

**OPG 2017-2021 Payment Amounts Application
EB-2016-0152**

**AMPCO Compendium
Panel 2Aii**

**Application Overview, Nuclear Rate-Setting Framework
& Business Planning**

years, on the presumption that the company should be incented to find additional savings each year). Reductions are proposed beginning in 2018, with additional reductions in 2019, 2020, and 2021. This mirrors the operation of the stretch factor under 4GIRM.

Chart 10 shows the product of applying the 0.3% stretch factor to Base OM&A and allocated corporate support OM&A.

Chart 10 – Stretch Reduction Amounts

(\$M)	2018	2019	2020	2021
Base & Corporate Support OM&A	1,663.2	1,691.1	1,709.7	1,730.4
Stretch Factor	0.3%	0.3%	0.3%	0.3%
Annual Stretch Reduction to Nuclear Revenue Requirement	5.0	10.1	15.2	20.4
Base & Corporate Support OM&A Used to Determine Payment Amounts	1,658.2	1,681.0	1,694.5	1,710.0

The total reduction over the term of the application is \$50.6M. Although the 0.3% stretch reduction is constant, the “snow plow” effect of maintaining prior years’ reductions means that the \$20.4M reduction in 2021 is a 1.2% reduction to that year’s stretch-eligible OM&A, or a 0.9% reduction to total nuclear OM&A.

This stretch reduction is incremental to the performance improvements required to achieve OPG’s business plan. Customers will benefit from these “up-front” budget reductions, and OPG will bear the risk of any shortfall.

3.2.2. Productivity Factor is Not Applicable

OPG is not proposing a nuclear industry productivity adjustment as part of the proposed X-factor. The nature and scale of capital work planned for the IR period mean that past productivity trends would not be a reasonable indicator of predicted productivity for OPG during the IR period.

Figure 2: Nuclear Business Planning Process



3.4.2. Major Nuclear Performance Initiatives

OPG's business plan includes four major nuclear performance initiatives that OPG plans to implement during the IR period:

- i. Human Performance,
- ii. Outage Performance,
- iii. Equipment Reliability, and
- iv. Parts Improvement.

Details of these initiatives are included in the Nuclear Business Planning and Benchmarking evidence at Ex. F2-1-1.

OPG's business plan is based on the successful execution of these initiatives. To the extent that OPG does not achieve the targeted benefits from these initiatives, the company's costs and nuclear generation forecast are at risk. OPG may also develop other initiatives during the

APPENDIX 5: Nuclear Financial Plan, Operational Targets, and Initiatives

Financial Plan

(in millions of dollars)	Actual	Business Plan			Projection		
	2015	2016	2017	2018	2019	2020	2021
OM&A							
Base	1,157	1,180	1,192	1,210	1,232	1,247	1,259
Outage Incremental	316	332	390	372	343	327	326
Project Portfolio	115	94	111	91	82	82	87
Pickering Continued Operations Enabling Costs	-	15	26	55	107	104	-
Darlington Refurbishment Project	2	1	42	14	4	48	20
Nuclear New Build	1	1	1	1	1	1	1
Total Nuclear OM&A	1,591	1,624	1,762	1,744	1,769	1,809	1,693
Capital							
Project Portfolio (including Spares and Minor Fixed Assets)*	315	353	279	258	282	278	199
Darlington Refurbishment Project (excluding Support Services)	681	1,189	1,063	1,094	951	833	1,170
Total Nuclear Capital	996	1,542	1,342	1,352	1,234	1,111	1,369
Provision Expenditures							
ONFA Funded	61	104	140	150	206	260	256
Internally Funded - Base	96	104	109	116	118	120	123
Internally Funded - Projects	40	39	39	40	40	40	40
Internally Funded - Darlington Refurbishment Waste Containers	6	56	32	43	30	33	26
Total Nuclear Provision Expenditures	203	303	320	348	394	453	445
Fuel Expense (Pickering and Darlington)	244	261	220	222	233	228	213

*In 2019, includes \$15M related to the load of new fuel bundles into the refurbished Darlington Unit 2

Operational Targets

The key 2016-2018 targets for the Nuclear business unit are set out below. These targets are informed by the latest industry benchmarks and are designed to drive continuous performance improvement.

Metric	NPI Max	Industry Best Quartile	Pickering				Darlington			
			2015 Actual	2016 Annual Target	2017 Annual Target	2018 Annual Target	2015 Actual	2016 ¹ Annual Target	2017 ¹ Annual Target	2018 ¹ Annual Target
All Injury Rate (#/200k hrs worked)	N/A	0.66	0.44	0.24	0.24	0.24	0.22	0.24	0.24	0.24
Collective Radiation Exposure (person-rem/unit)	80.00	42.25	100.90	111.50	126.90	137.30	73.72	65.00	87.80	72.10
Unit Capability Factor (%)	92.0	89.4	79.4	77.6	71.5	72.0	76.9	91.1	85.1	86.0
Forced Loss Rate (%)	1.00	1.03	2.89	5.00	5.00	5.00	4.86	1.00	1.00	1.00
On-line Corrective Maintenance Backlog (work orders/unit)	N/A	11	125	55	28	28	24	20	15	10
WANO NPI (Index)	N/A	92.9	68.5	72.3	71.1	71.1	83.7	87.3	84.3	93.0
Human Performance Error Rate	N/A	0.0020	0.0055	0.0030	0.0030	0.0030	0.0031	0.0030	0.0020	0.0020
Total Generating Cost per MWh ²	N/A	\$38.71	\$64.00	\$71.09	\$76.48	\$75.32	\$52.40	\$47.35	\$47.85	\$48.68

¹ Darlington targets reflect the impact of the Unit 2 Refurbishment starting in October of 2016, where applicable.

² Metrics exclude centrally-held Pension and OPEB costs and asset service fees. Targets may change subject to allocations and assumptions being finalized. Darlington metrics have been normalized after 2016 for generation forgone during the Unit 2 refurbishment. The non-normalized Darlington target for 2017 is \$63.76/MWh and 2018 is \$63.50/MWh.

	Green = Max NPI Points Achieved (if applicable) or Best Quartile Performance
	White = 2nd Quartile Performance
	Yellow = 3rd Quartile Performance
	Red = 4th Quartile Performance

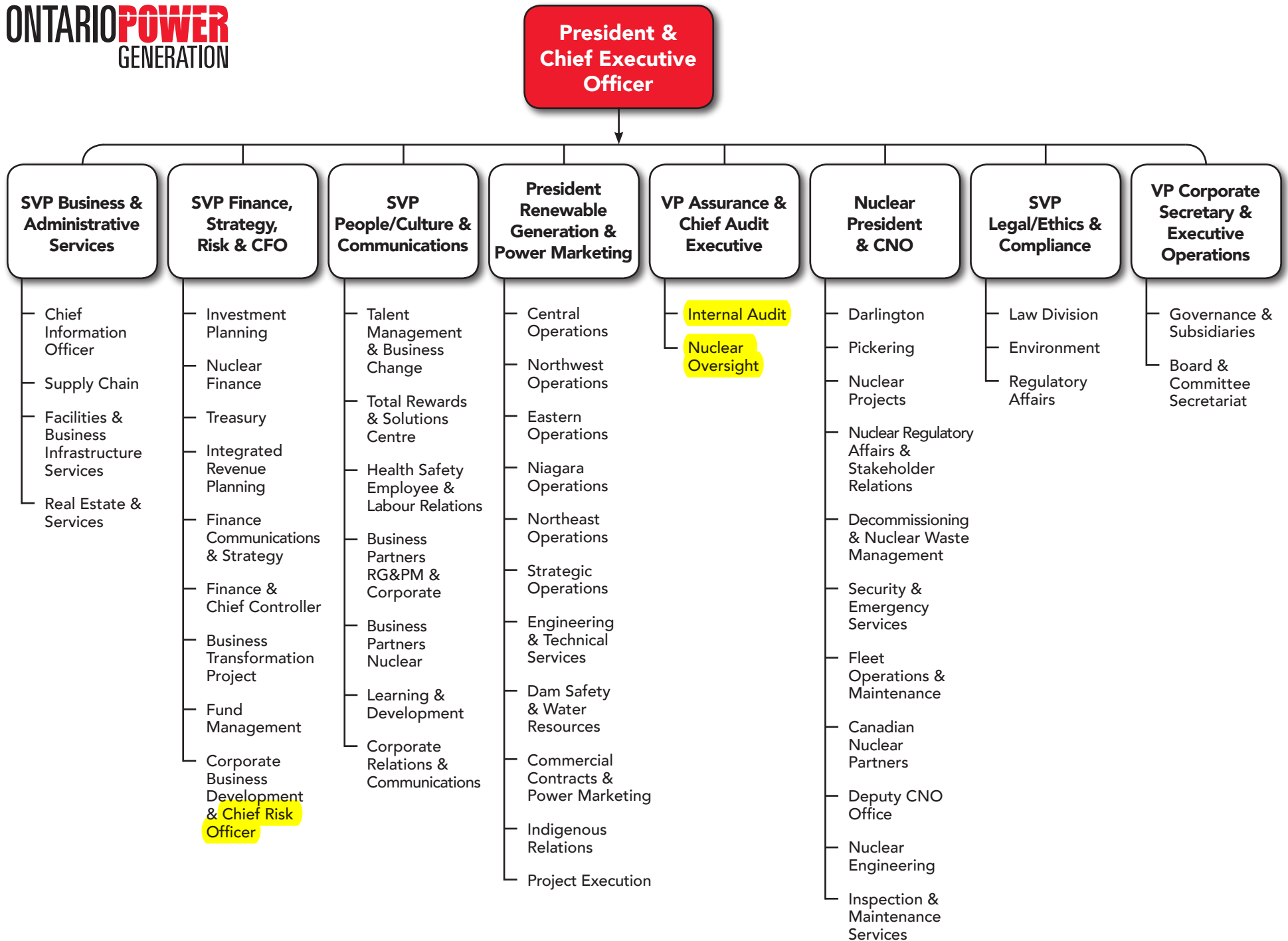
Darlington Refurbishment Project Targets

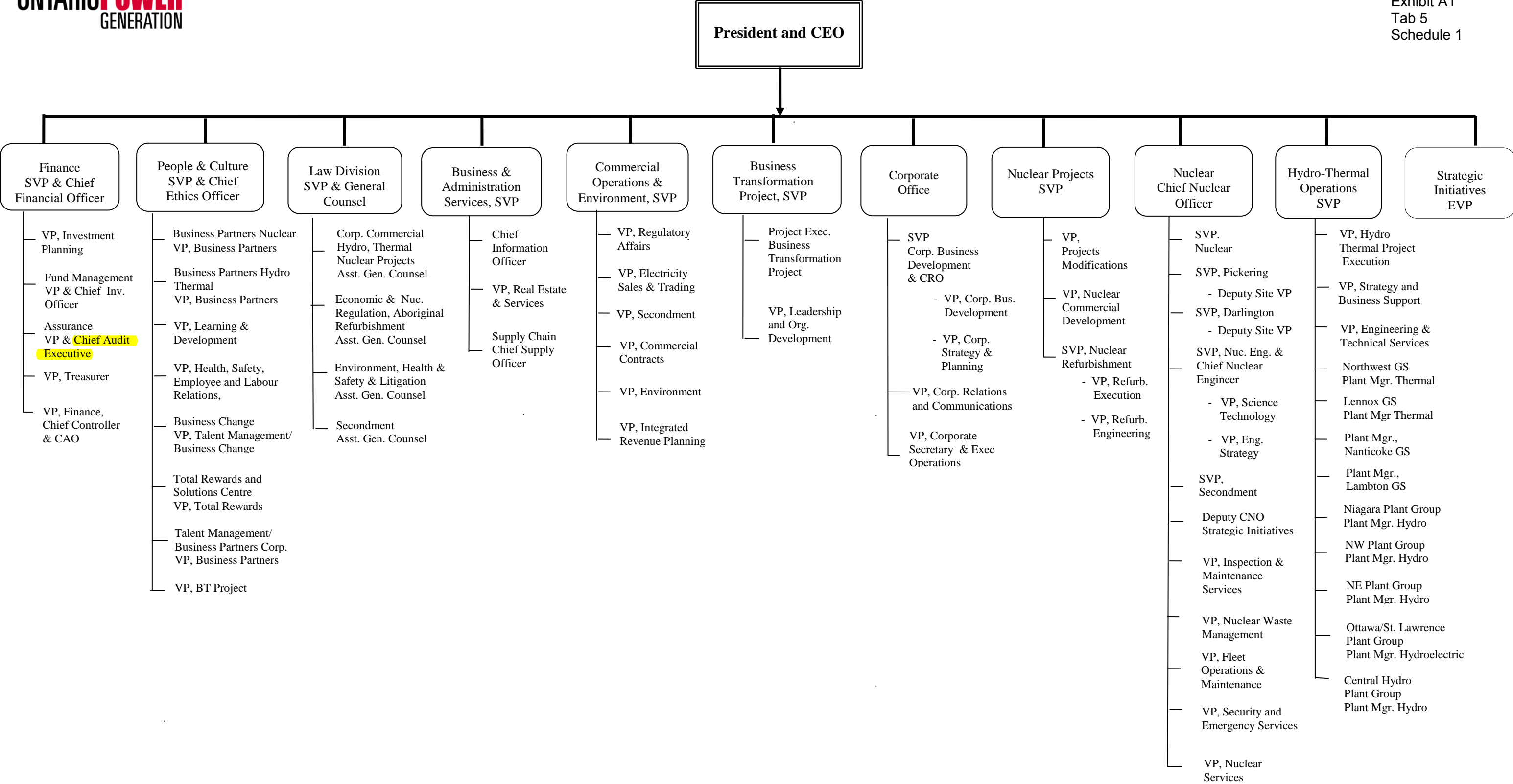
Milestone	Target Completion Date
Unit 2 Execution Estimate Complete	August 15, 2016
Unit 2 Refurbishment Start (Breaker Open)	October 15, 2016
Unit 2 Reactor Defueling Complete	February 2017
Heavy Water Storage & Drum Handling Facility In-Service	May 2017
Unit 2 Reactor Component Removals Complete	April 2018
Unit 2 Calandria Tube Installation Complete	September 2018
At least 284 Unit 2 Fuel Channels Installed	December 31, 2018

