delivery of explosives will

TABLE A9:
HUMAN HEALTH DETAILED COMMITMENTS

4) Health of Workers

be licensed for their transport. Post delivery transport and use of explosives will be in accordance with the requirements of the Ontario Mines and Mining Plants Regulations (O.Reg. 854/90). [IRC-EIS-07.06]

- Explosives use during excavation activities will use best industry practice and is considered to be typical use within the mining industry. [IRC-EIS-07.07, IRC-EIS-03.13]
- Only personnel licensed to work with explosives, as defined under the Explosives Use Act, will be permitted to handle, use, store, and clean up spills related to explosives. [IRC-EIS-09.04]
- Damaged or unused explosive materials will generally be removed from the DGR site and disposed of by the explosive supplier. [IRC-EIS-09.05]
- No explosives will be stored underground during the operational phase of the DGR. [LIC-027, EA-158, IRC-EIS-09.01]

MIT-P-11. The Handling, Storage and Disposal of Hazardous and Liquid Industrial Waste procedure will be implemented.

- Hazardous waste such as expired chemicals, cleaners, paints, aerosol cans, batteries, and electronic components will be disposed in compliance with all federal and provincial requirements. [EA-055]
- Material Safety Data Sheets for hazardous materials *[at the DGR facility]* will be readily available as required by Workplace Hazardous Materials Information System (WHMIS) legislation. [EA-059, EA-155]
- Annual usage of hazardous materials is relatively small and large volumes of hazardous materials will not be stored at the site. [IRC-EIS-07.03, LIC-071 (Section 9.3.3 of PSR)]
- Above ground, chemicals will be stored in substance appropriate, secured storage cabinets. The location of the storage units will be as required in close proximity to large equipment and determined in consultation with contractors. Below ground, chemicals will be stored in dedicated areas, in substance appropriate, secured cabinets, for example, in the diesel fuel bay, and maintenance shop. [IRC-EIS-07.05, EA-235]
- Materials will be stored and handled according to the Workplace Hazardous Materials Information System (WHMIS). [LIC-026]

MIT-R-12. Security measures will be in place.

- Same detailed mitigation commitments as those listed in Table A5, Radiation and Radioactivity Detailed Commitments.

MIT-R-20, MIT-R-23, and MIT-R-24. See the descriptions of the mitigation commitments for the emergency management and associated mitigation measures, mine rescue, and fire protection programs in Table 3-5, Radiation and Radioactivity Mitigation and Monitoring Commitments.

- Same detailed mitigation commitments as those listed under commitments MIT-R-20, MIT-R-23, and MIT-R-24 in Table A5, Radiation and Radioactivity Detailed Commitments.

[Note: Mitigation commitments to minimize the radiological exposure of workers are presented in Table A5, Radiation and Radioactivity Detailed Commitments.]

MONITORING COMMITMENTS:

MON-P-01. Air quality of the underground DGR will be monitored under the EMP *[Environmental Management Plan]* to ensure that the health and safety of personnel within the DGR is not compromised during underground construction and operations. [based on EAFMP-033, EA-018, EA-020, EA-100, LIC-036,

TABLE A9:
HUMAN HEALTH DETAILED COMMITMENTS

4) Health of Workers

LIC-037]

- Air monitoring equipment will be installed. Airflow, CO and NO_2 measurements will be monitored. Explosive gas monitors will also be installed to monitor a range of potential gases, including methane and hydrogen. Instrumentation measuring airflow, temperature, relative humidity, etc. will also be installed and measurements will be monitored remotely on surface at the main control room. [based on EAFMP-033, EA-018, EA-020, EA-100, LIC-036, LIC-037]
  - Instrumentation measuring airflow, temperature, relative humidity and other pertinent parameters will be installed at the main shaft. [EA-021]
  - Airflow, carbon monoxide (CO), and nitrogen dioxide (NO_2) will be measured at the ventilation shaft. [EA-019]
  - Temperature, CO and airflow will be monitored at backend of active emplacement rooms where ventilation air exhausts into return air tunnels. [IRC-EIS-04.22]
  - Emplacement room exhaust regulators will be equipped with combustible gas monitors to monitor a range of gases (e.g., methane and hydrogen). [EA-022, LIC-037]
- The buildup in pressure *[in a closed panel]* will be slow and will be monitored. [IRC-EIS-09.33]
- Air temperature and quality will be remotely monitored to establish when it would be safe to resume shaft sealing activities *[following placement of an asphalt lift during shaft sealing]*. [EA-088]
- A monitoring program will be established for the operation of the *[ventilation]* system. [based on EA-017]

