EB – 2013 – 0321

IN THE MATTER OF the Ontario Energy Board Act, 1998, S. O. 1998, c. 15, Schedule B;

AND IN THE MATTER OF an application by Ontario Power Generation Inc. pursuant to section 78.1 of the Ontario Energy Board Act, 1998 for an order or orders determining payment amounts for the output of certain of its generating facilities.

LAKE ONTARIO WATERKEEPER'S CROSS-EXAMINATION COMPENDIUM PANEL 8, July 15-16, 2014

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LOW Interrogatory #001

Ref: Ex. D2-02-01 Darlington Refurbishment

Issue Number: 4.9
Issue: Are the proposed test period in-service additions for the Darlington Refurbishment Project) appropriate?

Interrogatory

Please provide a detailed budget of expenses related to the environmental studies and monitoring of the Darlington Nuclear Generating Station (DNGS) required by the Darlington Refurbishment Environmental Assessment (EA) and EA Follow-up Program. We request a budget for the test period, as well as one for the continued operation of the DNGS.

Response

The 2014-2015 budget amounts related to the environmental studies and monitoring required by the Darlington Refurbishment Environmental Assessment ("EA") and EA Follow-up Program for the test period is shown below for activities which are incremental to the normal operations of the plant. The purpose of the follow-up program is to determine if the environmental effects are as predicted in the EA, to confirm whether the proposed mitigation measures are effective, and determine if new mitigation strategies are required. Any additional mitigation/monitoring requirements will be determined based on whether any exceedance of the effects thresholds agreed to by the appropriate regulatory agencies or prescribed through the Fisheries Act authorization. Any additional funding will be identified as part of the continued operation of the DNGS.

Environmental Follow-up Program	Estimated Budget	
	2014	2015
Effluent Characterization	$60 K	$30 K
Fisheries Authorization	$100 K	0
Entrainment Study	$150 K	$150 K
Benthic Invertebrate Community Study	$100 K	$100 K
Thermal Monitoring	$60 K	$10 K

Witness Panel: Darlington Refurbishment

UNDERTAKING JT2.4

Undertaking

To obtain cost information with respect to other environmental budgetary programs, in addition to any monitoring already identified in the existing interrogatory response.

Response

The estimated 2014 - 2015 costs for environmental programs at Darlington, incremental to the monitoring identified in interrogatory response L-4.9-12 LOW-001, is provided in the table below.

Environmental Program Costs*	Total Estimate $M 2014-2015
Refurbishment environment support (labour)	2.1
Environmental governance and compliance management	1.1
Waste, effluent, and chemical management	1.2
Groundwater monitoring	0.3
Sampling and analysis for chemical waste, groundwater wells	0.8
Biodiversity studies and monitoring	0.2
Chemistry laboratory support for environmental monitoring	2.2
Stack and filter testing emission verification	0.4
Radiological Environmental Monitoring Program (per CSA N288.4-10)	1.0
Total	9.2

In addition to the above, each contractor working on the DRP is required to implement an Environmental Management plan applicable to their work activities. These plans are developed by the contractor based on the Nuclear Projects – Environmental Requirements Guideline (N-GUID-09701-10013) and reviewed and accepted by OPG staff. Each contractor's plans will include applicable monitoring requirements to ensure their activities conform to the environmental effluent and emission limits for Darlington NGS. OPG cannot provide the additional amounts to protect the environment, associated with these contracts, as they are included within the general costs of the particular project.

1.4 Follow-Up Program Requirements

Under the provisions of the *CEA Act*, a follow-up program may be required to verify the accuracy of an EA and/or to determine the effectiveness of measures taken to mitigate adverse environmental effects of the Project. In the case of the subject Project, the Screening Report identified a series of follow-up actions specifically developed for the Project with a focus on the following:

- Surface water (liquid effluents and stormwater quality);
- Aquatic environment (impingement, entrainment and thermal effects);
- Malfunctions and accidents (safety improvement opportunities (SIOs)); and
- Effects of the environment on the Project (liquefaction potential of fill materials).