Initiatives

The following initiatives are aimed at closing performance gaps in order to achieve targeted results for the Nuclear business unit:

- **Workforce Planning & Resourcing Initiative:** This initiative focuses on developing and implementing the resourcing strategy to support the safe operation of the plants and successful completion of the Darlington refurbishment, while minimizing disruption and costs associated with the Pickering end of commercial operations. A dedicated team will optimize workforce planning strategies across the Nuclear business and provide oversight on the resourcing approval process.
- **Outage Performance:** This initiative focuses on delivering predictable outage performance through improved planning and execution of outage work to meet planned outage day targets. Areas for improvement include: model work order development and utilization; outage schedule and resource planning quality; implementation of a long-term purchased services agreement to optimize contracted work and improve quality of supplemental staff execution; inspection and maintenance execution improvements; Life Cycle Management Plan development improvements; and completing a feasibility study for placing the Pickering station on a 30-month outage cycle.
- **Equipment Reliability:** This initiative aims to improve equipment reliability, improve effectiveness of the maintenance program and reduce equipment failures to meet forced loss rate targets.
- **Human Performance:** This initiative focuses on: 1) Behaviours associated with procedural use and adherence; 2) Leadership accountability whereby leaders understand and model the behaviours expected from all staff; and 3) Supervisor effectiveness whereby supervisors set and communicate clear expectations to positively influence behaviours.
- **Parts Improvement Project:** This initiative focuses on obtaining the right parts on time, reducing churn in the work management system, and ultimately improving equipment reliability through the completion of 19 cross-functional sub-initiatives across the Engineering, Supply Chain, Fleet Operations & Maintenance, and Work Management functions.
- **Inventory Reduction Initiative:** This initiative is to develop a strategy to optimize inventory levels and reduce costs by targeting half the historical growth rate for 2016. The 2016 growth rate would be lower than benchmark.





OVERVIEW OF OPG

1.0 PURPOSE

This evidence provides an overview of OPG, including a summary of its mandate, objectives, key assets, corporate governance and organization. OPG's nuclear and regulated hydroelectric businesses are described in Ex. A1-4-2 and Ex. A1-4-3, respectively.

2.0 CORPORATE OVERVIEW

OPG is an electricity generation company whose principal business is the generation and sale of electricity in Ontario. OPG's focus is on the effective stewardship of generation assets owned by the people of Ontario. This is achieved by focusing on: (i) the safe, reliable operation of its facilities including the avoidance of harm to employees, contractors, and the public at large, (ii) the management of these facilities by maintaining a strong focus on delivering value for money and (iii) adhering to the highest standards of corporate citizenship, including a commitment to environmental and social objectives.

As part of its business, OPG owns and operates both regulated and unregulated generation facilities. OPG's regulated generation facilities consist of two nuclear generating stations with a total generation capacity of 6,606 MW and 54 regulated hydroelectric generating stations with a total generation capacity of 6,425 MW, for a combined regulated generation capacity of 13,031 MW.

While not regulated facilities, the Bruce A and B Generating Stations have an impact on the calculation of the payment amounts. These stations are owned by OPG and leased on a long-term basis to Bruce Power L.P. The revenues from the lease, net of costs, are used to reduce the payment amounts for the regulated facilities.

The locations of the regulated facilities and other OPG facilities are illustrated on the map provided as Attachment 1.

1 In 2015, OPG's regulated facilities generated a total of 74.7 TWh, representing
2 approximately 55 per cent of the total electricity generated in the Province of Ontario (137.0
3 TWh). The nuclear facilities generated 44.5 TWh and the regulated hydroelectric facilities
4 generated 30.2 TWh, or approximately 60 per cent and 40 per cent of OPG's total regulated
5 energy production, respectively. Further details on the regulated facilities are provided in Ex.
6 A1-4-2 and Ex. A1-4-3.

7
8 In addition to generating electricity for sale to the IESO-administered market, OPG's
9 regulated assets sell ancillary products to the IESO markets, including operating reserve,
10 voltage control/reactive support, black start capability, and automatic generation control.
11 Revenues associated with sales of ancillary products from the regulated facilities are
12 discussed in Exhibit G - Other Revenues.

13 14 **3.0 OPG GOVERNANCE AND ORGANIZATION**

15 OPG's Board of Directors ("OPG Board") is appointed by the shareholder. The OPG Board
16 currently has 15 members, who bring substantial expertise in managing large businesses,
17 managing and operating nuclear stations, managing capital-intensive companies, and
18 overseeing regulatory, government, and public relations. The OPG Board has established
19 the following committees to focus on areas critical to OPG's success:

- 20
21 • **Audit and Risk Committee:** The Audit and Risk Committee is responsible for the
22 integrity, quality and transparency of OPG's financial information, the adequacy of the
23 financial reporting process, the systems of internal controls, and OPG's related
24 principles, policies and procedures which management has established. The
25 Committee is responsible for the oversight of the Company's regulatory filings,
26 financial statements, and other annual disclosures. The Committee also provides
27 oversight of the performance of the OPG Pension Fund, the Used Fuel Segregated
28 Fund and the Decommissioning Segregated Fund. Additionally, the Committee is
29 responsible for the oversight of enterprise-wide risk and associated risk management
30 activities. The Committee reviews management's assessment of the principal risks to

1 achieving the Company's strategic and business plan objectives and the strategies
2 for monitoring and responding to these risks.

- 3
- 4 • **Compensation, Leadership and Governance Committee:** The Compensation,
5 Leadership and Governance Committee provides oversight of OPG's human
6 resources and compensation policies and practices, including Chief Executive Officer
7 ("CEO") objectives and compensation, disclosure on compensation and human
8 resources matters, leadership talent review, succession planning, labour negotiations
9 and human resources policies. The Committee also oversees the OPG Board's
10 governance program and practices to ensure alignment with corporate governance
11 best practices, including annually reviewing and assessing the OPG Board's system
12 of corporate governance.
13
 - 14 • **Generation Oversight Committee:** The Generation Oversight Committee is
15 responsible for the oversight of safe, secure and efficient operations of OPG's
16 generating facilities. The Committee is responsible for reviewing significant
17 operational, transactional and strategic risks against business plan objectives.
18 Additionally, the Committee oversees the development, risk management, financing
19 and execution of new and existing generation projects. The Committee is responsible
20 for reviewing the results of assessments by regulators and/or independent oversight
21 organizations, including proposed remediation programs. The Committee ensures
22 that OPG's generating facilities comply with nuclear, health and safety, and
23 environmental laws and regulations.
24
 - 25 • **Darlington Refurbishment Committee:** The Darlington Refurbishment Committee is
26 responsible for the oversight of the Darlington Refurbishment Project. The Committee
27 is responsible for retaining external independent oversight advisors and reviewing
28 results and/or major findings from external assessments and management's
29 proposed remediation programs and plans. The Committee monitors progress of the
30 refurbishment project against the final approved execution scope, budget and
31 schedule as well as project risks and associated mitigation plans.

OPG's senior management team is led by OPG's President and CEO, who is also a member of the OPG Board. The leaders of the nuclear and regulated hydroelectric business units report to the President and CEO. The organization and management of the nuclear and the regulated hydroelectric business units, which are the subject of this Application, are described in greater detail in Ex. A1-4-2 and Ex. A1-4-3, respectively.

Also reporting directly to the President and CEO are the various functions that provide support to the operational business units. These include Business and Administrative Services, Finance, People and Culture, and Law. Please refer to the organizational chart provided in Ex. A1-5-1 for further detail.

4.0 OPG's MANDATE AND OBJECTIVES

In addition to being governed by the various policies in areas such as safety, Code of Business Conduct, disclosure and the environment, OPG is subject to the terms of a Memorandum of Agreement between the Shareholder and OPG, dated July 17, 2015 (the "Memorandum of Agreement"), which sets out the Shareholder's expectations regarding OPG's mandate, governance framework, generation performance and investment, financial framework and communications. The Memorandum of Agreement confirms that OPG will operate as a business enterprise with a commercial mandate, governed in principle and at first instance by an independent Board of Directors. The Memorandum of Agreement is provided in Attachment 2.

The Memorandum of Agreement further states that the Shareholder may at times direct OPG to undertake special initiatives, which will be communicated as written declarations by way of a Unanimous Shareholder Agreement, or Declaration, in accordance with section 108 of the *Business Corporations Act* (Ontario) and made public. Copies of the shareholder directives that OPG has received are posted on OPG's website at:

<http://www.opg.com/about/management/open-and-accountable/Pages/shareholder-directives.aspx>.

OVERVIEW OF NUCLEAR FACILITIES

1.0 PURPOSE

This evidence describes OPG's nuclear facilities and sets out an overview of OPG's nuclear mandate, objectives, organization, and governance framework.

The evidence is substantially the same as Ex. A1-4-3 submitted in OPG's last rates application (EB-2013-0321) with the exception of an update to section 3.0, Nuclear Organization.

2.0 OPG'S NUCLEAR GENERATING FACILITIES

OPG's nuclear generating facilities consist of Pickering Generating Station ("Pickering") and Darlington Generating Station ("Darlington") (collectively, the "nuclear generating stations").

All of OPG's nuclear generating stations are based on CANDU technology, a pressurized-heavy-water reactor using natural-uranium technology developed in Canada. CANDU reactors are unique in their use of natural uranium, deuterium oxide (heavy water) as a moderator/coolant, on-line refueling capability and two shut down safety systems. These plants serve as base load resources as they have been designed to operate at full power. Chart 1 below provides basic information about the nuclear generating stations.

Chart 1

Nuclear Generating Stations Basic Information

	Pickering		Darlington
	Units 1 and 4¹	Units 5-8	Units 1-4
In-service dates	1971 - 1973	1983 - 1986	1989 - 1992
Net in-service capacity	1,030 MW	2,064 MW	3,512 MW
Number of units in-service and size in MW's	2 x 540	4 x 540	4 x 934

¹ Pickering Units 2 and 3 were laid up in 1997 and have been placed into a safe store condition for eventual dismantling.

While OPG's ten nuclear units are based on CANDU principles, they reflect three generations of design philosophy and technology with Pickering Units 1 and 4, Pickering 5 to 8, and Darlington built in the 1960s, 1970s, and 1980s respectively. This results in significant variations among the three nuclear stations, including technology system components and overall design.

