PROJECT AND PORTFOLIO MANAGEMENT - NUCLEAR

1.0 PURPOSE

This evidence provides an overview of the nuclear operations project portfolio and other related project work. The project portfolio includes project OM&A, which forms part of the overall OM&A amounts in the revenue requirement, and project capital which is included in rate base when projects are completed and placed into service. This evidence also discusses the process for managing this portfolio and the forecast level of nuclear capital and project OM&A expenditures (excluding the Darlington Refurbishment Program ("DRP")) in the test period.

2.0 NUCLEAR OPERATIONS PROJECT PORTFOLIO

OPG Nuclear employs a portfolio management approach to assess and prioritize all nuclear operations projects (both project OM&A and capital). The portfolio management approach (e.g., project prioritization, project phases, approval processes, and the role of the Asset Investment Screening Committee ("AISC")) is discussed in section 3.0 below and is unchanged from that presented in EB-2013-0321.

OPG Nuclear projects within this portfolio are developed to meet regulatory commitments (e.g., from the Canadian Nuclear Safety Commission), increase system or unit reliability, address system obsolescence, or optimize station generation. Since 2010, expenditures on major capital spares have also been considered part of the capital project portfolio, due to their role in supporting system or unit reliability.

As shown in Chart 1, starting in 2014, actual and forecast nuclear operations project portfolio spending (i.e., annual capital expenditures and project OM&A) increased beyond the range of $250M to $300M (or $25M to $30M per nuclear unit) which OPG had historically targeted for project portfolio expenditures:

Chart 1

Nuclear Operations Project Portfolio Expenditures

Line No.	Category	2013 Actual	2014 Actual	2015 Actual	2016 Budget	2017 Plan	2018 Plan	2019 Plan	2020 Plan	2021 Plan
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
1	Project Portfolio - Capital	190.9	269.8	292.5	322.0	253.0	238.0	248.0	259.0	180.0
2	Project Portfolio- OM&A	87.4	80.8	100.7	78.2	98.9	90.4	81.7	83.0	86.8
3	Total Nuclear Portfolio	278.3	350.6	393.2	400.2	351.9	328.4	329.7	342.0	266.8

Overall, total average annual portfolio spending in the period 2017-2021 is $323.8M ($32.4M per unit). In conjunction with this increase in capital expenditures, various initiatives are being undertaken by OPG to improve project management, as described in section 3.2 below.

Key drivers of the changes in nuclear operations project portfolio expenditures over the 2013-2021 period are addressed in Ex. D2-1-2 (Capital Expenditures) and Ex. F2-3-1 (Project OM&A).

In addition to the nuclear project portfolio, there may also be the following capital and project OM&A expenditures:

- Capital expenditures on Minor Fixed Assets (see Ex. D2-1-2);
- Capital and project-related OM&A expenditures on special, non-recurring projects that are managed outside of the project portfolio, referred to as “Non-portfolio projects” (see Ex. D2-1-2 and Ex. F2-3-1); and,
- Capitalization of Darlington new fuel (see Ex. F2-5-1 section 2.0).

3.0 NUCLEAR PROJECT MANAGEMENT PROCESSES

3.1 Overview

The OPG corporate investment and project approval processes are outlined in Ex. A2-2-1, with further detail on asset management and project review provided in Ex. A2-2-1 Attachment 4. The nuclear project management processes are developed within that framework.

The OPG Board of Directors approves the annual nuclear projects portfolio budget during the business planning process. The annual nuclear projects portfolio budget is administered by the AISC, which determines project prioritization and allocates portfolio funding to specific projects. A separate process is used to approve a Business Case Summary ("BCS") based on the recommended projects which the AISC has prioritized and for which budgets have been allocated. The AISC consists of members from Nuclear Engineering, stations and Finance. This committee has the mandate to review project recommendations and evaluate acceptance of new projects to be added into the nuclear project portfolio from an OPG nuclear fleet perspective. The AISC evaluates the project value, relative priorities, schedules, and cost estimates of the submitted projects along with the resourcing constraints on the organization as a whole. If the AISC supports the proposal, the applicable BCS will be routed as per the Organizational Authority Register for approval of the associated funding (see Ex. A2-2-1, Attachment 4, section 3.0 for a description of OPG's approval process for BCSs and the Organizational Authority Register).