MON-P-02. Monitoring of equipment function (e.g. ventilation system performance, dewatering systems, etc) will be managed through local human-machine interfaces with status of operation provided to the surface control room. [IRC-EIS-05.49]

MON-P-03. The stack monitor (i.e., surface exhaust air sampling device) will have an alarm which sends a signal back to Control Room if the sampling device has failed (i.e., low air flow). [IRC-LPSC-01.72]

MON-P-04. The target values for the *[health and safety]* performance indicators indicated in Table 1 *[of OPG response to IR-LPSC-04-66 (OPG 2013a)]* will be reviewed and modified, as necessary, prior to the start of site preparation and construction activities. [IRC-LPSC-04.18]

MON-H-15. EA follow-up monitoring will be conducted during site preparation and construction and operations phases, to verify both predictions of the effects and effectiveness of mitigation. [based on H-24-05 and H-17-05]

- See detailed commitments associated with MON-H-15 in Table A2, Hydrology and Surface Water Quality Detailed Commitments

[Note: Additional details on the above monitoring are provided in Table 4a and Table 4b of the EA Follow-up Monitoring Program (NWMO 2011a).]

TABLE A10: ECOLOGICAL FEATURES DETAILED COMMITMENTS
Valued Ecosystem Components
1) Lake Huron 2) Stream C 3) South Railway Ditch 4) Wetland within the Project Area

TABLE A10:
ECOLOGICAL FEATURES DETAILED COMMITMENTS

MITIGATION / MONITORING COMMITMENTS:

The ecological feature VCs identified in the EIS for the assessment of combined effects resulting from the DGR project are as follows:

1) Lake Huron
2) Stream C
3) South Railway Ditch
4) Wetland within the Project Area.

The assessment of the ecological feature VCs, documented in EIS Section 7.12, Ecological Features, considered both the non-radiological and radiological effects. For each ecological feature VC, the relevant indicator VCs were identified and assessed for their combined effects. Although for a number of indicator VCs, measurable changes resulting from the DGR project were noted individually, no likely adverse effects were identified with mitigation measures in place.

1) Further details on the mitigation and monitoring commitments for the indicator VCs for Lake Huron are provided in the following tables of this report:

- Table A1: Geology Detailed Commitments
- Table A2: Hydrology and Surface Water Quality Detailed Commitments
- Table A3: Terrestrial Environment Detailed Commitments
- Table A4: Aquatic Environment Detailed Commitments
- Table A5: Radiation and Radioactivity Detailed Commitments
- Table A7: Indigenous Interests Detailed Commitments
- Table A8: Socio-economic Environment Detailed Commitments

2) -3) Further details on the mitigation and monitoring commitments the indicator VCs for Stream C and South Railway Ditch respectively, are provided in the following tables of this report:

- Table A2: Hydrology and Surface Water Quality Detailed Commitments
- Table A3: Terrestrial Environment Detailed Commitments
- Table A4: Aquatic Environment Detailed Commitments
- Table A5: Radiation and Radioactivity Detailed Commitments

4) Further details on the mitigation and monitoring commitments for the indicator VCs for the wetland within the Project Area are provided in the following tables of this report:

- Table A1: Geology Detailed Commitments
- Table A3: Terrestrial Environment Detailed Commitments
- Table A4: Aquatic Environment Detailed Commitments
- Table A5: Radiation and Radioactivity Detailed Commitments