Planning is underway to extend the safe operation of Pickering, whereby all six units at Pickering would operate until 2022, at which point two units would be shut down and the remaining four units would operate until 2024 (referred to as "Pickering Extended Operations"). Further details regarding Pickering Extended Operations is provided in Ex. F2-2-3.

Darlington will be undergoing refurbishment over the period 2016-2025, as discussed in Ex. D2-2-1 and Ex. F2-7-1.

3.0 NUCLEAR ORGANIZATION

The nuclear organization is led by the President, OPG Nuclear and Chief Nuclear Officer (per OPG's organizational chart shown in Ex. A1-5-1). The operating groups within the nuclear

organization are described below (all reporting to the President, OPG Nuclear and Chief Nuclear Officer).

- **Darlington and Pickering Stations** – led by the Senior Vice President Darlington and Senior Vice President Pickering and focused on the operation, maintenance, and performance of Pickering and Darlington.
- **Nuclear Engineering** – led by the Senior Vice President, Nuclear Engineering and Chief Nuclear Engineer and focused on plant safety and reliability by provision of various engineering services (e.g., design engineering, component engineering, station engineering).
- **Fleet Operations and Maintenance** – led by the Vice President, Fleet Operations and Maintenance and focused on driving improvement across the Nuclear fleet.
- **Security and Emergency Services** – led by the Vice President, Security and Emergency Services and responsible for provision of security services for all of OPG including nuclear sites and facilities, as well as ensuring compliance with all CNSC security requirements.
- **Inspection and Maintenance Services** – led by the Vice President, Inspection and Maintenance Services and responsible for providing inspection and maintenance services to Darlington and Pickering facilities.
- **Decommissioning and Nuclear Waste Management** – led by the Senior Vice President, Decommissioning and Nuclear Waste Management, and responsible for the ongoing long-term management of nuclear waste produced by its operations, including low and intermediate level radioactive waste and used fuel. Also responsible for the planning and conduct of decommissioning of all OPG owned and operated nuclear facilities. This includes oversight on the Pickering Extended Operations project and management of the overall planning for the end of commercial operations at Pickering. Further details on nuclear waste management and decommissioning including the funding of nuclear liabilities are provided in Exhibit C2.
- **Nuclear Projects** – led by the Senior Vice President, Nuclear Projects and responsible for managing the planning and development of all projects in Nuclear.

1 This includes major refurbishment projects at Darlington, as discussed in greater
2 detail in Ex. D2-2-1.

3
4 A more detailed description of the roles and responsibilities of the various operating groups
5 in the Nuclear organization is provided in Attachment 1 to Ex. F2-2-1.

6 7 **4.0 NUCLEAR OBJECTIVES**

8 OPG Nuclear has the following cornerstone major focus areas with the purpose of making
9 the existing nuclear facilities more dependable, predictable, and cost effective:

- 10 • **Safety:** The Safety cornerstone makes nuclear safety, employee safety and
11 environmental safety (e.g., radiation) the overriding priorities. It requires that all laws
12 and industry/regulatory expectations are met, activities are performed conservatively
13 and responsibly, and that business decisions are made with the full knowledge of the
14 risks and potential impacts.
- 15 • **Human Performance/Leadership:** The Human Performance/Leadership
16 cornerstone recognizes that minimizing individual fallibility and organizational
17 programs/processes is the basis for operational excellence.
- 18 • **Reliability:** The Reliability cornerstone requires that OPG operate, maintain and
19 engineer the nuclear facilities such that equipment, performance, availability and
20 output are optimized.
- 21 • **Value for Money:** The Value for Money cornerstone delivers solutions that are the
22 best combination of cost, quality and performance.

23
24 These cornerstone major focus areas are the basis for the establishment of performance
25 targets and key initiatives during the benchmarking and business planning process, as
26 discussed in Ex. F2-1-1.

Board Staff Interrogatory #72

Issue Number: 4.3

Issue: Are the proposed nuclear capital expenditures and/or financial commitments for the Darlington Refurbishment Program reasonable?

Interrogatory

Reference:

Ref: Exhs D2-2-7, D2-2-8 and D2-2-10

OPG has provided copies of third party reports in the above referenced exhibits.

- a) Please provide a copy of any other third party reports regarding the DRP prepared during the planning phase that have not already been filed by OPG in EB-2016- 0152.
- b) Please provide a copy of all audit reports regarding the DRP.
- c) Will OPG receive reports from any other third party independent oversight groups involved in the DRP during the execution phase? What is the frequency? Will they generate written reports? Who will receive the reports?
- d) What is OPG's Audit program during the execution phase of the DRP? What areas will be audited? What is the schedule for the audits during the execution phase of the DRP? Who will receive the reports?

Response

- a) There are an extensive amount of third party reports regarding the Darlington Refurbishment Program (DRP) that cover technical details on a variety of topics. The following is a list of third party oversight reports regarding the DRP:

1) Modus/Burns & McDonnell – Definition Phase

Reports are provided as Attachments as listed:

- 1. Initial Project Assessment – Darlington Nuclear Refurbishment Project (August 13, 2013)
- 2. Report to Nuclear Oversight Committee – 4th Quarter 2013
- 3. Report to Nuclear Oversight Committee – 1st Quarter 2014
- 4. Report to Nuclear Oversight Committee – 2nd Quarter 2014
- 5. Report to Nuclear Oversight Committee – 3rd Quarter 2014
- 6. Report to Nuclear Oversight Committee – 4th Quarter 2014

7. Supplemental Report to Nuclear Oversight Committee Observations Regarding 4d Cost Estimate - 4th Quarter 2014
8. Report to Nuclear Oversight Committee – 1st Quarter 2015
9. Report to Nuclear Oversight Committee – 2nd Quarter 2015
10. Report to Darlington Nuclear Refurbishment Project – 3Q 2015
11. Report to Darlington Review Committee of OPG Board of Directors
12. Nuclear External Oversight Assessment Report Cost Management & Earned Value
13. Nuclear External Oversight Assessment Report Assessment of 4c Estimate and Cost Management
14. Nuclear External Oversight Review of OPG Risk Management Practices and Procedures – February 2015
15. Report to Board of Directors Board Retreat October 1-2, 2015
16. BMcD/Modus Recommendations 2Q 2015 Report to NOC
17. Nuclear External Oversight Assessment of OPG Operating Experience & Lessons Learned Practices and Procedures
18. Nuclear External Oversight Review of Darlington Refurbishment Schedule Management Practices and Procedures
19. Attachment B – Update of BMcD/Modus Recommendations from Initial Project Assessment of August 2013
20. Nuclear External Oversight Assessment Report of DR Team's Process for Developing the RQE Estimate (already filed at Ex. D2-2-8, Attachment 2)
21. Independent Oversight Team – Assessment of OPG Scope Definition and Management Process

2) Previous Ontario Minister of Energy - Independent Advisor

Reports are provided as Attachments as listed:

22. Report to the Minister of Energy on the Oversight of the Darlington Refurbishment Program - Q3 2014
23. Report to the Minister of Energy on the Oversight of the Darlington Refurbishment Program - Q4 2014
24. Report to the Minister of Energy on the Oversight of the Darlington Refurbishment Program - Q1 2015
25. Report to the Minister of Energy on the Oversight of the Darlington Refurbishment Program - Q2 2015
26. Report to the Minister of Energy on the Oversight of the Darlington Refurbishment Program - Q3 2015
27. Report to the Minister of Energy on the Oversight of the Darlington Refurbishment Program – Q4 2015

- b) OPG produces two types of audit reports that are applicable to the DRP: (1) Nuclear Oversight reports, and, (2) Internal Audit reports:

1) Nuclear Oversight

During the period of January 1, 2014 to September 30, 2016, Nuclear Oversight performed 45 Audits and Assessments (34 Audits, 11 Assessments) that included Darlington Nuclear Refurbishment in scope. Of those, 13 identified issues requiring corrective action within Refurbishment.

Nuclear Oversight works closely with the Line organizations being evaluated, including implementing processes that provide acknowledgement of the issues identified and achieving agreement and ownership of corrective actions.

The issues identified during this period consisted of deficiencies/gaps from a fleet or station perspective as well as specific to the refurbishment project. The areas requiring further corrective action included assessment of planning and design activities, conduct and implementation of plant activities, as well as assessment of programmatic effectiveness.

The following chart contains the list of the Nuclear Oversight Audits and Assessments that included Darlington Nuclear Refurbishment in Scope. All findings and associated management actions relevant to the DRP are provided in Attachment 28.

Chart 1 – Nuclear Oversight Audits

Audit #	Audit Title
2014-005	Work Protection
2014-006	Pressure Boundary Section 18
2014-008	PB Program Review (incl. CAP review surveillance)
2014-011	Procurement Engineering
2014-012	Human Performance
2014-017	Fire Protection Program
2014-018	Environment Programs
2014-020	PB Design Control (including PB Procurement Engineering)
2014-021	PB Control of Processes & Test Control and Material Management
2015-013	Software Program – Real Time Process Computing
2015-014	Environmental Management
2015-016	Fire Protection
2015-018	PB Design Control (incl: PB Procurement Eng. Aspects)
2015-020	Pressure Boundary Audit - Section 18
2015-021	Reactor Safety Program
2015-022	Project Management
2015-024	Items & Services Management, including Pressure Boundary
2015-029	Heavy Water Management

Audit #	Audit Title
2015-033	Configuration Management
2016-001	Health & Safety Management System Program
2016-002	Corrective Action Program
2016-004	Equipment Reliability
2016-005	Major Components
2016-008	Welding
2016-013	Risk and Reliability
2016-014	Environmental Management
2016-015	Conduct of Maintenance
2016-016	Records and Documentation
2016-020	Work Management
2016-021	Work Protection
2016-027	Integrated Aging Management
2016-028	DNR Project Management
2016-029	DNR Conduct of Engineering
2016-031	DNR Emergency Preparedness

Chart 2 – Nuclear Oversight Assessments

Assessment #	Assessment Title
2014-200	Darlington Nuclear Refurbishment (DNR) Engineering Activities
2014-204	Darlington Performance Assessing - Operations & Maintenance Readiness for DNR
2014-310	Contract Administration Assessment
2014-319	Fleet Performance Assessing - CMO 180 Day Follow
2015-202	Darlington Nuclear Refurbishment Chemistry
2015-205	DNR - Engineering
2015-206	DNR Contractor Safety Plan
2015-208	Darlington NLO Initial Training
2015-321	Follow-up to Human Performance Audit NO-2014-012
2016-208	Pressure Boundary Darlington Refurbishment
2016-209	SATM & Housekeeping Darlington Nuclear Generating Station ("DNKS")

2) Internal Audit

During the period of January 1, 2014 to September 30, 2016, Internal Audit performed 17 audits that included DRP in scope.

The issues identified during this period include (but are not limited to) deficiencies with documentation, unclear organizational accountabilities, contractor non-compliances, planning and scheduling issues, and financial controls.

The following table contains the list of the Internal Audit reports relating to DRP. All findings and associated management action plans relevant to the DRP are provided in Attachment 29 (confidential).

Chart 3 – Internal Audit Reports

Audit #	Audit Title
14-15	Administration of Contractual Documentation - Refurbishment
14-17	Finance's Control Over Darlington Refurbishment
14-18	Turbine Generator (TG) Critical Parts Procurement – Darlington Refurbishment Project
14-26	Darlington Station Readiness for Refurbishment
15-17	EPC Contractor Procurement Review – Darlington Nuclear Refurbishment Project
15-24	Invoice Review & Approval Process – DRP Projects
15-47	ES MSA Recovery negotiations Audit - Follow-up on 2013 Auditor General Findings
16-07	Darlington Nuclear Refurbishment Project Management Audit
16-08	Darlington Nuclear Refurbishment – Contractor Invoicing Audit
16-09	Darlington Nuclear Refurbishment On boarding
16-13	Darlington Nuclear Refurbishment Contractor and Subcontractor Management Audit
16-23	Darlington Nuclear Refurbishment– Retube & Feeder Replacement Construction and Tooling Audit
16-24	Darlington Nuclear Refurbishment Turbine Generator Engineering Audit
16-25	Darlington Nuclear Refurbishment Integrated Database for Project Reporting Audit
16-39	DNR Contractor Procurement – R&FR Project Audit

c) External oversight of the DRP is being conducted on behalf of the Board of Directors, the Ontario Minister of Energy, and OPG's President and CEO. This will continue throughout the Execution Phase:

- 1) Darlington Refurbishment Committee of the OPG Board of Directors- Burns and McDonnell

OPG's Board of Directors recently re-engaged Burns and McDonnell with Modus as subcontractors to provide independent oversight services during the Execution Phase. The Burns and McDonnell reports are submitted to the Darlington Refurbishment Committee of the OPG Board of Directors at their quarterly meetings.