Each project BCS includes contingency in the cost estimate. However, the AISC project portfolio annual budgets do not contain contingencies. OPG expects the AISC to fully utilize the annual portfolio budgets. When a project requires contingency funds contained within the BCS approved release, a request is made by the project manager to the AISC for additional funding. If additional funding is approved, the AISC will re-allocate funding to attempt to stay within the overall project portfolio annual budget. For example, such a request could be accommodated by other projects that are completed under budget, by delaying or deferring other projects, or from AISC budget funds not yet allocated.

There are fives phases to the life cycle of a nuclear project, as follows:

(i.) Project Identification – The objective of the identification phase is to build the initial business need for the project, including an assessment of the business need, gap or opportunity. This work is funded from base OM&A. Potential projects are generally identified by Engineering through system health reviews, component condition assessments, and the life cycle plans that are prepared for major systems. Component condition assessments are continuous or periodic inspections of the condition of a

specific component so as to determine the need for preventive or remedial action. Other drivers include new or revised regulatory requirements, spare parts obsolescence, an opportunity to improve reliability based on forced loss rate analysis, or security needs. Projects with an anticipated benefit for multiple sites may be identified and sponsored by the support divisions. Station screening committees review potential projects and forward their recommendations to the AISC for approval based on the net benefit documented in business cases.

(ii.) Project Initiation – The purpose of the initiation phase is to evaluate viable alternatives and identify the initial project scope, schedule, conceptual funding and applicable stakeholders for the preferred alternative. If the review concludes that undertaking a project is the recommended solution, the next step for most projects is completion of a definition phase BCS. This phase is generally funded from the project OM&A budget. Potential projects are screened and success at this phase will lead to an allocation of future funding from either the project portfolio capital or project OM&A budget.

(iii.) Project Definition – The goal of the definition phase is to further define the project and demonstrate readiness for execution, including completion of sufficient engineering to determine bulk material requirements, development of the project cost estimate and execution plan, assessment of risk and development of mitigating plans, identification of and application for any requirements for regulatory approvals, and procurement of engineered equipment. A full release or partial release execution phase BCS is usually developed at this stage.

(iv.) Project Execution – The execution phase includes completion of detailed engineering, procurement (if not completed in the definition phase), and detailed construction/installation planning and/or physical execution of the project and commissioning work.

(v.) Project Close-out and Post-implementation Review – The close out phase is the last phase in the project life cycle and includes preparation of a project close out report and Post-Implementation Review to document final costs and lessons learned.

A project's movement through these five phases is monitored by the AISC to ensure that periodic and systematic reviews are conducted, and to provide the opportunity to redirect or

cancel the project as it is defined (in accordance with OPG's project management process) before proceeding to the next phase.

Given the amount of assessment and engineering work that is completed at each phase of a project life cycle, OPG seeks to ensure that project scope is appropriately defined prior to proceeding to the next stage in the process. A project is generally approved for execution only after project engineering, scope definition and planning execution is sufficiently complete. The scoping process, combined with the ongoing AISC review and BCS approval processes, enhances OPG's ability to bring projects to completion within budget and schedule.

3.2 Initiatives to Improve Project Management within OPG

OPG continuously seeks to improve the performance of its project management function. In 2012, OPG implemented an Engineering, Procurement and Construction ("EPC") contracting strategy with its vendors. This model established a single point of accountability for design, procurement and construction of a designated portion of a project, while OPG maintains exclusive oversight. Prior to implementing the EPC model, OPG had relied upon differerent vendors or internal resources for each of the three components. Reliance upon a single vendor responsible for all three components was expected to facilitate on-time and on-budget delivery of projects as it allows for proper adherence to procedures and schedules and reduces delays or conflicts that may occur among vendors and/or OPG during handoffs along the three stages. An EPC contracting strategy was also expected to increase OPG's project execution capabilities, allowing additional project work to be undertaken within the nuclear project portfolio to meet the station needs for regulatory and reliability improvements. Adopting an EPC contracting strategy was consistent with OPG's workforce plan for staff reductions through natural attrition by allowing OPG to optimize its resources and efforts on project oversight. Through the primary competitive process that selected vendors, OPG achieved reduction in trade labour rates and improved contract terms and conditions prior to proceeding.

In 2012, a competitive process was used to select two vendors to enter into Extended Services Master Services Agreements ("ESMSA") for EPC services. These agreements extablished a set of terms and conditions in advance, such that the procurement cycle for

executing new EPCs or any combination of engineering, procurement or construction would be significantly shortened. A summary of the ESMSA contracts is provided in Ex. D2-2-3 Attachment 5 and the contract is provided in Ex. D2-2-3 Attachment 10.

