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STANDING COMMITTEE ON PUBLIC ACCOUNTS

DARLINGTON NUCLEAR GENERATING STATION REFURBISHMENT PROJECT

(SECTION 3.02, 2018 ANNUAL REPORT OF THE OFFICE OF THE AUDITOR
GENERAL OF ONTARIO)

1st Session, 42nd Parliament
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The Honourable Ted Arnott, MPP
Speaker of the Legislative Assembly

Sir,

Your Standing Committee on Public Accounts has the honour to present its Report and commends it to the House.

Catherine Fife, MPP
Chair of the Committee

Queen's Park
December 2019

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1st Session, 42nd Parliament
(as of October 28, 2019)

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* MICHAEL GRAVELLE was replaced by JOHN FRASER on October 31, 2019.

PETER TABUNS regularly served as a substitute member of the Committee.

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CONTENTS

INTRODUCTION	1
ACKNOWLEDGEMENTS	1
BACKGROUND	1
AUDIT OBJECTIVE	2
MAIN POINTS OF AUDIT	2
ISSUES RAISED IN THE AUDIT AND BEFORE THE COMMITTEE	3
Demand and Supply of Skilled Trades and Experienced Management Staff	3
Contractors' Performance and Profits	4
Safety Performance	5
Prerequisite Project Work Costs	6
CONSOLIDATED LIST OF COMMITTEE RECOMMENDATIONS	9

INTRODUCTION

On April 10, 2019, the Standing Committee on Public Accounts held public hearings on the audit of the Darlington Nuclear Generating Station Refurbishment Project (Section 3.02 of the Auditor General's *2018 Annual Report*).

The Committee endorses the Auditor's findings and recommendations, and presents its own findings, views, and recommendations in this report. The Committee requests that Ontario Power Generation (OPG) and the Ministry of Energy, Northern Development and Mines (Ministry) provide the Clerk of the Committee with written responses to the recommendations within 120 calendar days of the tabling of this report with the Speaker of the Legislative Assembly, unless otherwise specified.

ACKNOWLEDGEMENTS

The Committee extends its appreciation to officials from Ontario Power Generation and the Ministry of Energy, Northern Development and Mines. The Committee also acknowledges the assistance provided during the hearings and report-writing deliberations by the Office of the Auditor General, the Clerk of the Committee, and staff in the Legislative Research Service.

BACKGROUND

OPG generates about half of the province's electricity primarily through 66 hydroelectric stations and two nuclear generating stations (NGSs): Darlington NGS (Darlington), located in Clarington (70 km east of Toronto), and Pickering NGS (Pickering), located in Pickering (just east of Toronto). Darlington began operating in 1990 and has four nuclear reactor units. It has generally produced over 15% of the electricity used in Ontario.

In 2006, at the direction of the Ontario government, OPG began assessing the feasibility of refurbishing Darlington Station's four nuclear reactor units, as these units' useful life was expected to end in the early 2020s. In January 2016, about five months after appointing a new president and CEO, OPG announced that it was ready to execute the Darlington Nuclear Generating Station Refurbishment Project (Project), which it estimated would:

- cost \$12.8 billion (\$10.8 billion of estimated Project costs and \$2 billion in contingency amounts to cover the cost of potential additional risks that might occur during the Project);
- take 10 years (from October 2016 to February 2026) to complete the main refurbishment work; and
- extend the useful life of Darlington's four nuclear reactor units to around 2055.

The majority of Project work has been contracted by OPG to external contractors, including a joint venture between SNC-Lavalin Nuclear Inc. and AECON Construction Group Inc. to complete the main nuclear reactor refurbishment work. As of June 30, 2018, OPG had about 980 of its own full-time-equivalent staff and about 1,500 contractor staff working on the Project.

In order to carry out the Project, OPG needed to obtain regulatory approval from the Canadian Nuclear Safety Commission (Commission), an independent federal agency that regulates the production and use of nuclear energy in Canada. OPG was required to identify any potential gaps between Darlington Station's operations at that time and the newest modern safety standards and practices, and to develop a plan for addressing those gaps.

AUDIT OBJECTIVE

The objective of the audit was to assess whether OPG had effective systems and procedures in place to

- plan and execute the Project in a cost-effective and timely manner in accordance with applicable legislation and standards; and
- manage, monitor, and publicly report on the progress and performance of the Project to protect the interest of Ontarians.