[PAGE LEFT INTENTIONALLY BLANK]

APPENDIX B: CROSS-REFERENCES BETWEEN OPG'S MITIGATION/MONITORING COMMITMENTS AND THE AGENCY'S 2015 POTENTIAL CONDITIONS

[PAGE LEFT INTENTIONALLY BLANK]

TABLE B.1: CROSS-REFERENCES BETWEEN OPG'S MITIGATION/MONITORING COMMITMENTS AND THE AGENCY'S 2015 POTENTIAL CONDITIONS

CEAA [2015] Topic[7]		Mitigation/Monitoring Commitment	
1	Definitions	–	–
2	General	MIT-S-07 (CEAA 2.2) MIT-S-08 (CEAA 2.3) MIT-S-06 (CEAA 2.6) MIT-H-19	MON-H-15
3	Stormwater management	MIT-H-01 (CEAA 3.1) MIT-H-02 (CEAA 11.1) MIT-H-03 (CEAA 3.5) MIT-H-04 (CEAA 3.6) MIT-H-09 (CEAA 3.7) MIT-H-14 (CEAA 3.2) MIT-H-07 (CEAA 4.5) MIT-H-10 (CEAA 4.3) MIT-H-11 (CEAA 9.6) MIT-H-12 MIT-H-13 MIT-H-15 MIT-H-16 MIT-H-17	MON-H-08 (OPG's proposed wording for CEAA 3.3) MON-H-09 (CEAA 3.4) MON-H-01 MON-H-02 MON-H-03 (CEAA 9.5) MON-H-10 MON-H-11 (CEAA 4.4) MON-H-12 (CEAA 4.6) MON-H-13 (CEAA 4.7) MON-H-14
4	Fish and fish habitat	MIT-W-01 (CEAA 4.1) MIT-W-02 (CEAA 4.2) MIT-H-10 (CEAA 4.3) MIT-H-07 (CEAA 4.5) MIT-W-03 MIT-W-04 MIT-W-05 MIT-W-06 MIT-T-10 MIT-A-07	MON-H-11 (CEAA 4.4) MON-H-12 (CEAA 4.6) MON-H-13 (CEAA 4.7) MON-W-02 (CEAA 4.8) MON-T-07 (OPG's proposed wording for CEAA 10.2) MON-H-03 (CEAA 9.5) MON-H-04 MON-W-01 MON-W-03 MON-A-06
5	Migratory birds	MIT-T-12 (CEAA 5.1) MIT-T-10 MIT-T-11	MON-T-07 (OPG's proposed wording for CEAA 10.2) MON-T-09 (CEAA 5.2)
6	Current use of lands and resources for traditional	MIT-I-04 (CEAA 6.1)	MON-A-01 (CEAA 7.2)

[7] The topics appear in the same order as presented in CEAA [2015].

CEAA [2015] Topic[7]		Mitigation/Monitoring Commitment	
	purposes	MIT-I-03 (CEAA 6.2) MIT-I-02 MIT-S-10	MON-A-02
7	Air quality	MIT-A-01 (CEAA 7.1) MIT-A-02 MIT-A-03 MIT-A-04 MIT-A-05 MIT-A-06	MON-A-01 (CEAA 7.2) MON-A-02 MON-A-03 (CEAA 8.1) MON-A-04 MON-A-05 (CEAA 8.2) MON-R-01 (CEAA 10.6)
8	Health and socio-economic	MIT-R-15 (OPG's proposed wording for CEAA 8.4) MIT-R-01 MIT-R-02 MIT-R-03 (CEAA 13.9) MIT-R-04 (CEAA 13.10) MIT-R-05 MIT-R-06 MIT-R-07 MIT-R-08 MIT-R-09 MIT-R-10 MIT-R-11 (CEAA 13.6) MIT-R-12 MIT-R-13 MIT-R-14 (CEAA 13.7) MIT-R-16 (CEAA 13.4) MIT-R-17 (CEAA 13.5) MIT-R-18 (CEAA 13.8) MIT-R-19 MIT-R-20 (CEAA 13.1) MIT-R-22 (CEAA 13.2) MIT-R-23 MIT-R-24 MIT-R-25 MIT-I-01 MIT-A-02 MIT-A-03 MIT-A-04	MON-A-01 (CEAA 7.2) MON-A-03 (CEAA 8.1) MON-A-05 (CEAA 8.2) MON-A-07 MON-R-03 (CEAA 8.3) MON-R-02 (CEAA 8.6) MON-S-01 MON-S-02 (CEAA 8.7) MON-R-01 (CEAA 10.6) MON-R-04 (CEAA 11.7) MON-R-05 (CEAA 11.8) MON-R-06 MON-R-07 MON-R-08 MON-P-01 MON-P-02 MON-P-03 MON-P-04