The CNSC Tribunal's decision (CNSC 2013a) reiterated the requirement for an EA follow-up program and required that the basis for that program be as described in the Screening Report. Accordingly, with specific reference to the requirements of the Screening Report and the Tribunal's decision, the follow-up program will comprise the elements described in Table 1.4-1.

Table 1.4-1: Follow-Up Program Elements

Program Element Reference Number	Applicable Environmental Component	Description of Follow-Up Program Element	Expected Timing and Duration
1	Surface Water	Review the DNGS effluent monitoring program relative to that of applicable CSA standards and subsequent confirmation through applicable ERA results to verify EA predictions related to liquid effluents. At a minimum, this shall include: • broad spectrum characterization of effluents (parameters beyond those currently contained in license/permits). • screening of the parameters for	Coordinate with OPG's review of new standards against current programs.

Program Element Reference Number	Applicable Environmental Component	Description of Follow-Up Program Element	Expected Timing and Duration
		inclusion in the site's operational ecological risk assessment (ERA). • review of the adequacy of existing effluent and environmental monitoring programs based on the site's ERA.	
2	Surface Water	Conduct a Stormwater Control Study for areas subject to refurbishment activities within the Protected Area during the Refurbishment of the first unit for two representative storm events (spring and summer storm) to confirm that the Project has not adversely affected storm water quality. Analyze the stormwater based on historical findings, including, but not limited to, Municipal/Industrial Strategy for Abatement (MISA) parameters such as total suspended solids, total phosphorus, aluminum, iron, oil and grease, ammonia and ammonium and biological oxygen demand[1].	One season of monitoring during the Refurbishment phase. Determine need for additional monitoring based on results.

[1] Proposed CNSC Screening Report listed "chemical oxygen demand." However, the MISA parameter is "biological oxygen demand."

Program Element Reference Number	Applicable Environmental Component	Description of Follow-Up Program Element	Expected Timing and Duration
3	Aquatic Habitat / Biota	Monitor data on cooling water discharge temperature and plume characteristics and interpret in relation to fish habitat and susceptibility of VEC species. Compare temperature criteria and other assessment metrics based on Griffiths (1980) with the results of the CANDU Owners Group study examining thermal effects to round whitefish eggs (underway by others).	Two monitoring periods (not withstanding any additional monitoring to be developed as part of an adaptive management plan): • one winter season (November to April) during the Refurbishment Phase. • one winter season (November to April) following restart of all reactors. (The comparison with the CANDU Owners Group study will occur once the study is published).
4	Aquatic Habitat / Habitat	Monitor entrainment and impingement mortality associated with DNGS intake.	Program will comprise three components (not withstanding any additional monitoring to be developed as part of an adaptive management plan): • entrainment monitoring with larger sample size and invertebrate component - prior to refurbishment outage. • benthic invertebrate community study - prior to refurbishment outage. • impingement and entrainment - two years of monitoring following restart of all reactors.

Program Element Reference Number	Applicable Environmental Component	Description of Follow-Up Program Element	Expected Timing and Duration
5	Malfunctions and Accidents	Design changes related to safety improvement opportunities (SIOs) will reduce accident frequency achievable. The assignment of probabilities to represent the SIO design changes is judged to be sufficient to approximate the reduction in accident frequency achievable. Per the requirements of CNSC S–294, the station PRA will be updated to reflect the detailed design and as-installed configuration prior to bringing refurbished units back on-line.	Prior to bringing refurbished units back on-line with updates provided to CNSC as part of this process.
6	Effects of the Environment on the Project	Undertake a full review of available documentation regarding fill materials and their liquefaction potential in the Protected Area. Should sufficient verification not be realized for the prediction of low liquefaction potential, undertake a liquefaction assessment of fill materials as appropriate.	Prior to bringing refurbished units back on-line.