MAIN POINTS OF AUDIT

OPG faced significant challenges and experienced cost overruns and delays in Project work that started prior to January 2016. However, it has applied lessons learned from that period to the remaining Project work and in the development of its cost and time estimates. OPG subsequently established time and cost estimates for the Project based on reliable information and reasonable assumptions. A fair and transparent procurement process was followed in the selection of the majority of contractors for the Project. A clear accountability structure is in place ensuring that contract terms and legislated safety and environmental standards are followed by staff and contractors, and that performance is monitored and appropriately addressed in a timely manner. Project timelines and costs are being managed, monitored, and publicly reported on a regular basis and corrective actions are taken when issues arise.

However, given the complexity of the Project and risks associated with work not yet done, uncertainty still remains as to whether the Project will be completed on time and on budget. Therefore, OPG must remain vigilant until the completion of the Project to avoid or mitigate risks.

ISSUES RAISED IN THE AUDIT AND BEFORE THE COMMITTEE

The following sections detail additional significant issues that were raised in the audit and before the Committee.

Demand and Supply of Skilled Trades and Experienced Management Staff

OPG will be in competition for skilled trades, particularly boilermakers (who remove and install nuclear reactor unit components), during several years when the Darlington refurbishment will overlap with the Bruce NGS refurbishment.

At the same time, OPG estimates that over 30% of its management staff and nearly all of its executives from its Darlington Refurbishment group will be eligible to retire by 2025 (before the Project's completion).

In response to the Auditor's recommendations, OPG noted that, in conjunction with the Electrical Power Systems Construction Association (EPSCA) and Bruce Power, it has forecasted demand for each skilled trade in the nuclear sector and will continuously update supply/demand models for critical risk trades.

OPG added that it also monitors impacts to the supply/demand model by non-nuclear infrastructure projects inside and outside of the Province and uses industry associations for additional information. OPG acknowledged that boilermakers' supply has been identified as the most significant skilled trades gap. To address this gap, OPG has launched a pre-apprenticeship program to fast track 100 boilermaker apprenticeships in 2019 and endeavoured to monitor apprenticeship commitments by OPG's vendors, among other initiatives.

OPG, Bruce Power, and the EPSCA have implemented a joint initiative aimed at ensuring skilled trades information is shared, and resource forecasts and strategies are developed in partnership. OPG has streamlined security clearances and implemented joint training programs to optimize worker capacity and capabilities.

OPG identified skilled trade resourcing as a risk early in the planning process for the Project and has been actively implementing tactical initiatives since 2015 aimed at mitigating this risk. Initiatives include

- significant advocacy work with all levels of government and schools;
- partnering with Skills Ontario, Durham College, General Motors, and various provincial and federal ministries to attract and train skilled trades for the nuclear industry; and
- collaborating with federal and provincial stakeholders to facilitate peak demand resourcing using international boilermakers.

OPG has also developed and implemented succession planning and development programs. OPG leverages a variety of industry best practice tools to ensure appropriate succession planning from line management through to executive management positions. For several positions, the process also interfaces with OPG business units that are outside of the Project. Successors

have been identified for all key management and executive management positions and for roles that require specialized skills or significant experience to be proficient.

OPG also leverages the external market for some roles, and in some cases, may choose to pursue an external candidate versus internal succession candidates.

All successors have Individual Development Plans that identify specific areas for training and development to ensure readiness and success. The succession planning process has also been enhanced to eliminate the same successors being identified for multiple roles. The succession planning process will continue throughout the life of the Project and will reflect changes in the organization as the project transitions from execution of the Unit 2 refurbishment to execution of future unit refurbishments.

Committee Recommendations

The Standing Committee on Public Accounts recommends that:

- 1. Ontario Power Generation should periodically update its forecast of the future supply of skilled trades identified as being at risk of shortage over the lifetime of the Project.**
- 2. Ontario Power Generation should continue to leverage industry best practices to ensure appropriate succession planning programs are in place over the duration of the Project.**

Contractors' Performance and Profits

The Auditor found OPG's costs have increased as a result of providing more assistance than expected to underperforming contractors, but it is not considering the increased costs when paying profit to these contractors. OPG has had to provide more assistance (mainly supervisory or management assistance) to contractors than it initially estimated to keep the Project on time and on budget. As of June 30, 2018, OPG estimated that it will spend almost \$50 million more on Project oversight and support than it initially estimated (including costs associated with providing additional support to contractors). However, OPG has not considered these additional costs when determining the amount of profit to pay the contractors.