2) Ontario Minister of Energy - Independent Advisor

Please see Ex. L-4.3-1 Staff-222 for description of the Ontario Minister of Energy's oversight during Execution Phase.

3) OPG President and CEO-Refurbishment Construction Review Board (RCRB)

Please see Ex. L-4.3-1 Staff-222 for a description of the RCRB. Reports are provided to OPG's President and CEO.

d) OPG's Audit program during the Execution Phase of the DRP is as follows:

1) Nuclear Oversight

Nuclear Oversight Rolling Audit Schedule Q3 2016 - Q3 2017 (Attachment 30) represents the current Nuclear Oversight Audit plan for the next five quarters. The DRP (see: Darlington Nuclear Refurbishment (DNR) column on the attached) is in scope for the majority of the planned audits. The Nuclear Oversight 2017-2019 Audit Plan is below:

Chart 4 – Nuclear Oversight 2017-2019 Audit Plan

AUDITS	2017	2018	2019
Pressure Boundary	X	X	X
Pressure Relief Valves			X
Conduct of Engineering – Design Authority	X		
Conduct of Engineering - Research and Technology	X		
Conduct of Inspection & Maintenance Services	X		X
Component & Equipment Surveillance			X
Software		X	
Items & Services Management		X	
Risk & Reliability			X
Equipment Reliability			X
Reactor Safety		X	
Project Management	X		
Major Components			X

Engineering Change Control	X		
Environmental Qualification	X		
Chemistry		X	
Welding			
Integrated Aging Management			
Decommissioning		X	
Nuclear Waste Management Program		X	
Nuclear Operations	X	X	X
Heavy Water Management			
Nuclear Operations (Fuel Handling)			X
Conduct of Maintenance	X	X	X
Work Protection		X	
Production Work Management		X	
Fire Protection		X	X
Training	X		X
Human Performance		X	
Corrective Action			X
Radiation Protection		X	
Health & Safety Management System Program			X
Environmental Management	X	X	
Nuclear Pandemic Planning	X		
Design Management			X
Nuclear Security (with Nuclear Safeguards)	X		
Radioactive Material Transportation		X	
Consolidated Nuclear Emergency Plan		X	X
Business Planning	X		
Records and Document Control			
Nuclear Safeguards (with Nuclear Security)	X		
Fuel			X
Managed Systems		X	
Conduct of Regulatory Affairs	X		
Independent Assessment (NIEP)			X
Component Equipment Surveillance (DNR only)		X	
Safety System Functional Audit (DNR only)			X

Nuclear Oversight audit reports are distributed to the senior management team within Nuclear (SVPs, VPs, Directors) and to line management who have been involved with audit.

2) Internal Audit

For 2016, Internal Audit will perform the audits set out in Chart 5 relating to the DRP. The 2017 to 2019 Audit Plan relating to DRP is provided in Chart 6.

Chart 5 – 2016 Internal Audit Plan

No.	Engagement Name	Status
1	DNR Onboarding	Complete
2	DNR Project Management	Complete
3	DNR Contractor Invoicing	Complete
4	DNR Contractor and Subcontractor Management	Complete
5	DNR Construction & Tooling - R&FR Project	Complete
6	DNR Engineering - Turbine Generator Project	Complete
7	DNR Integrated Database for Project Reporting	Complete
8	DNR Contractor Timekeeping	In Progress
9	DNR EPC Procurement	In Progress
10	DNR Project Revisions & Rework	In Progress
11	DNR Contractor Procurement - R&FR Project	Complete
12	DNR Project Cost Management System	In Progress
13	DNR Finance Controls	In Progress

Chart 6 – 2017 – 2019 Internal Audit Plan

Darlington Nuclear Refurbishment			
Year	2017	2018	2019
Program Management	Program Oversight & Reporting	Program Oversight & Reporting	Program Oversight & Reporting
	Vendor Productivity	Quality Management Program	-
Core Project Execution – Project Management	Retube & Feeder Replacement (“R&FR”) – Project Execution	Steam Generator – Project Execution	R&FR – Project Execution
	Fuel Handling – Project Execution	Turbine Generator – Project Execution	Turbine Generator – Project Execution
	Balance of Plant – Project Execution	-	Balance of Plant – Project Execution

The distribution for Internal Audit reports is as follows:

Reports are directed to:

- SVP, Nuclear Projects
- Other Executive Leadership Team Members (as applicable if their organization has ownership for actions)
- Process Owner for the Audit

Other stakeholders included on the distribution (copied) are:

- President & Chief Executive Officer
- SVP Finance, Strategy, and Chief Financial Officer
- Nuclear President & Chief Nuclear Officer
- SVP Nuclear Refurbishment
- VP Nuclear Finance
- Director Refurbishment Systems Oversight
- Director Nuclear Oversight
- Other impacted stakeholders (as applicable)

SEC Interrogatory #2

Issue Number: 1.2

Issue: Are OPG's economic and business planning assumptions that impact the nuclear facilities appropriate?

Interrogatory

Reference:

Please provide summaries of all internal audit reports conducted since 2014, their findings, recommendations, and the status of any actions that are to be taken.

Response

OPG declines to answer on the basis that this is not an appropriate question. The question ignores the principle of proportionality which underlies the interrogatory process, in that it is overly broad and all encompassing.

The question asks OPG to review all audits for a three-year period and summarize the findings, recommendations and status. OPG's business generates a large quantity of documents that may be captured by the question asked in this interrogatory.

Without waiving this objection, Attachment 1 to this response provides a listing of all audits undertaken in the last three years except those related exclusively to OPG's unregulated business. If the information requested was refined to reference specific materials relating to an issue on the approved issues list, OPG could undertake to produce the relevant materials. For example, OPG has provided responsive material on audits of the Darlington Refurbishment Program in Ex. L-4.3-1 Staff-72 (b).

INTERNAL AUDIT

COMPLETED ENGAGEMENTS – 2014 to Q3 2016

(Note: Engagements pertaining exclusively to OPG's non-regulated business are excluded)

Board Report	Internal Audit Engagement
AFC 2014 Q1	R&FR – Contractor Requirements Audit
AFC 2014 Q1	Recruit, Select and Hire
AFC 2014 Q1	Parts and Equipment Obsolescence
AFC 2014 Q1	BT Change Initiatives – Progress Review of Process Risks and Controls Impacts
AFC 2014 Q2	DN Refurbishment - R&FR, Applications for Payment
AFC 2014 Q2	AG Management Actions Follow-Up Activity
AFC 2014 Q2	Environmental Management – Centre-led Oversight
AFC 2014 Q2	Administration of Contractual Documentation - HTO
AFC 2014 Q2	Hydro Asset Management
AFC 2014 Q2	Real Estate Process
AFC 2014 Q2	Project Governance Alignment with Project Development Protocol
AFC 2014 Q3	Network Security, Threat and Vulnerability Management
AFC 2014 Q3	New Horizons IT Support Agreement
AFC 2014 Q3	Administration of Contractual Documentation – Refurb.
AFC 2014 Q3	Finance Controls for Darlington Refurbishment Project
AFC 2014 Q4	New Horizons IT Support Agreement
AFC 2014 Q4	Rate Regulation Process
AFC 2014 Q4	Finance Controls for Darlington Refurbishment Project
AFC 2014 Q4	Critical Materials Procurement
AFC 2014 Q4	Nuclear Liability Cost Estimate
AFC 2014 Q4	Enterprise Systems Consolidation Project (ESCP) Implementation review
AFC 2014 Q4	Darlington Ops Readiness for Refurbishment
AFC 2014 Q4	Stakeholder Relations Program (SRP) Review - 2014
AFC 2014 Q4	Board Chair Expense Audit
AFC 2014 Q4	Directors of the Board Expense Audit
AFC 2014 Q4	ELT Expense Audit
AFC 2015 Q1	Investment Planning
AFC 2015 Q1	IT Service Agreement Costs Recovery
AFC 2015 Q2	Darlington Primary Heat Transport (“PHT”) Pump Motor
AFC 2015 Q2	Darlington Outage Management
AFC 2015 Q2	Corporate Strategy & Planning Process
AFC 2015 Q2	Aboriginal Relations
AFC 2015 Q2	Employee Business Expense Audit

Board Report	Internal Audit Engagement
AFC 2015 Q2	Invoice Review Process – DRP Projects
AFC 2015 Q2	Controllershship Function
AFC 2015 Q2	DRP Fraud Risk Assessment
AFC 2015 Q3	Pickering Planned Outage Management Audit
AFC 2015 Q3	Nuclear Warehousing and Logistics Audit
AFC 2015 Q3	Real Time Process Controls Systems (“RTPCS”) Security Audit - Nuclear
AFC 2015 Q3	Emergency Management Audit
AFC 2015 Q3	Enterprise System Consolidation Project (“ESCP”) - Post Implementation Review
AFC 2015 Q3	Finance and Accounting Transactions – Shared Services Audit
AFC 2015 Q3	Integrated Revenue Planning Audit
AFC 2015 Q3	Security Processes Audit
AFC 2015 Q3	Strategic Sourcing Audit
AFC 2015 Q3	Hydro Production – Water Management Audit
AFC 2015 Q3	New Horizons Systems Solutions (“NHSS”) – Billings Audit
AFC 2015 Q3	Pension and OPEB Audit
AFC 2015 Q3	Nuclear Contractor Time Reporting (Update - Design Phase)
AFC 2015 Q4	Isotope Sales – Mb-Microtec
AFC 2015 Q4	Nuclear Generation Planning & Production
AFC 2015 Q4	Nuclear Engineering Strategy
AFC 2015 Q4	Isotopes Sales - SRBT
AFC 2015 Q4	HR Recruiting - Follow-up to AG Findings
AFC 2015 Q4	Code of Business Conduct
AFC 2015 Q4	EPC Contractors Procurement Oversight
AFC 2015 Q4	Nuclear Liability Cost Estimate
AFC 2015 Q4	Isotope Sales - UKAEA
ARC 2016 Q1	Project Controls - Projects & Modifications (“P&M”) Group
ARC 2016 Q1	Darlington Nuclear Refurbishment (“DNR”) Contractor Invoicing
ARC 2016 Q1	DNR Onboarding
ARC 2016 Q1	DNR Project Management
ARC 2016 Q1	ES MSA Recovery Negotiations - Follow-up on 2013 Auditor General Findings
ARC 2016 Q1	Services Procurement
ARC 2016 Q1	Board of Directors On-Boarding
ARC 2016 Q1	Compensation - Follow-up on 2013 Auditor General Findings
ARC 2016 Q1	2015 Business Expense Audit – Board of Directors
ARC 2016 Q1	2015 Business Expense Audit – Chairman of Board
ARC 2016 Q1	2015 Business Expense Audit – Executive Leadership Team
ARC 2016 Q1	Ontario Energy Board (“OEB”) Rate Application

Board Report	Internal Audit Engagement
ARC 2016 Q1	Stakeholder Return Program
ARC 2016 Q2	SMART Objectives
ARC 2016 Q2	IT Governance & Risk Management
ARC 2016 Q2	Law Contract Management Support
ARC 2016 Q2	Business Transformation Performance
ARC 2016 Q2	Business Continuity
ARC 2016 Q2	Darlington Nuclear Refurbishment (“DNR”) Contractor Management
ARC 2016 Q2	DNR Retube & Feeder Replacement (“R&FR”) Project - Construction & Tooling
ARC 2016 Q2	IESO Settlements
ARC 2016 Q2	DNR Integrated Database (“IDB”) for Project Reporting
ARC 2016 Q2	DNR Turbine Generator Project - Engineering
ARC 2016 Q3	Cyber Security - IT End Point Security
ARC 2016 Q3	Data Loss Prevention
ARC 2016 Q3	Project Management – Inspection & Maintenance Services (“IMS”) Initiatives
ARC 2016 Q3	SMART Objectives – Follow up
ARC 2016 Q3	Learning and Development
ARC 2016 Q3	Supplier Quality
ARC 2016 Q3	DNR Contractor Procurement - Retube & Feeder Replacement (“R&FR”) Project

ASSET MANAGEMENT AND PROJECT REVIEW PROCESSES

OPG's asset management and project review processes are largely unchanged from EB-2013-0321. Their description is provided for reference.