1.5 Relationship to Site Monitoring Programs

In practice, the monitoring elements of the EA follow-up program will be incorporated into the existing programs at the station that may be underway concurrently. The CNSC licensing and compliance process, as well as the requirements of other applicable approvals and regulatory processes (e.g., *Fisheries Act* authorization; Provincial Environmental Compliance Approval (ECA)) will serve as the means to ensure that the EA follow-up program requirements are appropriately designed and carried out. As examples, it is anticipated that the Power Reactor Operating License (PROL) for the station as amended to facilitate refurbishment and continued operation will include the requirement for implementation of the EA follow-up activities as they are prescribed in the Record of Proceedings, Including Reasons for Decision (CNSC 2013a). Similarly, it is also expected that authorization(s) granted under the *Fisheries*

Act may include requirements for periodic monitoring to confirm compliance with the authorization.

In the case of both examples above, the follow-up monitoring elements are specific in terms of scope, timing and objectives. Nonetheless, it is to be noted that the objectives of the regulatory approvals are related and generally similar to those of the follow-up program elements, and the routine monitoring to demonstrate regulatory compliance will continue in accordance with the approvals granted beyond the specific term and scope of the follow-up program.

All applicable OPG governance relative to the conduct of environmental monitoring will be used in the development of the EA follow-up program. This will include processes for program management, health and safety and quality control/quality assurance (QA/QC). In addition, OPG is in the process of implementing the N288 series of standards developed by the Canadian Standards Association (CSA) relating to environmental monitoring and associated activities for Class 1 nuclear facilities. These standards on environmental management of nuclear facilities were developed to align with internal and external stakeholder expectations while incorporating current international best practices.

A summary of the CSA standards N288.4 (CSA 2010), N288.5 (CSA 2011) and N288.6 (CSA 2012) are provided below:

- N288.4 (CSA 2010) Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills:

  The standard addresses the monitoring of radioactive and non-radioactive contaminants, physical stressors, potential biological effects, and pathways for both human and non-human biota. The monitoring program design is risk informed and based on the results of an environmental risk assessment completed for the facility. This program is called the Environmental Monitoring Program (EMP). Detailed design of the DNGS EMP to comply with N288.4 (CSA 2010) has been completed. OPG will have its first annual EMP report compliant with N288.4 (CSA 2010) in 2014 which will provide the results of the 2013 program.

- N288.5 (CSA 2011) Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills.

  Federal and provincial regulations set the requirements to monitor and report on the characteristics of airborne and waterborne effluents. This standard expands on some of the basic regulatory requirements and addresses design,

implementation and management of an effluent monitoring program that meets legal, business practices and incorporates best management practices.

- N288.6 (CSA 2012) Environmental risk assessment at Class I nuclear facilities and uranium mines and mills.

  The standard addresses the design, implementation and management of the environmental risk assessment (ERA), including human health risk assessment (HHRA) and ecological risk assessment (EcoRA). This standard is intended to be used in conjunction with N288.4 standard on environmental monitoring and CSA 288.5 standard on effluent monitoring to establish a risk based monitoring program.

  The ERA also inputs into the effluent monitoring program by identifying the specific nuclear/hazardous substances of concern and the sources or release points from the nuclear facility or licensed activity. An ERA also contributes to development of effluent limits that are the focus of compliance monitoring. The effluent monitoring program can inform the ERA by providing the effluent loading that was used in estimating environmental exposure concentrations of nuclear and hazardous substances.

For follow-up program elements 1 to 4, these standards will provide the overall guidance for planning, design and implementation of the monitoring programs. The relationship to these standards is discussed further in subsequent sections.

1.6 Relationship to Integrated Implementation Plan (IIP)

The refurbishment of a nuclear generating station is managed in accordance with the CNSC Regulatory Document; RD-360, *Life Extension of Nuclear Power Plants* (CNSC 2008). RD-360 requires the licensee to demonstrate that continued station operation poses no unreasonable risk to health, safety, security or the environment and will conform to international obligations.

OPG has conducted an Integrated Safety Review (ISR) of the DNGS and has completed the EA. The results of the ISR and EA including the follow-up program in this document will be incorporated into a Global Assessment Report (GAR). The GAR presents significant ISR results, including plant strengths, the Integrated Implementation Plan (IIP) for corrective actions and safety improvements, and an overall risk judgment on the acceptability of continued plant operation.