At the same time as the EPC contracting strategy was being implemented, OPG began an ambitious program to complete major prerequisite projects (Facilities and Infrastructure Projects ("F&IP")) in advance of the Darlington Refurbishment Program. These projects consisted of either new facilities and infrastructure or upgrades to the existing facilities and infrastructure. The F&IP projects included major, one-time complex undertakings such as the D2O Storage Facility and the Auxiliary Heating System ("AHS") projects and were managed by the Projects and Modifications ("P&M") organization. Despite reduced resources resulting from OPG's workforce reductions, P&M also retained its accountability for its assigned Nuclear Operations portfolio projects while undertaking the F&IP.

Projects within the nuclear project portfolio traditionally involve in-plant modifications of existing systems, new equipment installation and upgrades to existing facilities. The initial outcome from implementation of ESMSA agreements for EPC services for projects within the nuclear project portfolio saw improvements such as reduced procurement cycle time. However, as discussed extensively in EB-2013-0321, the contracting strategy using the ESMSA agreements for the larger F&IP projects proved challenging, pointing to weaknesses in project oversight and to contractor issues related to planning, scope, cost estimating, subcontractor management, and risk management. Some of these projects, including the AHS, exceeded the original cost estimates and schedules. OPG's experience with the AHS project as well as others has been used as a source of lessons learned, which have been applied to the ongoing management of these projects and also as input for continuous improvement initatives in project management within OPG Nuclear (the AHS project is discussed further in Ex. D2-1-3 section 3.4).

The five main continous improvement initiatives in project management underway are as follows:

1) Centre of Excellence for project management: OPG is currently centralizing the standards for project planning and controls, risk management, and other project management functions for all nuclear projects through the establishment of a Centre of Excellence that supports all Nuclear projects and ensures consistent deployment of the same tools, standards, processes and practices.
2) Identification of appropriate contracting strategy: OPG will pursue various contracting strategies depending on the project. OPG will consider factors such as project cost estimates, unique risks or risks that can be effectively transferred, and contactor capability/specialization or project complexity, to determine if a project specific contract agreement is needed. Where appropriate, OPG will also consider entering into other contracting agreements such as a Design Engineering Services Agreement ("DESA"), separate from the construction and execution contract. OPG will continue to use ESMSA contracting strategies where suitable. Use of project specific agreements or DESAs will allow OPG to select a contractor best suited for unique projects, optimize risk transfer, and leverage specific performance incentives to increase the probability of the project meeting cost and schedule expectations.
3) Implementing new approaches to improve ESMSA vendor project execution performance: This intiative has various components as follows:
   - OPG has added another ESMSA vendor to mitigate contractor capacity and capability risk for the projected work program.
   - OPG has implemented a Collaborative Front End Planning program that will allow more intrusive and real time oversight by OPG through collaborative planning between the vendor and OPG to ensure there is a common understanding of the project requirements and that the proposed solutions meet those requirements.
   - OPG will be physically embedding engineering resources with the contractor providing enginering services under an ESMSA agreement. This is viewed as an opportunity to provide enhanced oversight as well as reducing review cycles to shorten timelines and help mitigate risk.
4) Improving OPG's staff project management and oversight capabilities: OPG's capability to collaborate with, provide direction to, and challenge vendors to ensure projects are delivered on budget and on schedule requires a well trained and

sufficiently staffed workforce. OPG will be undertaking improvements in project management and contractor oversight training. In addition, in conjunction with the ongoing workforce planning and resource initiative, OPG will address any staffing gaps within P&M to ensure that it has sufficient resources to manage and oversee its projects.

5) Improving project cost and schedule predictability: There are two main components in this initiative, as follows:

- Implementing a revised approval process for the Nuclear Operations project portfolio. The intent is to ensure sufficient project work has been completed to provide confidence in cost and schedule, including risk identification and contingencies for the next planned project phase. The reviews offer management an opportunity to challenge the project manager on readiness and confidence in project estimates and schedules before progressing.
- Improved estimating of project cost and schedules by establishing common estimating practices including standardized estimating templates and checklists for preparation of project estimates, and incorporating lessons learned from previous projects. The amount of conceptual funding (funded from Base OM&A) at the project initiation phase has also been increased, consistent with industry practice, in order to improve initial estimates.