1.0 ASSET MANAGEMENT

OPG's investments and initiatives are targeted at programs that will result in increased generating capacity, extended service lives, improved performance, and reduced long-term operations and maintenance costs.

In addition to improving performance of its existing assets, OPG also evaluates development initiatives with respect to its regulated facilities which can include plant life extensions, plant redevelopments or new supply developments. These development initiatives are typically larger in size, have higher risk profiles and longer time horizons than the projects held within the business unit portfolios. These potential investments are subject to more rigorous internal evaluations and scrutiny during the approval process.

2.0 PROJECT PORTFOLIOS AND SUPPORTING DOCUMENTATION

As part of the business planning process, business units submit project lists that have been prioritized to maximize value and address regulatory requirements while considering risks, corporate business objectives, asset management processes, and funding guidelines. All known projects necessary to meet work program requirements and having cash flows within the business plan time horizon are listed, with the total cost of the projects being consistent with the funding guidelines.

The project list is a snapshot of the project work intended to be done over the business plan horizon. As time progresses, priorities may be re-set and the project list may change as dictated by the needs of the business. Details regarding the prioritization process are provided later in this schedule.

2.1 Planning Business Cases

“Planning” business cases, or project screening forms in nuclear, are produced for qualifying projects that are planned for release within the plan period. Inclusion of a project in the business plan does not constitute approval to proceed with the project. Request for project approval and release of funds to commence work on a project is a separate process and requires a more comprehensive business case summary (“BCS”). Business case requirements for project release are discussed later in this schedule. Planning business cases are a preliminary and usually more condensed version of the full BCS.

2.2 Project Categorization

Investments must also be categorized according to the type of benefit they are expected to produce. Investments fall within the following three categories established by OPG:

- Value Enhancing – Discretionary investments that promise value creation or strategic opportunities, such as added revenues, reduced costs, increased efficiencies, or new business opportunities.
- Regulatory – Expenditures required to satisfy environmental, safety or other requirements in law or regulation to allow the continued operation of existing facilities.
- Sustaining – Required to maintain existing infrastructure and facilities at their current performance level.

2.3 Project Prioritization Process

As the business units compile their project lists, the total cost of all initially identified work may exceed funding guidelines and/or the business unit’s capacity to undertake the work during the planning period. Prioritization processes are then applied to assist with the selection of the highest priority projects while remaining within the funding guidelines and resource capabilities. Since business units manage different assets, prioritization approaches are also unique to each business unit. However, business unit prioritization approaches have common elements such as value, consideration of risks, and regulatory compliance. The approach for nuclear projects is presented in Ex. D2-1-1.

3.0 BUSINESS CASE REQUIREMENTS FOR PROJECT RELEASE

Approval is required for the release of funds to undertake project work. The documentation for seeking approval is a BCS, which provides an explanation of the need and the business opportunity, along with an analysis of feasible alternatives for meeting this need and the rationale for the recommended alternative.

Requests for releases of funds are approved in accordance with the OPG Organizational Authority Register ("OAR"). The OAR sets out delegated authorities within OPG, and defines approval limits for decisions made on behalf of the corporation. Approval requirements are based on the cumulative amount of funds being released, with more restrictive requirements for projects of a strategic nature or unplanned work (projects not identified in the project portfolio during business planning). The OAR also specifies authorities for approval of over-variances for previously released projects, and for superseding releases where projects must be reconsidered due to significant scope, schedule or cost changes.

Functional reviews of BCSs are also carried out to ensure that they meet the criteria for the quality and completeness of the information required to enable an informed decision on approval of the project release. The functional review is required where there is a significant impact on the function or its deliverables. For example:

- Projects with substantial IT requirements are reviewed by the relevant IT Department.
- Projects with significant legal or contractual issues are reviewed by Law Division.
- Projects involving real estate transactions or leasing of office spaces are reviewed by Real Estate Services.
- Projects with significant labour relations or health and safety issues are reviewed by People and Culture.

4.0 POST IMPLEMENTATION REVIEW PROCESS

The post implementation review ("PIR") process is used by OPG to assess achievements following completion of projects. Specifically, a PIR is an appraisal process designed to evaluate whether planned results of a given investment have been met following project

1 completion. The two main objectives of the PIR process are to verify whether the benefits
2 stated in the project business case were realized, and to capture the lessons learned from
3 each project so that they can be applied to improve future projects and investment decisions.

4
5 Post implementation reviews follow a simplified or comprehensive format depending on the
6 size and scope of the investment involved. All projects must have a PIR completed as
7 specified in the PIR plan, ideally within twelve months of the project being completed.

8
9 OPG selects a number of complex or high value projects to undergo a comprehensive PIR
10 within each business planning period. A comprehensive PIR is an independent and broad
11 review of a completed project. It is an intensive exercise requiring a multi-disciplinary team,
12 ideally independent from the project team, to review all phases of a project. It provides
13 detailed feedback on how the project was developed, planned, and executed to help gather
14 lessons for future investments. It is only performed on a small number of projects due to the
15 high resource requirements.

Project Over-Variance Approval

Final Security Classification of the BCS: **OPG Confidential**

This form should not be used for over-variances in excess of 20% of cost or schedule or both. Submit this form with attachment of the latest approved Business Case Summary.

UPDATE

Part A: Project Information						
Project #:	16-34000		Title:	DN Auxiliary Heating System Facility		
Phase:	Execution		Class:	Capital	Records File:	D-BCS-73110-10002
	LTD	2016	2017	2018	Future	Total
Current Approval	93,773	5,619	105	0	0	99,497
Amount Requested	-	2,067	4,910	675	0	7,652
New Total Release	93,773	7,686	5,015	675	0	107,149

Brief Description of the Project:

The existing Construction Boiler House (CBH) provides back-up heating steam to DNGS when all operating units are shutdown. The CBH is beyond it useful service life, and has a total capacity of supplying up to approximately 45,000 kg/hr steam, which does not meet the required 110,000 kg/hr required to maintain the Station temperature above 10 degrees Celsius as specified in the design requirements.

The business objective of this Regulatory project is to provide a source of reliable back-up steam to the DNGS main heating steam header to support irregular operating conditions in the event when all four turbine units are shut down in the winter to mitigate potential major equipment damage due to freezing. This will be achieved by replacing the existing CBH with a new Auxiliary Heating Steam (AHS) Facility. The scope of this project includes the disconnection and demolition of the existing CBH.

This Investment is part of Ontario Power Generation's (OPG) commitment to the Canadian Nuclear Safety Commission to resolve outstanding issues related to the CBH. This project is also categorized as an ongoing operational support project required for meeting the extended Darlington Station life.

Project Status:

Construction of the facility and connection to the Station has been completed. The contractor has completed testing of the AHS Facility up to 100% steam capacity with OPG as Owner Only. Transfer of the facility to OPG as Owner/Constructor for commissioning is in progress.

Remaining Work:

- Resolution of deficiencies by contractor (identified during construction completion declaration walkdown)
- OPG Commissioning
- Software Qualification to satisfy revised Software Categorization
- Available for Service Declaration
- Installation of additional security enhancements
- Engineering, procurement and construction for relocation of steam and condensate lines in Unit 4 reactor auxiliary bay (interference with station operation)
- Engineering, procurement and construction for steam bypass at Unit 3 steam header tie-in to limit steam release in event of steam break
- Cut and cap CBH connections to the Station and services
- Demolition of the CBH, and remediation of the site

*Associated with OPG-STD-0076, Developing and Documenting Business Cases

Project Over-Variance Approval

Reason for Schedule Variance:

- Level 1 work protection violation documented under Station Condition Record D-2015-18210. Work was performed on equipment that was not guaranteed isolated. The event was categorized as C2, and a corrective action plan was issued. The key actions included improvement of contractor's process, training and OPG oversight. (10 weeks)
- Discovery and design issues that resulted in field changes and design changes (10 weeks)
- Procurement delays resulting from bill of materials revisions (design changes)
- Relocation of steam and condensate lines in Unit 4 reactor auxiliary bay (loading bay) rescheduled to the summer of 2017, due to availability of heating steam header outage.
- Old Construction Boiler House demolition rescheduled to later half of 2017, after the following: the operation of the new AHS Facility through initial warranty period and first heating season; and relocation of the steam and condensate lines in Unit 4.
- The following is a summary of the impact on milestones:

<u>Milestone</u>	<u>Existing Target Date</u>	<u>New Target Date</u>
New AHS AFS	2015-OCT-31	2016-JUN-30
CBH Start of Demolition	2016-JUN-15	2017-SEP-01
CBH Demolition Final AFS	2016-OCT-30	2018-FEB-28
Project Closeout Complete	2017-JUN-30	2019-FEB-28

Reason for Cost Variance:

- Interest incurred during the delay of project completion (October 2015 – April 2016) - \$2,404k
- OPG Engineering oversight for the design changes and extended duration of construction - \$1,142k
- The Burner Management System software has been re-categorized to account for personnel safety. OPG Engineering support for demonstrating compliance with the revised software categorization is estimated to be \$110k.
- OPG Project Management and Supports for the design changes and extended duration of construction - \$578k
- OPG Project Management and Supports for the extended duration of project - \$260k
- There is an increase in the Engineer, Procure & Construct (EPC) contract cost. The contractor was behind schedule and over spent. The contractor did not account for updating OPG's valve packing database. The contract was re-negotiated from performance fee type to fixed price type. The fixed price contract is greater by [REDACTED]
- After the construction was substantially complete, due to the piping penetrations through the security fence, additional blind spots were identified, and new security camera(s) and lights will be required. This work will be contracted out to the EPC Contractor or other - [REDACTED]
- Around the clock security surveillance of the fence will be required until the additional camera(s) and lights are installed. - \$1,051k
- A new bypass line will need to be installed in order to mitigate the nuclear safety risk of a steam line break. The existing line and valve are oversized, and will not limit the release of steam into the reactor auxiliary bay. This work will be contracted out to the EPC Contractor or other - [REDACTED]
- Increased contingency is required for the following risks
 - o [REDACTED] general contingency for the remaining work - [REDACTED]
 - o Delays in the field during steam line relocation in Unit 4 - [REDACTED]
 - o Software qualification will need to be performed by a third party, instead of crediting the testing and commissioning work that already been completed, in order to satisfy the revised software categorization. - [REDACTED]
 - o Risk of discovery issues (hazardous materials, contaminated soil, etc.) during CBH Demolition [REDACTED]

Project Over-Variance Approval

- The following table shows the contingency in the yearly cashflow (\$k):

Year	2016	2017	2018
Total Release without contingency			
Contingency			
Total Release with contingency	7,686	5,015	675


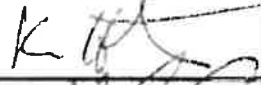

Options Considered to Mitigate Overruns:

- Converted the EPC contract from performance fee type to fixed price type for all remaining work.
- Where feasible, issue new requests for proposals to obtain competitive bids for outstanding scope.