2.0 FOLLOW-UP PROGRAM PLANNING AND IMPLEMENTATION FRAMEWORK

This EA Follow-Up Program provides the framework for the development and implementation of the follow-up program objectives as required by the Screening Report and summarized above. The process for developing the details of each follow-up program element will generally follow a step-wise approach. The proposed steps are:

1) Review the preliminary program;

2) Develop the sampling plan (for program elements 1 to 4). The design of the sampling plan or EMP will follow the systematic planning process identified in CSA N288.4 (CSA 2010) as described below:

   a) Define the objectives of the EMP;

   b) Identify the information required to meet the defined objectives;

   c) Define the boundaries of the EMP;

   d) Determine how the data collected will be used to achieve the defined objectives;

   e) Specify performance or acceptance criteria; and

   f) Develop the detailed design of the EMP that will be implemented to obtain the required data.

   It should be noted that the performance or acceptance criteria includes decision points for use in determining revisions to monitoring and mitigation measures based on thresholds, occurrences, unforeseen effects and other established criteria.

3) Identify how each element might be incorporated or coordinated with DN site monitoring programs;

4) Review the details of program elements with the RAs and other appropriate regulatory agencies;

5) Review and discuss the program with other stakeholders as appropriate;

6) Determine the method of reporting results to the RAs, public, Aboriginal groups and other stakeholders;

7) Incorporate appropriate elements of the program into existing or ongoing DN site monitoring programs;

8) Identify appropriate measures that might be taken to rectify unacceptable results.

The follow-up program will have a specific focus on issues of relevance to the EA. However, because DNGS is an operating station, it already involves a range of existing and ongoing monitoring activities, each with its own scope and purpose. These existing programs comprise environmental monitoring carried out for related purposes, including specific license and other approval requirements as well as to confirm overall regulatory compliance. The follow-up program elements will augment and enhance existing monitoring programs underway during the various Project phases. The phased-based timing for the follow-up program elements is illustrated in Table 2-1.

Table 2-1: Follow-up Program Elements by Project Phase

Program Element #	Follow-Up Program Element	Pre-Refurbishment	Refurbishment Phase	Continued Operation Phase
1	Effluent Characterization Program	✓		
2	Stormwater Control Study		✓	
3	Thermal Monitoring Program		✓	✓
4.1	Benthic Invertebrate Community Study	✓		
4.2	Entrainment Monitoring	✓		
4.3	Impingement and Entrainment Monitoring			✓
5	Probabilities Associated with SIOs		✓	✓
6	Review of Liquefaction Potential		✓	

The following sections describe how each of the follow-up program elements (see Table 1.4-1) will be advanced in terms of planning, design and implementation. This material is intended to serve as the basis for initial consultation with regulators and stakeholders concerning the nature of the follow-up elements currently being

LOW Interrogatory #005

Ref: Darlington Nuclear Refurbishment and Continued Operation Environmental Assessment Follow-up Program.

Issue Number: 4.9
Issue: Are the proposed test period in-service additions for the Darlington Refurbishment Project) appropriate?

Interrogatory

For each of the following studies described in the Follow-up Program:

(a) 2.1 Program Element 1: Effluent Characterization Program

(b) 2.2 Program Element 2: Stormwater Control Study

(c) 2.3 Program Element 3: Thermal Monitoring Program

(d) 2.4 Program Element 4: Entrainment and Impingement Mortality Monitoring

Please address the following:

(e) Has OPG begun to implement the Program?

(f) Please provide a detailed budget of expenses expected to implement the Program.

Response

The follow-up monitoring program consists of program elements which are executed at various stages of the refurbishment project. OPG's approach to conducting the environmental studies identified in program elements 2.1, 2.2, 2.3 and 2.4 is to confirm its understanding of the objectives and targets, develop sampling plans, obtain regulatory acceptance of the plans and then execute and report on the studies. The studies will confirm if the environmental effects are as predicted in the EA and whether the proposed mitigation measures are effective, and determine if new mitigation strategies are required.