In response to the Auditor's recommendations, OPG noted that it collaborates with its vendors using several arrangements, which are outlined below:

- In cases where OPG as the owner needs to monitor vendors' execution activities to ensure services are rendered in accordance with the terms and conditions of the contract, on time, on budget, safely, and with quality, OPG's oversight teams are "co-located" with the vendor execution team to facilitate accurate, transparent, and efficient communication.
- In rare instances, where OPG believes that the unique expertise lies within its own organization (e.g., plant-specific knowledge), it steps in to assist contractors directly.

OPG noted that as the Project owner it is ultimately accountable, and that stepping in to assist the contractors is the most prudent and cost-effective way to manage risks in some cases. OPG tracks the costs associated with the support provided and retains contractual rights to recover these amounts at a later date.

The Project has a dedicated contract management group responsible for proactively managing commercial matters, including

- management and enforcement of contracts within the agreed terms and conditions;
- performance of post-payment audits;
- recovery of costs in accordance with contractual terms; and
- preparation, negotiation, and issuance of contract amendments.

Committee Recommendation

The Standing Committee on Public Accounts recommends that:

- 3. Ontario Power Generation should continue to track the costs associated with the support provided to contractors and retain contractual rights to recover these amounts at a later date.**

Safety Performance

The Auditor noted that there have been no serious injuries to Project staff; however, OPG had not met its safety targets and could be more proactive in its safety efforts. While the severity of safety incidents on the Project has been low (i.e., no staff injured on the Project had to miss work for more than one day), the frequency of safety incidents has remained mostly unchanged, at about 0.5 incidents for every 200,000 hours worked between 2016 and the first half of 2018. This is higher than OPG's targets of 0.24 in 2016 and 0.37 in 2017 and 2018. OPG investigated individual incidents but could do more to prevent recurring incidents (such as staff dropping tools from above ground that nearly hit others).

In response to the Auditor's recommendations, OPG noted that it continues to have a healthy reporting culture, with low level events being consistently identified, reported, and trended. OPG uses a self-critical, proactive leading indicator (what the Auditor refers to as "near misses") in order to evaluate and assess precursors of possible safety incidents. OPG has modified its process for trending safety events, and since 2018, trending of data has been increased to monthly (from quarterly) in order to better respond to emerging trends.

OPG has performed an analysis of all 2018 safety events, to assess the effectiveness of corrective actions implemented in response to specific safety events, and found the following:

- Working at Heights: following the implementation of corrective actions stemming from an adverse trend in 2017, the number of high Maximum

Reasonable Potential for Harm (MRPH) events dropped from 8 in 2017 to 1 in 2018.

- **Material Handling:** following the implementation of corrective actions stemming from a self-assessment performed in response to an adverse trend in March 2018, the number of low level material handling events over the past twelve months dropped from 25 to 15.
- **Falling Objects:** following the implementation of corrective actions stemming from an adverse trend in 2017, the number of high Maximum Reasonable Potential for Harm (MRPH) events dropped from 5 in 2017 to 2 in 2018.

OPG works with its vendor partners to ensure that robust corrective action programs are in place and adverse safety conditions are effectively tracked, trended, investigated, and addressed. OPG also observes the vendor's corrective action program to ensure it effectively promotes safe project execution. OPG stated that any declines in vendor safety performance will continue to be addressed.

The 2017 safety stand-down (i.e., suspension of work) was taken to remind all vendor staff of the importance of good safety practices, and has been reinforced jointly by OPG, its vendors, and industry experts.

In 2019, OPG introduced an additional corporate-wide leading indicator for safety, Timely Completion of Safety Corrective Actions (TCSCA), which measures completion of corrective actions arising from high level significant safety events. OPG recognized that hand and eye injuries were a big contributor to medically treated events in 2018, and as a result, has proactively introduced new face protection and glove standards for specific work activities.

OPG's processes for investigating safety incidents and implementing corrective actions are continually assessed and remain aligned with industry best practices, including assessments for common causes.