Project Over-Variance Approval

Part B: Variance Detail				
k\$	Current Approval	Amount Requested	Variance	Comments
OPG Project Management & Support	5,812	7,701	1,889	<ul style="list-style-type: none"> - Project Management for the design changes, software qualification, and extended duration of construction (\$838k) - Temporary security enhancements (\$1,251k)
OPG Design & Engineering	2,857	4,110	1,253	<ul style="list-style-type: none"> - Engineering oversight for the design changes, extended duration of construction, and increased drawing office support (\$1,142k) - Demonstrate compliance to revised software categorization (\$111k)
OPG Procured Materials				
Vendor Core Team				
Design Contract (Historical)				
EPC Contract				
Interest				
Subtotal				
Contingency				
Total	99,497	107,149	7,652	
Removal Costs Included	4,354	4,354	0	

**Project Over-Variance
Approval**

Part C: Review/Approvals			
	Signature	Comments	Date
Recommended by: Glenn Jager CNO Project Sponsor			3 MAY 2016
Finance Approval: Ken Hartwick SVP Finance & CFO			13 11/16
Approved by: Jeff Lyash President & CEO			May 12/16

UNDERTAKING JT3.22

Undertaking

WITH REFERENCE TO CCC INTERROGATORY #8, TO PROVIDE A LIST OF THE PIRS COMPLETED AND APPROVED FOR THE NUCLEAR BUSINESS WITHIN THE LAST 12 MONTHS, INCLUDING THE DATE OF THE PIR, THE BUDGET, AND THE ACTUAL COST OF THE PROJECT

Response

Project Title	PIR Approval Date	Budget (\$M)	Actual Cost (\$M)
Radiation Sheilding Structure	26-Nov-15	4.0	4.0
PN Clean Water Supply for EHPSW and ELPSW Lube Lines	26-Nov-15	0.6	0.1
PA Dryer Beetle Power Supply Modification	27-Nov-15	0.4	0.2
Standby Generator Governor Upgrades	5-Jan-16	22.9	22.8
TMB Fire Code Compliance	18-Jan-16	0.4	0.3
PN Post Accident Gamma Monitoring	23-Jan-16	3.8	2.8
Radioactive Emission Reduction (Stack Monitors)	28-Jan-16	13.4	10.6
Modified 37-Element Bundles	4-Jul-16	9.0	6.0
PA Unit 4 FM Service Room Grating Modification	23-Jul-16	0.4	0.3
Pickering 'A' Machine Shop Modification	28-Jul-16	1.6	1.6
PA Turbine Steam Release Valve Solenoid Reliability Improvement	25-Aug-16	0.9	0.6
Severe Accident Management Guidance (SAMG) Implementation	22-Sep-16	19.5	15.4
Power Operated Valve Program Recovery Project	30-Sep-16	6.9	6.8
PA RB Ventilation Dampers Alternative Containment Boundary Configuration	3-Oct-16	0.3	0.1
PA EQ Containment Damper Deficiency - Installation of New Maintenance Dampers	18-Oct-16	1.5	1.4

SEC Interrogatory #21

Issue Number: 4.3

Issue: Are the proposed nuclear capital expenditures and/or financial commitments for the Darlington Refurbishment Program reasonable?

Interrogatory

Reference:

[D2/2/4, p.3-4]

Please provide a table showing all individual capital projects previously undertaken by OPG (and its predecessor Ontario Hydro) with a final cost of at least \$250M (in 2016 dollars) in the previous 30 years. For each of those projects, please provide the following information:

- a. Name and description of the project.
- b. Original forecast budgeted capital cost.
- c. Final capital cost.
- d. Capital cost variance.
- e. Rationale for cost variance (if +/- 10%).
- f. As applicable, lesson learned from the cost variance to the planning of the DRP project.
- g. Original forecast project completion/in-service date.
- h. Actual project completion/in-service date.
- i. Schedule variance.
- j. Rationale for schedule variance.
- k. As applicable, lessons learned from the schedule variance to the planning of the DRP project.

Response

Since 2005, the Niagara Tunnel Project is the only capital project at OPG's regulated facilities with a cost greater than \$250M (in 2016 dollars).

1 Consistent with OPG's conduct in EB-2007-0905, EB-2010-0008 and EB-2013-0321,
2 historical information for the period prior to 2005 is not provided. The information from before
3 2005 is not relevant as OPG was not regulated prior to April 1, 2005.

4
5 In issuing an earlier version of the filing guidelines for OPG's prescribed facilities (EB-2006-
6 0064), the OEB stated:

7
8 *OPG, along with some other stakeholders, submitted that data should not be required*
9 *for 2004 or earlier years, as proposed in staff's discussion paper. As the current*
10 *payment regime was implemented in April 2005, these stakeholders questioned the*
11 *relevance of 2004 and pre-2004 information. OPG, for its part, also indicated that*
12 *providing the information would be a significant burden for it. The Board has accepted*
13 *these submissions, and has not included information relating to 2004 or earlier years*
14 *in the Filing Guidelines.*

15
16 *OEB Cover Letter re: Setting Payment Amounts for Ontario Power Generation Inc.'s*
17 *Prescribed Generation Assets, Filing Guidelines, EB-2006-0064, July 27, 2007, p. 3.*

18
19 The OEB has, therefore, already made a determination that data from before 2005 is not
20 relevant.

21
22 Below is the information for the Niagara Tunnel Project:

- 23
24 a. Name: Niagara Tunnel Project
25
26 b. Original forecast budgeted capital cost: \$985M
27
28 c. Final capital cost: \$1,464M (Note: The total OEB-approved value was \$1,405M)
29
30 d. Capital cost variance: \$479M
31
32 e. Rationale for cost variance (if +/- 10%): Project encountered sub-surface conditions that
33 were significantly more adverse than anticipated based on pre-project geotechnical
34 investigations.
35
36 f. As applicable, lesson learned from the cost variance to the planning of the DRP project:
37 The specific lessons learned from the Niagara Tunnel Project that were provided to the
38 DRP can be found in Ex. L-4.3-2 AMPCO-052, Attachment 4.

39
40 With respect to the two lessons learned relating to cost specifically, DRP confirmed that it
41 implemented project cost estimates broken out by month and by the work breakdown
42 structure, and such estimates are provided at gate releases in advance of funding
43 releases. In addition, DRP also implemented a forecasting model to allow timely
44 forecasting of estimate-at-completion.

- 45
46 g. Original forecast project completion/in-service date: June 2010

Witness Panel: Darlington Refurbishment Program

- 1
2 h. Actual project completion/in-service date: March 2013
3
4 i. Schedule variance: 2 years, 9 months
5
6 j. Rationale for schedule variance: Project encountered sub-surface conditions that were
7 significantly more adverse than anticipated based on pre-project geotechnical
8 investigations.
9
10 k. As applicable, lessons learned from the schedule variance to the planning of the DRP
11 project.
12
13 The specific lessons learned from the Niagara Tunnel Project that were provided to the
14 DRP can be found in Ex. L-4.3-2 AMPCO-052, Attachment 4.
15
16 The Niagara Tunnel Project lessons learned with respect to schedule were based on its
17 success with using a time-way (linear) schedule. As DRP is a megaprogram made out of
18 many individual projects, each project schedule is developed individually and integrated
19 into the overall program master schedule. The schedule is also resource loaded so that
20 OPG can measure performance by hours and units as well as progress based on pre-
21 defined earning rules. For more information on scheduling and the earning rules, please
22 see Ex. L-4.3-1 Staff-057.

20 Project Closeout

20.1 Purpose

The purpose of the Project Closeout phase is to ensure that all Project related activities and deliverables are complete prior to completion of the Project and to determine whether the asset is attaining or exceeding the performance objectives (GFA, etc).

20.2 Description

The Closeout phase involves doing all the activities identified in the Project Closeout Plan to complete an orderly windup of the Project. This includes handoff of all remaining deliverables to the end users, closing out all contracts, finalizing Project costs and closing the OPG work order, ensuring the necessary records are filed, and reviewing lessons learned from the Project.

The OPG Project Director is responsible for preparing a Project Closeout Report or causing such report to be prepared by the OR. The Project Sponsor is responsible for reviewing and accepting The Project Closeout report after verifying that the scope of work and the Project objectives have been completed satisfactorily.

After the Project is in-service, a Comprehensive Post Implementation Review (PIR) will be conducted in accordance with the approved Business Case and current OPG governance to verify that the Project business objectives have been achieved and to capture lessons learned for future projects.

When it is determined that the scope of work and the Project objectives have been completed satisfactorily, the OPG Project Director will prepare a Certificate of Acceptance for acceptance by the Project Sponsor.

20.3 Prerequisites

Prerequisites for the Project Closeout Phase are

- Certificate of Substantial Performance of the ADBA for the Niagara Tunnel Facility
- new tunnel in operation
- Project Closeout Plan
- operating license (if applicable).

20.4 Key Activities

Key activities in the Project Closeout Phase are

- scope verification
- flow verification test
- finalise as-built documentation
- turnover all Project documentation to NPG
- prepare Deficiencies report, including schedule for rectification
- prepare Project Completion Report
- prepare Project Management Controls Report

- warranties for the Construction Contracts
- operating and maintenance manuals for the tunnel facility (to be provided in an editable file format)
- spare parts list
- training documentation for the facility
- all permits, certificates and licenses
- quality assurance records
- all Project correspondence files save those deemed “privileged” by OPG Law Division, such later files will be delivered to OPG Law Division.

20.9 Project Completion Report

The Project Completion Report will be prepared by the Project team under the direction of the OR Project Manager and will

- analyse Project performance relative to the PEP
- identify problems in Project execution and their solutions
- record the Project history focusing on those things the Project team would do again or do differently on another similar project. This information would be of particular importance to OPG should the fourth tunnel ever be built, and may also prove useful as OPG pursues other generation projects.

The “Lessons Learned” part of the report will address, among other things, the following:

- What contributed most to the success/failure of the Project?
- What worked well? What did not work well?
- What constraints limited our performance? How could those constraints be removed in future?
- Where did we have problems? Should these have been foreseen? If so, what indicators were missed?
- What innovations did we introduce on this Project? What were their impacts?
- What other things could we have done to improve Project performance and success?
- Is the client (NPG) satisfied with the facility as delivered?
- How effective was the Risk Management Plan in eliminating, avoiding, transferring, or mitigating risk events?

The OR Project Controls Manager will document all Project controls issues arising from the management of the Project, including cost, scope and schedule variances.

20.10 Certificate of Acceptance

The purpose of the Certificate of Acceptance is to ensure that all Project stakeholders and the Project Sponsor are satisfied that the Project is complete and meets their requirements.

A formal document will be prepared by the OPG Project Director for the approval and signature of the OPG Project stakeholders. This document will be accepted by the signature of the NPG Manager and the Project Sponsor.

AMPCO Interrogatory #54

Issue Number: 4.3

Issue: Are the proposed nuclear capital expenditures and/or financial commitments for the Darlington Refurbishment Program reasonable?

Interrogatory

Reference:

Ref: EB-2013-0321 D1-2-1 Att2 Project Execution Plan R03, The Niagara Tunnel Project, Project Execution Plan January 2013, Page

Preamble: Section 20.9 of the Project Execution Plan titled Project Completion Report states the following:

"The Project Completion Report will be prepared by the Project team under the direction of the OR Project Manager and will:

- analyse Project performance relative to the PEP
- identify problems in Project execution and their solutions
- record the Project history focusing on those things the Project team would do again or do differently on another similar project. This information would be of particular importance to OPG should the fourth tunnel ever be built, and may also prove useful as OPG pursues other generation projects.

The "Lessons Learned" part of the report will address, among other things, the following:

What contributed most to the success/failure of the Project?

What worked well? What did not work well?

What constraints limited our performance? How could those constraints be removed in future?

Where did we have problems? Should these have been foreseen? If so, what indicators were missed? What innovations did we introduce on this Project? What were their impacts?

What other things could we have done to improve Project performance and success?

Is the client (NPG) satisfied with the facility as delivered?

How effective was the Risk Management Plan in eliminating, avoiding, transferring, or mitigating risk events?

The OR Project Controls Manager will document all Project controls issues arising from the management of the Project, including cost, scope and schedule variances."

- a) Please provide the Project Completion Report prepared by the Project team under the direction of the OR Project Manager.

1 b) Please discuss how the lessons learned have impacted the planning of the DRP.

2
3 c) Please provide the project control issues documented by the OR Project Controls
4 Manager.

5
6
7 Response

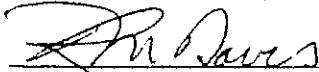
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9
10 a) Please see Attachment 1 for the requested Project Completion Report. The format and
11 content of the Project Completion Report ultimately differed from what was contemplated
12 in the Niagara Tunnel Project Execution Plan. Instead of reporting on lessons learned
13 and project controls within the Project Completion Report, this information will be included
14 in the Post-Implementation Review. Please see Ex. L-1.2-5 CCC-008 for more
15 information on the Post-Implementation Review.

16
17 b) Please see Ex. L-4.3-2 AMPCO-52 and L-4.3-15 SEC-21 for the integration of lessons
18 learned into the Darlington Refurbishment Program, including lessons learned from the
19 Niagara Tunnel Project.

20
21 c) Please see part a, as well as L-4.3-2 AMPCO-052, Attachment 4 on the lessons learned
22 relating to project controls.