In most instances the data required to support these studies are collected over multiple periods and during various station configurations. To date OPG has confirmed its understanding of the objectives and targets for most of these program elements with the Canadian Nuclear Safety Commission ("CNSC") and Environment Canada ("EC") and have begun developing sampling plans which will be submitted to the CNSC for approval. Following the approved schedule, the first sampling campaign will be for program element 2.1 which is slated to commence in 2015. The budget for each of these studies is provided in the response to LOW Interrogatory # 001 (Ex. L-4.9-12 LOW-001).

Witness Panel: Darlington Refurbishment

LOW Interrogatory #003

Ref: Ex. D2-02-01, Attachment 4-12, Program Environmental Management Plan (Program EMP)

Issue Number: 4.9
Issue: Are the proposed test period in-service additions for the Darlington Refurbishment Project) appropriate?

Interrogatory

How will this Program EMP integrate continuing environmental studies and monitoring required by the EA and EA Follow-up Program?

Response

OPG document NK38-NR-PLAN-09701-10001 0004 "Darlington Refurbishment – Environmental Program Management Plan" was issued on January 31, 2014. This document replaces Ex. D2-02-01, Attachment 4-12. A copy of the new document is attached.

The Darlington Refurbishment Program Management Plans set out the activities that OPG will undertake to manage the refurbishment activities. As set out on pages 7 and 8 of the attachment, OPG will establish environmental metrics for the refurbishment project that will be used to monitor performance. These monitoring activities, in combination with field inspection, will be used to confirm that OPG's contractors performing the refurbishment are effectively managing their responsibilities.

The environmental studies and monitoring program for the Darlington Nuclear Generating Station will continue throughout the Darlington Refurbishment project. All effluents, emissions, and wastes that are currently safely managed will continue to be monitored during the refurbishment activities. The requirements for emissions, effluents and waste that have been established in the licence issued by the CNSC and in the Ontario Ministry of the Environment Environmental Compliance Approvals for Darlington Nuclear Generating Station will apply throughout the refurbishment activities.

The EA Follow-up program is a separate program that will be performed in accordance with the requirements established by the CNSC. The elements of the EA Follow-up program that pertain to ongoing performance monitoring will be integrated, as applicable. Elements of the EA follow-up program that are distinct from ongoing monitoring activities will not be integrated.

Witness Panel: Darlington Refurbishment

LOW Interrogatory #006

Ref: Darlington Nuclear Refurbishment and Continued Operation Environmental Assessment Follow-up Program.

Issue Number: 4.9
Issue: Are the proposed test period in-service additions for the Darlington Refurbishment Project) appropriate?

Interrogatory

For the impingement and entrainment monitoring under part of Program Element 4:

(a) What compensatory mechanisms will OPG pursue to offset biota and habitat losses resulting from DNGS operations?

(b) Please provide a detailed budget of expenses related to these compensatory measures.

Response

The compensatory mechanisms to provide offsets for biota losses due to impingement and entrainment from DNGS operations are currently being assessed and will be included in the submission for the Fisheries Act authorization. Detailed budget of expenses will not be available until after the application is approved by Fisheries and Oceans Canada ("DFO"). There are no habitat losses resulting from DNGS operations.

Witness Panel: Darlington Refurbishment

UNDERTAKING JT2.5

Undertaking

To provide an anticipated date for conclusion of talks with the Department of Fisheries.

Response

Work is currently underway to submit an application for an authorization to Fisheries and Oceans Canada in support of the Darlington Refurbishment project and the continued operation of the facility. It is anticipated that this application will be submitted by the end of June, 2014. Once submitted, Fisheries and Ocean Canada will assess the application and define any offsets which may be required to compensate for any residual effects. It is our understanding that Fisheries and Oceans Canada have up to 90 days from the date they deem our application complete to issue an authorization with any terms and conditions. If the authorization identifies the need for offset, OPG will build the requirements into our business planning process and develop implementation plans accordingly.

LOW Interrogatory #007

Ref: Darlington Nuclear Refurbishment and Continued Operation Environmental Assessment

Issue Number: 4.9
Issue: Are the proposed test period in-service additions for the Darlington Refurbishment Project) appropriate?

Interrogatory

Please provide a detailed budget of expenses related to planning and implementing adaptive management programs during the test period and continuing operation of the DNGS.