Committee Recommendations

The Standing Committee on Public Accounts recommends that:

- 4. Ontario Power Generation should continue to monitor and analyze safety events in order to identify common causes, better respond to emerging trends, assess the effectiveness of corrective actions, apply lessons learned over the duration of the Project, and introduce new safety indicators if needed.**
- 5. Ontario Power Generation should provide vendors with regular updates about safety standards and industry best practices to remind all vendor staff of the importance of good safety practices.**

Prerequisite Project Work Costs

Prior to starting the main refurbishment work on its four nuclear reactor units, OPG had to perform work on 18 prerequisite projects. The Auditor found that the total cost of these prerequisite projects is expected to be over \$725 million (or

over 75%) more than initially estimated, and to be completed later than planned. About \$345 million of this significant cost overrun was already included as estimated spending in the Project's total cost estimate of \$12.8 billion, which OPG publicly released in January 2016 (with the majority of the remaining cost overrun covered by the Project's contingency). The main causes for the cost overrun, as outlined by the Auditor, are listed below:

- OPG relied on initial prerequisite Project work cost and time estimates that were not based on a detailed understanding of the Project's complexity and technical requirements.
- OPG did not accurately consider known risks when developing contingency amounts for prerequisite Project work.
- Some contractors were selected to perform prerequisite Project work largely based on their low bid prices even though competing contractors scored higher on technical criteria.
- Prerequisite Project work was assigned to OPG staff with limited relevant experience.
- Project management and oversight of contractors performing prerequisite Project work were inadequate.

In response to the Auditor's recommendations, OPG noted that the process established for developing the first unit estimate (Unit 2) is the same process that will be used to develop estimates for all subsequent units, and is consistent with industry best practices. OPG added that the Project uses a stage gate (i.e., decision points) process to develop detailed planning prior to releasing execution funds at the project-level within the program.

OPG revised and issued its procedure for procurement activities which includes the following relevant features:

- In preparation of the Procurement Package, a number of factors are considered including, for example, Scope of Work, Technical Requirements, Applicable Codes and Standards, etc. ("Procurement Package").
- The evaluation criteria and weightings are determined collaboratively between the procurement departments (known as the Supply Chain) and the project manager (known as the Requisitioner), and are fully disclosed to the participants.

OPG stated that it will continue to incorporate lessons learned and industry best practices on project management into governance, processes, tools, and training in accordance with the Enterprise Project Excellence Initiative, including the following:

- **Enterprise Projects Organization:** Implement a centre-led Project Management Organization (PMO) and other project support services across OPG.

- **Processes and Standards:** Standardize governance and processes for project management, project controls, portfolio management, and commercial management to enable a scalable project delivery model.
- **Peer Team:** Establish a peer team for the purpose of performance improvement.
- **Tools and Software:** Standardize project support software for cost, schedule, risk, reporting, portfolio management, and commercial management.
- **Resources and Training:** Improve knowledge and proficiency of key project resources.
- **Project Portfolio Management:** Further align the project portfolio with enterprise strategic objectives.
- **Metrics and Analytics:** Standardize portfolio reporting metrics and analytics.

Committee Recommendation

The Standing Committee on Public Accounts recommends that:

- 6. Ontario Power Generation should periodically review its evaluation scorecards as part of its procedure for procurement activities and adjust the weightings applied to technical criteria and bid price as necessary.**

CONSOLIDATED LIST OF COMMITTEE RECOMMENDATIONS

The Standing Committee on Public Accounts recommends that:

- 1. Ontario Power Generation should periodically update its forecast of the future supply of skilled trades identified as being at risk of shortage over the lifetime of the Project.**
- 2. Ontario Power Generation should continue to leverage industry best practices to ensure appropriate succession planning programs are in place over the duration of the Project.**
- 3. Ontario Power Generation should continue to track the costs associated with the support provided to contractors and retain contractual rights to recover these amounts at a later date.**
- 4. Ontario Power Generation should continue to monitor and analyze safety events in order to identify common causes, better respond to emerging trends, assess the effectiveness of corrective actions, apply lessons learned over the duration of the Project, and introduce new safety indicators if needed.**
- 5. Ontario Power Generation should provide vendors with regular updates about safety standards and industry best practices to remind all vendor staff of the importance of good safety practices.**
- 6. Ontario Power Generation should periodically review its evaluation scorecards as part of its procedure for procurement activities and adjust the weightings applied to technical criteria and bid price as necessary.**