**Niagara Tunnel Project
Post Implementation Review**

Prepared by:



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Canadian Power Utility Services
Date: Nov 30, 2016

Reviewed by:



C. Greco
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Date: Dec 2, 2016

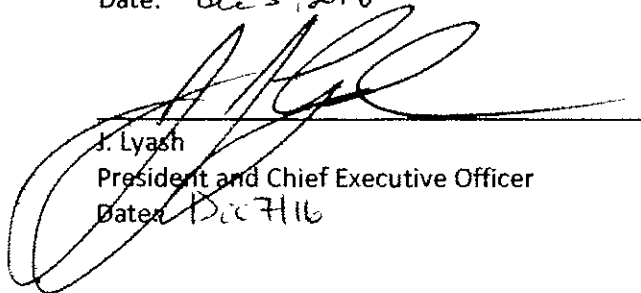
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M. Martelli
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Date: 2 Dec 16



K. Hartwick
Senior Vice President Finance, Strategy, Risk &
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Date: Dec 5, 2016



J. Lyash
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Date: Dec 7, 16

Niagara Tunnel Project

Post-Implementation Review

Niagara Tunnel Project

Post Implementation Review

Prepared by:

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Canadian Power Utility Services

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Executive Summary

The Niagara Tunnel Project was intended to take advantage of additional water available from the Niagara River under the Niagara Diversion Treaty, thereby increasing the annual energy output of the Sir Adam Beck (SAB) generating complex by up to 1.6 TWh per year. When the OPG Board of Directors approved it in July 2005, the new tunnel was expected to be in-service by June 2010, and the cost was estimated to be \$985 million.

Substantial geotechnical investigations to establish the subsurface conditions along the tunnel route had been carried out over several years prior to the Project. Nevertheless, unexpectedly difficult rock conditions were encountered within the Queenston Shale layer during the first year of tunnel mining. This resulted in a significant delay and Contractor claims for additional costs that required revision of the Project schedule and budget and approval of a Superseding Business Case by the OPG Board in 2009. Under an amended agreement with the Contractor, a new target cost and target schedule were established that set the approved tunnel in-service date as December 2013 and the revised Project budget, including contingency, at \$1,600 million. The tunnel was completed and put in service in March 2013 and the final Project cost is now expected to be approximately \$1,464 million.

The completed tunnel is 10.2 km long with a finished internal diameter of 12.7 m. It reaches a maximum depth below the surface of 140 m. The facility also includes a new intake and modifications to the existing International Niagara Control Works upstream of Niagara Falls, and an outlet with an emergency closure gate at the SAB end. The tunnel discharges into the Pumping Generating Station Canal near the PGS reservoir. The new tunnel has met its key business objective of delivering 500 m³/s of additional flow to the SAB Complex.

The Project was carried out using a Design-Build approach, with Strabag AG of Austria being the prime Contractor. A Tunnel Boring Machine manufactured by the Robbins Company under subcontract to Strabag was used to excavate the tunnel. Hatch Mott MacDonald acted as OPG's Owner's Representative throughout the Project.

6.79 million labour hours were worked on site over the eight years of construction. A total of 735 days were reported lost due to work-related injuries or illnesses for an overall LTI frequency of 0.94. This was below the Ontario construction industry average over that period. In addition, all Environmental Assessment and Community Impact Agreement commitments for the Project were met.

Appendix D – Lessons Learned

ID	Category	Issue	Problem/Success	Impact	Recommendation	Additional OPG Comments/Actions
1	Schedule	Time-way (linear) schedule.	Success - Excellent tracking and communication tool for a linear project.	Allowed the Project team, stakeholders, and sponsor to understand both progress and performance.	Although OPG carries out a limited number of linear projects, it could consider employing this format on other types of projects. Project team should document the Time-Way Scheduling process and any lessons learned to share with other project teams.	None.
2	Cost	BCS cost broken out by month in a defined work breakdown structure.	Success - Able to monitor against the baseline.	More accurate tracking/forecasting.	Projects should have a detailed cost broken out by month in advance of project release.	None.
3	Cost	Forecasting model.	Success - Development of a detailed forecasting model.	Ability to forecast final completion cost quickly after month end.	Projects should have a forecasting model developed in order to forecast final costs based on current month actuals.	None.
4	Scope	Disposal of surplus goods.	Problem - Unclear language in the ADBA with respect to: 1) Owner/Contractor roles in the Disposal of Surplus Goods Process, and	Inefficient use of resources (OPG, Owner's Rep, & Contractor) with numerous revisions of plans required.	Clear contract language that identifies OPG's expectations to optimize the net value recovered. Use of an unreserved auction was effective for a project of this size.	None.

ID	Category	Issue	Problem/Success	Impact	Recommendation	Additional OPG Comments/Actions
			2) Method of disposal.			
5	Scope	Identification of Plant Group wants/needs.	Problem - It was difficult for the Plant Group to identify all of their requirements from the concept drawings	Uncertainty about the end product (i.e. intake fencing, parking lot, fall arrest, etc.).	Involve appropriate stakeholders early in the project. The Plant Group needs to be provided sufficient time and resources to document what they want and the rationale. Dedicated resources should be considered.	None.
6	Quality	Owner requirements/ expectations and inadequate division of responsibilities.	Problem - Owner has limited input on Contractor's resource allocation to: QA, QC, Health & Safety, and Environment (i.e. production employees were responsible for quality control).	Owner requirements/ expectations in these areas not met. Production overrides quality - conflict of Contractor's priorities. Quality control was impacted.	Design-Build contracts should contain Owner's requirement for Contractor site positions, numbers, disciplines, and qualifications. If quality control is to be properly enforced by the contractor, a clear division/separation of the role must be made. Having production employees responsible for quality typically does not work. Independent management (i.e. 3rd party) of Quality is a	Further assessment of OPG contracting model/terms - emphasize inclusion of project-specific and/or OPG standards in the areas of safety, environment, & quality (SEQ).

ID	Category	Issue	Problem/Success	Impact	Recommendation	Additional OPG Comments/Actions
					better (recommended) approach for priority management.	
7	Quality	Issue management.	Problem - Reactive approach taken by Contractor to resolve technical/construction issues. Root cause analysis not performed by Contractor.	Cost and schedule impact.	In tunneling, the premise to battle through existing situations/conditions is the norm. Fixing a problem when it is encountered should be given greater consideration (i.e. over break, excessive construction water). Also, proceeding with work that does not have a submittal or has a submittal without an 'acceptable status' should not occur (i.e. overbreak restoration).	A more robust contingency planning process (by the contractor) to incorporate root cause techniques to support problem resolution of construction/technical issues.
8	Quality	Method Statements.	Problem - Contractor did not utilize method statements effectively.	Education by OR required.	Method Statements are an effective tool if taken seriously and prepared with the intent of being utilized and not just to satisfy a Project/Contract requirement.	Provide Method Statement templates/examples that clearly outline expectations of Contractor.

ID	Category	Issue	Problem/Success	Impact	Recommendation	Additional OPG Comments/Actions
9	Human Resources	Consistent staffing.	Problem - There were significant staff changes in the Plant Group engineering and management ranks as a result of the long duration of the project.	No real buy-in/alignment from Plant Group staff to review/comment on any drawings circulated.	No recommendation - it is difficult to allocate OPG production and engineering staff on a project for 8 years.	None.
10	Human Resources	Team building.	Success - A team-building event held at the beginning of the project allowed all parties (Contractor & key subcontractors, OPG, OR) to get to know each other on a personal basis.	This opened the lines of communication and assisted in building trust between parties which allowed resolutions to be achieved on a shorter timeline.	Whether it is an organized team building event or simply a summer barbecue, these events should be held on a regular basis throughout the life of the project.	None.
11	Human Resources	Dedicated core project team.	Success - core OPG/OR project team remained dedicated to the Project.	Consistency and limited knowledge transfer loss.	Start out with key players and bring on people as needed.	None.
12	Communications	Use of tables and bullets in the monthly report.	Success - Although making the monthly report somewhat longer, the use of table and bullet formatting in various sections of the report made the detail contained in the monthly report more visible and comprehensive.	Improved communications.	Share NTP monthly report template with the HTO PMO to make it available for other projects.	None.

ID	Category	Issue	Problem/Success	Impact	Recommendation	Additional OPG Comments/Actions
13	Communications	Community Impact Agreement (CIA) & Liaison Committee.	Success - Forecast impacts of the Project on the host communities were proactively addressed.	Compensation payments permitted host municipalities to address significant local concerns in advance and the Liaison Committee promoted ongoing dialogue to limit community issues throughout Project execution.	Adopt similar agreements & procedures with host communities where warranted by project scale & potential community impacts.	None.
14	Communications	Communication management.	Problem - Information was not consistently being cascaded to the site-level. Miscommunication with external stakeholders.	OPG reputation. Project cost and schedule.	Ensuring the most recent/accurate information is available to those that require it. Too often information is not shared and by the time it reaches the level where it is required it is either too late or inaccurate. Sharing information is a key to success.	Incorporate Contractor into overall project communication matrix. Contractor discipline / management system issue.
15	Communications	Partnering approach / teamwork.	Success - All parties eventually 'bought into' the partnering concept even though the Contractor was very silo'd (internally).	Effective teamwork and cooperation by external stakeholders.	If a partnering concept is established early in the project, it can be extremely effective. Effective partnering requires 'give-and-take' on both sides. Having divided sectors which may have individual	OPG's code of conduct and expense policies may restrict team building opportunities with external contractors and forego the benefits.

ID	Category	Issue	Problem/Success	Impact	Recommendation	Additional OPG Comments/Actions
					needs that are put above completion as a whole are harmful and not in the spirit of partnering. Recognizing/considering the thoughts/ideas of others is a part of this.	
16	Risk	Comprehensive risk review meetings.	Success - The diverse attendance of key project management and construction staff allowed for productive risk review meetings (monthly reviews and analysis meetings).	Proactive risk management with risk definition and risk response actions evolving over the life of the project.	Commercial terms and conditions with installation contractors, design contractors, and owner's engineer should stipulate involvement of all parties in co-operative risk management activities.	Emphasize 'shared' risk register approach.
17	Risk	Combined risk management process was required by underwriters of the Builders All-Risk Insurance.	Success - It promoted collaboration between the contractor, owner, & owner's rep in the identification and management of the majority of the significant Project risks.	Strong communication amongst all parties concerning design & construction risks ensuring clear understanding of risks, appropriate mitigation, & clear establishment of accountabilities.	Where warranted by project scale & risks, adopt combined risk management process ensuring owner / contractor collaboration on risk management during execution of future OPG projects.	Share this practice with other HTO PMO Clients at a future quarterly PMC meeting.
18	Risk	Format of the risk registers.	Problem - Original risk registers were populated in Excel format. Became cumbersome to review.	Less efficient meetings.	Populate risk registers in a database format to allow for easier sorting / review of risks and tracking of changes.	Look at using established commercial software for this on future projects.

ID	Category	Issue	Problem/Success	Impact	Recommendation	Additional OPG Comments/Actions
19	Risk	Attempt to transfer risk through fixed price.	Problem - Design-build lump-sum contract model gives the Owner the expectation of risk acceptance by the Contractor even though the risk has not been adequately assessed or priced. Risks that are not identified and allocated become disputes.	Project may not have had sufficient overall cost allocation (contingency) to cover risks. False sense of security in reporting to corporate oversight.	Risk assessment must start before the contract stage, be thorough and documented. Allocation of risk must be addressed in the contract.	None.
20	Procurement	Contracting strategy - Fixed-price contract inappropriate for projects with significant site-specific underground or geotechnical risks.	Problem - Significant geotechnical risk that Design-Build contractor never accepted. Conditions were more adverse than the baseline which resulted in claims / disputes. Contractor cannot absorb significant losses (without potential for recovery on future work).	Increased costs and schedule delays due to significant work/time to: (i) resolve disputes, and (ii) renegotiate the contract.	Forego fixed price where geotechnical risks are high and match contracting strategy to risk profile. Use target cost approach with incentives/disincentives to optimize risk transfer to contractors.	Consider utilization of the CII PDCS tool.
21	Procurement	Contract renegotiation.	Success - Renegotiated Target Price Contract was accurate with no cost or schedule overruns over a period of four years.	There was a shared ownership of cost and schedule and more awareness of Owner's risk.	Better model for underground works than fixed price.	None.