Response

The environmental risk assessment process as defined in CSA N288.6, Environmental Risk Assessment ("ERA") informs the environment monitoring program that applies to current DNGS operations. The environmental risk assessment process includes adaptive management.

In the Follow-up Program for the environmental assessment of the Darlington NGS refurbishment and continued operations, OPG commits to planning and implementing a program of environmental effects monitoring that targets confirmation of the results of the environmental assessment. The monitoring programs include effluent monitoring, storm water monitoring, cooling water monitoring.

Should the results of these monitoring programs exceed established thresholds, OPG will investigate whether additional confirmatory monitoring is required and review mitigation options to determine if additional technically and economically feasible opportunities are available to further reduce the potential effects.

Budgets are established as part of the annual business planning process where new requirements are identified. As additional monitoring or mitigation measures are defined, budgets will be developed and approved to support work program activities.

Witness Panel: Darlington Refurbishment

taking the LUEC numbers that you have here and then adding .4 across the board?

MR. ROSE: That is correct.

MR. ELSON: Okay. Thank you. So going back to my earlier questioning under 3.15, that's JT3.15, what we are looking for is a total cost of the DRP, including capitalized and interest and escalation in 2014 dollars, assuming a 50, 100, 150, 200, and 250 percent cost overruns with respect to all of the OPG project management costs, contractor costs, and other costs.

So that's the number that we are looking for, and that would be an arithmetic calculation, except to the extent that cost overruns are not borne by OPG, if that makes sense. So we would be saying if the costs are increased by 50 percent, you know, how much of those are borne by OPG at the end of the day.

MR. KEIZER: So we will give you an answer about whether or not we are going to answer that question at the break.

MR. ELSON: Okay. That is the earlier undertaking, and we have no further questions.

MR. MILLAR: Ms. Feinstein, I believe you are next.

QUESTIONS BY MS. FEINSTEIN:

MS. FEINSTEIN: Thank you. I am Pippa Feinstein, here on behalf of Lake Ontario Waterkeeper, and I only have two more questions for the panel, a bit of a follow-up from Mr. Shepherd's questions earlier today.

My first question is about the Modus reports. I

didn't find any specific reference to environmental risk management or any risks that would threaten OPG's compliance with our environmental approvals in these reports. Would these issues fall under the scope of these kinds of reports, and have past reports examined these kinds of issues?

MR. GOULD: If there were issues presented, if we saw that there were unusual risks to the project, that would not be outside of our scope to look at those. As of this time we haven't seen any of that -- those types of issues.

MS. FEINSTEIN: Okay. Thank you. Are there members of the, I guess the Burns & McDonnell, the Modus teams, with specialties in environmental regulatory compliance issues or with experience with environmental risks that are associated with the construction of projects like the refurbishment project?

MR. GOULD: Burns & McDonnell has a very world-renowned division on environmental practices and remediation, and if necessary we would call on those resources. As I said, as of this time we have not found a reason to do that.

MS. FEINSTEIN: Okay. Thank you. On page 7 of the June 26th report, there are cited soil conditions as being responsible for delays in the campus plan projects in the third quarter of 2013. Is this -- and this is quite a specific question, so I don't know if you would know this off the top of your head, but is this something that would be related to an environmental concern? Do you know

anything about those soil conditions that you are referring to in the report?

MR. GOULD: We are just looking strictly at the potential for interruption to the project. We have not done any analysis of the soil or the agent that may be at play here. That probably is outside of our scope.

MS. FEINSTEIN: Okay. Thanks. So --

MR. REINER: I may be able to offer an answer to that.

MS. FEINSTEIN: Thank you.

MR. REINER: So the soil conditions specifically that are being addressed are tritium in the soil. That has resulted in us taking mitigation measures. We have had to construct a soil lay-down area in order to deal with the tritium emissions, so to appropriately decontaminate the soil before it can actually be moved offsite.

And so that added cost, I believe is the cost that is impacting the projects here that Modus has identified.

MS. FEINSTEIN: Okay. And were you able to discuss that issue in that level of detail with Modus?

MR. REINER: I mean, we certainly are able -- we are able to talk to them at that level of detail, but again, to the extent -- as Modus put it, to the extent that that creates risks for refurbishments, they would either comment on or not comment on it.