CEAA [2015] Topic[7]		Mitigation/Monitoring Commitment	
		MIT-A-05 MIT-A-06 MIT-S-01 MIT-S-02 MIT-S-03 MIT-S-04 MIT-S-05 MIT-S-06 (CEAA 2.6) MIT-S-07 (CEAA 2.2) MIT-S-08 (CEAA 2.3) MIT-S-09 MIT-S-10 MIT-S-11 MIT-S-12 MIT-S-13 MIT-P-01 MIT-P-02 MIT-P-03 MIT-P-04 MIT-P-05 MIT-P-06 MIT-P-07 MIT-P-08 MIT-P-09 MIT-P-10 MIT-P-11	
9	Species-at-risk	MIT-T-06 (CEAA 9.1) MIT-T-07 (OPG's proposed wording for CEAA 9.2) MIT-T-09 (CEAA 9.3) MIT-T-08 (CEAA 9.4) MIT-H-11 (CEAA 9.6) MIT-T-10 MIT-T-11	MON-H-03 (CEAA 9.5) MON-T-07 (OPG's proposed wording for CEAA 10.2) MON-T-08
10	Plant and wildlife	MIT-T-01	MON-T-01 (CEAA 10.1)

CEAA [2015] Topic[7]		Mitigation/Monitoring Commitment	
		MIT-T-02 MIT-T-03 MIT-T-04 MIT-T-05 MIT-T-10	MON-T-02 (CEAA 10.3) MON-T-03 (CEAA 10.4) MON-T-04 (CEAA 10.5) MON-R-01 (CEAA 10.6) MON-T-05 MON-T-06
11	Groundwater	MIT-H-02 (CEAA 11.1) MIT-G-01 (CEAA 11.2) MIT-G-04 (CEAA 11.3) MIT-G-08 (CEAA 11.4) MIT-G-09 (CEAA 11.5) MIT-H-08 MIT-G-06 MIT-G-07	MON-G-06 (CEAA 11.6) MON-R-04 (CEAA 11.7) MON-R-05 (CEAA 11.8) MON-G-02 MON-G-03 MON-G-04 MON-G-05 MON-G-07 MON-G-08 MON-G-09 MON-H-04
12	Waste rock management	MIT-G-02 MIT-G-03 MIT-G-04 (CEAA 11.3)	MON-H-05 (CEAA 12.1) MON-H-06 (CEAA 12.2) MON-H-07 (CEAA 12.3)
13	Accidents and malfunctions	MIT-R-20 (CEAA 13.1) MIT-R-22 (CEAA 13.2) MIT-H-18 (CEAA 13.3) MIT-R-17 (CEAA 13.5) MIT-R-11 (CEAA 13.6) MIT-R-14 (CEAA 13.7) MIT-R-18 (CEAA 13.8) MIT-R-03 (CEAA 13.9) MIT-R-04 (CEAA 13.10) MIT-R-21 (CEAA 8.5) MIT-R-23 MIT-R-24 MIT-G-05 MIT-G-07	MON-G-01 MON-G-10 (CEAA 14.3)
14	Climate change	MIT-H-05 (CEAA 14.1) MIT-H-06 (CEAA 14.2)	