ID	Category	Issue	Problem/Success	Impact	Recommendation	Additional OPG Comments/Actions
22	Integration	Owner's Rep. and OPG (Project Management and Law) co-ordination of Project changes and risk management.	Success - Very successful integration of Owner's Rep. and OPG (Project Management and Law) efforts related to the drafting, review, and signoff of PCD's.	Well-defined roles resulted in effective management of Project risks and changes - best practices in team integration employed.	Project management teams employing external Owner's Rep.'s should reference NTP - reflects an excellent use of personnel and resources and effective time management as well as risk mitigation practices. Best practices employed with very successful results.	None.
23	Technical / Design	Original contract did not require full-time design representative at site. Requirement added when Amended Design-Build Agreement (ADBA) was negotiated.	Problem - Initial problems with construction QC and interpretation of design when design rep. was not on site.	QC and engineering issues leading to delay and rework (cost and schedule impact).	When using the Design-Build project delivery model, the Contractor should be required to have a design representative on site full-time during construction.	None.
24	Technical / Design	Lack of technical and procurement expertise allocated to the Project by the Design-Build contractor.	Problem - Design-Build contractors tend to focus resources on the areas of the work where the company has expertise (i.e. contractor focus on tunnelling to the	Lack of management and coordination of subcontracts leads to cost over-runs, quality issues and schedule over-runs.	Design-Build contracts should contain Owner's requirement for site positions, numbers, disciplines, and qualifications.	None.

ID	Category	Issue	Problem/Success	Impact	Recommendation	Additional OPG Comments/Actions
			detriment of structures, gates, mechanical equipment, etc.).			
25	Technical / Design	Resolution of problems.	Success - Major problems were overcome by OPG, the Owner's Rep., and the Contractor working together harmoniously and pragmatically	Timely resolution of problems.	In part this was made possible by scoring and choosing the correct Contractor during proposal evaluations.	None.
26	Business Processes	Signing authorities for contract changes - same level of signing authority for changes as in the original contract.	Problem - Difficult to obtain executive level signatures. Numerous change orders over life of contract and some were of insignificant value or had no impact on cost or schedule envelopes.	Slows down the change management process; requires unnecessary legal input because of 'high level signature'.	Reconsider OPG OAR policy given success with revised DBA precedent that permits flexible contract administration - low cost (under \$100K) and no schedule changes within approved cost and schedule envelopes do not require signing by EVP levels; set-up specific project authorities tailored to the project.	Include detailed descriptions on PCD's.

ID	Category	Issue	Problem/Success	Impact	Recommendation	Additional OPG Comments/Actions
27	Project Controls	Inadequate inventory management by the Contractor.	Problem - Difficulty in substantiating the value of goods in inventory at the time of contract conversion to target-price and substantiating the value of surplus goods at disposition (i.e. scrap/write-off, transfer or sale).	Reputational risk for OPG concerning inadequate controls, risk of inability to recover unsubstantiated Project costs, etc.	Ensure that future contracts stipulate OPG expectations on robust inventory management to facilitate substantiation of procurement activities and control of OPG-owned project assets.	OPG also needs to have proper project controls infrastructure in-place to support target-price contracts.
28	Project Controls	Inconsistent use of cost, schedule, and resource tracking tools.	Problem - True schedule position not well understood by all stakeholders. Each stakeholder had difficulty in assessing true cost, schedule, and resource position.	Ineffective resource allocation. Schedule and cost impact.	Decide on standard tools (project-specific) early in the process and allocate resources to ensure consistency and compliance with standards. Utilize simple forms (i.e. inspection, audit, or summary forms) to accurately capture and report on daily progress.	Common scheduling approach required - contractor tracked progress outside of P3 and had to report using P3.
29	Project Controls	Subcontractor management.	Problem - Subcontract submissions and claims were a straight pass through by the Contractor without any review.	Negotiations more difficult and time consuming. No language in Contract to force the Contractor to review for reasonableness.	More of a relationship issue - Emphasize requirement for a subcontractor management plan and OPG expectations. There are limited opportunities to update our contract T&C's.	None.

ID	Category	Issue	Problem/Success	Impact	Recommendation	Additional OPG Comments/Actions
30	Project Controls	Dispute Resolution processes - OPG's use of a DRB composed of 'professional arbiters'.	Problem - Original DRB process did not result in a streamlined, satisfactory resolution of the major overbreak claim. In particular, usual protections of legal proceedings (like arbitration or litigation) were not available resulting in significant risk to OPG.	A decision that required a "compromise" and ultimately a renegotiation of the DBA. Significant additional legal costs and management time expended in a process with an 'unknown' outcome.	Limit use of DRB's in DB agreements (possibly to technical issues only). Before any 'new' process is used or considered for use as a dispute process, ensure it has been practically evaluated in (a) OPG, or (b) industry. Where speed of resolution outweighs risk of a finding against OPG, consider more informal resolution processes (such as an advisory committee of executives or technical panels of experts) and write the process into the agreement. Arbitration and litigation for significant issues remains the preferred approach.	None.
31	Health and Safety	Owner-Only execution.	Success - The Owner's Rep. and Plant Group did a very good job separating Strabag's work from the Plant Group's work.	Minimal risk of OPG assuming Constructor role for the entire project.	Requirement to establish clear, consistent boundaries between the contractor and OPG.	None.

ID	Category	Issue	Problem/Success	Impact	Recommendation	Additional OPG Comments/Actions
32	Environment	EA commitments (made several years prior) constrained opportunities during detailed design & construction.	Problem - Limited creativity on design and construction that prevents incorporation of Contractor experience and innovations that could reduce Project cost and shorten the duration of the project.	Prevented potential cost & schedule savings such as tunnel alignment through St. Davids Gorge (above problematic Queenston shale), multiple workfaces, excavation methods, construction logistics, etc.	Throughout the EA process on future OPG projects, retain as much flexibility as possible to accommodate subsequent (contractor) experience & innovations during detailed design & construction.	None.
33	Environment	Environmental Management Plan	Problem - Although this was a comprehensive document and a very good planning tool, it needed updating as the Project proceeded into construction. Tendency was for the document to be more theoretical than practical. Also, the actual Contractor environmental staff numbers were much less than initially defined.	Increased regulatory compliance risks.	Insufficient resources - Probably one manager and 2 assistants would have been the appropriate level of environmental staffing, especially in the initial stages. The use of third party consultants, rather than on site specialists, proved to be the manner of addressing many of the technical issues (e.g. water treatment, storm water management plan).	None.

ID	Category	Issue	Problem/Success	Impact	Recommendation	Additional OPG Comments/Actions
34	Environment	Water treatment requirements.	Problem - Plant as initially sized was too small for the amount of water and sediment to be processed. Specifically, the sediment/total solids loading was considerably more than anticipated. The first retention pond was poorly designed/constructed.	Sedimentation plans had to be developed and then amended as the Project proceeded. Also, process water had to be discharged at the Intake, after the FOG, this water should have been treated in the same manner as that being discharged at the Outlet or the piping system within the tunnel should have been restored much more quickly to route the water back to the Outlet.	The addition of the more robust sedimentation pond upstream of the initial pond with the cells operating on a rotating basis greatly alleviated the problem. Use of the sediment, combined with organic matter, proved to be a useful material for site restoration/revegetation.	None.
35	Stakeholder Management	EPSCA Labour Relations	Success - Contractor used a single union (labourers) employed under the EPSCA agreement.	EPSCA prevents major strikes (however does not stop inter-union squabbles over jurisdiction).	Note: This approach required the Contractor to resolve disputes at the labour board and may have prevented expertise from other skilled trades. This is a project-specific LR approach.	None.

ID	Category	Issue	Problem/Success	Impact	Recommendation	Additional OPG Comments/Actions
36	Stakeholder Management	Relationship with Regulatory Agencies	Success - Good Relationship with Regulatory Agencies. Upfront consultation and ongoing meetings with key agencies (e.g. MOE, DFO, MNR) and local municipalities – greatly assisted.	Issues could normally be directly addressed.	Upfront consultations and meetings with Regulatory Agencies. Development of working relationships.	None.
37	Records Management	Project mandated to use OPG's SCI system.	Problem - No explanation/description provided for each SCI number which left room for misinterpretation in numbering/filing of documents, drawings, correspondence, etc.	Many submittals/documents have been given the wrong SCI number; NPG will need to cross-reference to correct the SCI number.	Provide detailed descriptions and examples for each SCI number mandated to be used on a project managed by an outside consultant.	None.
38	Records Management	Project database.	Problem - Multiple databases were used to track Project information.	Provided ability to locate various information quickly. Using multiple databases required double entry at times. The submittal database was secure which limited the flexibility to make required changes.	An all-inclusive database program to track all project information, which provides program flexibility. Note: These types of programs were not very common at the time this project was initiated.	None.

AMPCO Interrogatory #10

Issue Number: 1.2

Issue: Are OPG's economic and business planning assumptions that impact the nuclear facilities appropriate?

Interrogatory

Reference:

Ref: Exhibit A2-1-1 Attachment 1 Page 10

Preamble: The evidence states "In the first quarter of 2014, the OSC approved an exemption which allows OPG to apply US GAAP up to January 1, 2019."

- a) Please discuss OPG's strategy in 2019 and beyond regarding US GAAP versus IFRS and the impact on revenue requirement of any anticipated adjustments.

Response

- a) Refer to Ex L-01.2-1 Staff-2a).

Board Staff Interrogatory #2

Issue Number: 1.2

Issue: Are OPG's economic and business planning assumptions that impact the nuclear facilities appropriate?

Interrogatory

Reference:

Ref: Exh A2-1-1, Attachment 3, Page 120

OPG received exemptive relief from the Ontario Securities Commission requirements to allow it to file consolidated financial statements based on US GAAP without becoming a US Securities and Exchange Commission registrant or issuing public debt. This exemption was received in the first quarter of 2014 and is effective until the earlier of January 1, 2019, the year after OPG ceases to have rate regulated activities or the date the International Accounting Standards Board prescribes the mandatory application of an IFRS standard to rate regulated entities.

- a) Please explain OPG's plans when any of these conditions are met with respect to the accounting standard to be used going forward.
- b) Please explain the potential rate setting impact since at least one of these conditions will be met during OPG's test period (i.e. January 1, 2019).

Response

- a) OPG is in the process of assessing potential options should the Ontario Securities Commission (OSC) exemption lapse under one of the three conditions referenced in the question. The company's plans in this regard have not been finalized and may depend on which of the three conditions is triggered. OPG's current thinking related to the three conditions is summarized below.

Before turning to the specifics, OPG notes that should the OSC exemption lapse and OPG be required to prepare a set of financial statements in accordance with IFRS for public filing purposes, the company would continue to prepare a set of statutory financial statements (and therefore maintain a set of financial records) under US GAAP as required by O. Reg. 395/11 under the *Financial Administration Act (Ontario)* (see Ex. A2-1-1 Att. 3, page 120). OPG would bring the matter to the OEB's attention.

- 1) OPG ceases to have rate regulated activities – As OPG would no longer be subject to rate regulation by the OEB, the company's plans in this scenario would not impact the rate-setting process.

- 1 2) January 1, 2019 – This trigger would apply if the International Accounting Standards
2 Board (IASB) has not issued and made effective, by this date, its decision on how
3 rate regulated accounting is to be addressed by IFRS. If it becomes reasonably likely
4 that an IASB decision on the rate regulated accounting standard under IFRS will not
5 be finalized with an effective date of January 1, 2019, OPG would consider whether
6 to seek the OSC's authorization for continued application of US GAAP for public filing
7 purposes. A contributing factor to the OSC requirements for disclosure is the reliance
8 that stakeholders place on the financial information reported by OPG. The extent to
9 which OPG has U.S. investors as its capital holders would factor into the ultimate
10 determination of OPG's reporting standard.
11
- 12 3) The International Accounting Standards Board prescribes the mandatory application of
13 an IFRS standard to rate regulated entities – The IASB project on rate regulated
14 activities has been ongoing for several years and is expected to provide greater
15 clarity regarding the application of IFRS standards to rate regulated entities. Upon
16 the outcome of the project, OPG would assess its options regarding reporting
17 standards, taking into account such factors as: the nature of the IFRS standard
18 determined to be applicable to rate regulated entities, the likelihood of obtaining the
19 OSC's authorization for continued application of US GAAP, the reliance placed on the
20 company's financial statements by investors, and the potential implications on the
21 rate-setting process.
22
- 23 b) OPG has not assessed the potential rate-setting impact of IFRS during the IR Term.
24 Should OPG be required to adopt IFRS for public financial disclosure purposes, OPG
25 would bring the matter to the OEB's attention.