It has been identified as a risk because we did incur a cost to deal with contaminated soil. And so that is something that they see and they are aware of.

MS. FEINSTEIN: Okay. And so if there were a similar

incident in which there was some kind of accident in construction dealing with sewage infrastructure, for example, at the site, or with the heavy water containment system?

MR. REINER: You know, what I will say is we wouldn't rely on Modus to be the entity that reports that kind of thing to the nuclear oversight committee. We have got a lot of regulatory compliance requirements and processes in place, and other checks and balances through other agencies that we are accountable to, and that is how those would get dealt with.

MS. FEINSTEIN: Okay. Thanks.

MR. GOULD: Just to add on to that, we would probably be looking at that to measure the impact, if there was any, to the project, but we would be looking at OPG to solve those types of issues internally.

MS. FEINSTEIN: Okay. So I understand that the nuclear oversight committee is charged with ensuring that there is environmental regulatory compliance. And if it doesn't do this through independent bodies such as Modus, is there a specific oversight committee, or some kind of committee or panel within OPG that deals specifically with those issues and reporting them to the nuclear oversight committee?

MR. REINER: They are reported a couple of ways.

There is an environment group in OPG that does have accountability and that provides a report that makes its way to the OPG board.

The stations are also required to report all of their environmental-related infractions or issues, and so there are specific metrics on the station report cards that report these. And in the case of refurbishment, anything that we would encounter in refurbishment would roll up into the station metric. So if we had a spill, for example, that would get counted against the spills on the station's report card.

MS. FEINSTEIN: How often are those reports required? Is it just required if there is an incident, or is it regular reporting?

MR. REINER: That is part of regular reporting. So those reports are -- they are updated on a monthly basis and they are provided to the nuclear oversight committee at the quarterly meetings.

MS. FEINSTEIN: So that I imagine if it's monthly, it would also deal with routine environmental monitoring. Would that include the environmental assessment follow-up monitoring that's required?

MR. REINER: The environmental assessment follow-up monitoring is a little different, in that there are specific programs that are being implemented to do that monitoring. Those programs will be executed by the station, and so they will be reporting their progress relative to those programs but that reporting will be done separately to the CNSC under the environmental assessment.

MS. FEINSTEIN: Okay. Thank you. Those are all my questions.

Thus, RQE for Refurbishment is intended to be a Class 2 Estimate, a type of estimate that typically forms a project's "Control Budget." By utilizing this methodical approach to developing RQE, the DR Team should be able to produce a high-confidence estimate against which the Project's performance can be properly measured so long as each of the inputs are carefully vetted and understood. It is also important to understand and accurately characterize what each of the estimates represent prior to RQE within the context of the level of project definition and the accuracy range. It is not unusual on highly visible projects for actual project costs to be compared against early (i.e. Class 5) point estimates without a discussion of their accuracy ranges, which could mislead external stakeholders.

A concept within the estimate that is commonly misunderstood is the application of contingency. Contingency is included in the base estimate and refers to costs that will probably occur based on past experience. As a result, contingency is expected to be spent as the project progresses through its life cycle. The utilization of contingency is not an indication of poor management.

OPG is taking significant steps in engineering and scope definition in order to provide a fundamental basis for RQE by: 1) utilizing the AACE guidelines to characterize the Project's scope and engineering maturity through a progression of cost estimates; 2) completing detailed engineering prior to the start of construction for all work; and 3) mitigating potential performance risk and estimating errors through construction and the use of a full scale mock-up for RFR. Proper planning of the execution phase of the Project will provide confidence in the reliability of RQE as well as minimize the risks of cost and schedule overruns during construction.

D. Timeline of Key Events

The following timeline of key events shows the parallel development of the Campus Plan Projects and the Refurbishment Project.

Date	Key Events
	Early Project Development – Initiation Phase (2006 to 2010)
2006 – 2010	• Feasibility studies for DNGS Refurbishment, leading to February 2010 announcement of Refurbishment Project • DR Program Charter approved • D2O Storage and Auxiliary Heat Steam system projects approved, then put on hold • Refurbishment Project's Scope Definition Phase begins, categorizing core and non-core scope • Environmental Assessment Studies submitted to the CNSC • Procurement process for RFR project begins
	Refurbishment Project Definition Phase (2011 to Current)
2011	• Bill Robinson retires; replaced by Albert Sweetnam as SVP of Nuclear Projects • Mike Peckham named VP of Projects & Modifications • OPG submits Integrated Safety Review (ISR) to CNSC • Environmental Impact Statement issued • Project charter for D2O Storage project issued August 2011; high-level scope and estimate of $210M provided to P&M management • Refurbishment Project' Release 4a Cost Estimate provided to Board of Directors
1Q 2012	• P&M negotiates and executes Extended Service - Master Service Agreements ("ESMSA") with two vendors – Black & McDonald and ES Fox – for use on Campus Plan Projects • SNC/Aecon Joint Venture selected as EPC for RFR project
2Q 2012	• D2O Storage Gate 3A conducted with revised EPC Project estimate - $108M • DR scope review conducted to identify potential scope to be deferred
3Q 2012	• AHS bid and award of EPC to [redacted] – total project estimate - $45.6M
4Q 2012	• P&M seeks full funding releases for D2O Storage and AHS • Refurbishment Project Release 4b cost estimate shows potential for upward pressure on budget

Date	Key Events
1Q 2013	• Refurbishment begins early gate review process for major projects • P&M publishes Lessons Learned report for D2O Storage – schedule overruns and multiple rejections of vendor's conceptual design lead P&M and Refurbishment to change model of development of project scope • Change in engineering strategy presented to NOC • Mr. Sweetnam leaves OPG • BMcD/Modus begins role as Independent External Oversight to NOC
2Q 2013	• Mr. Robinson returns as SVP of Nuclear Projects • DR Team management identifies early lessons learned from EPC model and moves to more direct oversight of contractors • Refurbishment scope review identifies priority ranking of project work • Refurbishment presents strategy to streamline Project by "unlapping" Unit 2, rationalizing project scope and deferring Turbine Generator controls to next unit • SNC/Aecon provides Class 4 project estimate for RFR project
3Q 2013	• Mr. Peckham leaves OPG • BMcD/Modus provides Initial Project Assessment to NOC • Refurbishment scope review performed based upon operational experience • Refurbishment revises procurement approach for Balance of Plant ("BOP") allowing direct award of work based on vendor qualifications • Soil conditions and underground utilities delay and increase cost of Campus Plan Projects within DNGS protected area • Refurbishment modifies scheduling approach for Definition and Execution Phases, embracing a level 3 integrated, resource loaded schedule
4Q 2013	• Integrated Implementation Plan (IIP) and Global Assessment report (GAR) submitted to CNSC • Release 4c Cost Estimate provided to BOD – overall cost estimate of $10B (with [redacted] contingency and [redacted] management reserve) with reductions in scope and unlapping • Results of the scope review by the Blue Ribbon panel reduces the Refurbishment Project's cost and defer execution of non-Refurbishment enhancements • Contractors release estimates showing variances to original contract values for D2O Storage and AHS after BOD approval of the 4c Cost Estimate.
1Q 2014	• Minister's Long Term Energy Plan released • Terry Murphy begins as VP of P&M • Refurbishment and P&M begin collaborative approach to engineering, scoping, planning and cost estimating of Campus Plan Projects and BOP work • Turbine Generator performance contract awarded to SNC/Aecon • P&M team provides root cause analysis of delays to D2O Storage; Mr. Robinson requests BMcD/Modus to provide independent assessment • Revised cost estimates for Campus Plan Projects provided by ESMSA contractors, leading to revisions to Business Cases • RFR mock-up facility completed
2Q 2014	• Revised BCSs presented to BOD for approval for Campus Plan Projects – AHS, Water & Sewer and OSB – management defers request for funds for D2O Storage, awaiting updated Class 2 estimate from vendor • BMcD/Modus provides assessment of Campus Plan Projects to NOC • SNC/Aecon produces Class 3 RFR Estimate for OPG's vetting