

Chapter 1

Ontario Power Generation

Section 1.02

Darlington Nuclear Generating Station Refurbishment Project

Follow-Up on VFM Section 3.02, *2018 Annual Report*

RECOMMENDATION STATUS OVERVIEW

	# of Actions Recommended	Status of Actions Recommended				
		Fully Implemented	In the Process of Being Implemented	Little or No Progress	Will Not Be Implemented	No Longer Applicable
Recommendation 1	3		3			
Recommendation 2	3		3			
Recommendation 3	1		1			
Recommendation 4	3		3			
Recommendation 5	3	2	1			
Recommendation 6	2		2			
Recommendation 7	3		3			
Total	18	2	16	0	0	0
%	100	11	89	0	0	0

Overall Conclusion

As of October 6, 2020, Ontario Power Generation (OPG) had fully implemented 11% of actions we recommended in our *2018 Annual Report*, such as re-assessing its process for reviewing safety incidents to determine why previously identified corrective actions have not reduced the number of safety incidents; and modifying its process of investigating safety incidents that are the same or similar to identify their common cause and prevent their recurrence.

OPG has made progress in implementing 89% of the recommendations, such as reassessing Project risks on a regular basis and updating time estimates, cost estimates and contingency amounts accordingly; reviewing and applying lessons learned from completed Project work to the remaining work on the Project; publicly reporting its progress against Project targets at least quarterly; forecasting the future supply of skilled trades at risk of shortages to determine the impact on the Project and taking action to help mitigate such risk; identifying and training staff to take over work done by

existing staff eligible to retire before the completion of the Project; and reviewing lessons learned on project management approaches from completed Project work and applying them to the remaining work on the Project. As these recommendations span the lifetime of the Project, they will be in the process of being implemented up to October 2026.

The status of actions taken on each of our recommendations is described in this report.

Background

Ontario Power Generation (OPG), a corporation wholly owned by the province, produces more than half of Ontario's electricity at more than 60 hydro-electric stations and two nuclear plants: Darlington Nuclear Generating Station (Darlington Station) and Pickering Nuclear Generating Station.

Darlington Station began operating the first of four nuclear reactors in 1990, and had generally produced over 15% of Ontario's electricity. In 2006, OPG began assessing the feasibility of refurbishing the four reactors to extend their useful life beyond the early 2020s.

In January 2016, OPG publicly announced its planned Darlington Nuclear Generating Station Refurbishment Project (Project), which it estimated would be complete by February 2026 at a cost of \$12.8 billion. The Project was expected to extend the useful life of the four reactors to around 2055. As of June 2020, OPG had spent about \$7.2 billion on the Project (\$5 billion as of June 30, 2018), with about 785 of its own full-time-equivalent staff working alongside another 842 contract staff (980 FTE staff and 1,500 contract staff in 2018).

During our 2018 audit, we found that although OPG faced significant challenges, cost overruns and delays in prerequisite Project work that had begun prior to January 2016, it had applied lessons learned to the remainder of the Project, establishing time and cost estimates based on reliable information and reasonable assumptions.

While OPG had forecast that the Project would meet the time and cost estimates it had publicly announced in January 2016, we found that several significant risks remained. For example, the potential existed for unexpected challenges in 2021, when OPG would begin working on the refurbishment of more than one reactor at the same time. Up to that time, OPG will have worked on the refurbishment of only one reactor at a time.

Some of the other significant observations from our 2018 audit included:

- OPG would be in competition for skilled trades over several years when the Project would overlap with another refurbishment project at the Bruce Nuclear Generating Station. A potential shortage of boilermakers, a specialized trade for removing and installing nuclear reactor unit components, would pose the biggest risk.
- OPG estimated that over 30% of its management staff and nearly all the executives working on the Project would be eligible to retire by 2025, a year before the Project's scheduled completion, potentially creating a major staffing gap. OPG had not yet identified replacements for these potential retirees.
- OPG estimated that it would spend almost \$50 million more overall on Project oversight and support than it had initially estimated. However, OPG had not yet factored in the impact of this additional cost when determining what it would pay contractors.
- Before starting the main refurbishment work on the four reactors in 2016, OPG began 18 prerequisite projects at a total cost expected to exceed \$725 million, or 75% more than its initial estimate. The main causes for the expected cost overrun included a lack of detailed planning and understanding of the work's complexity. This resulted in inaccurate estimates and scoping, poor risk assessment, underweighting technical criteria when selecting contractors, assigning complex work to staff with limited relevant

experience, and poor project management and oversight of contractors.

- While there had been no serious injuries to Project staff, OPG had not met its safety targets. The frequency of safety incidents was mostly unchanged since 2016 when the refurbishment started. OPG could have been more proactive in reducing recurring, preventable safety incidents. For example, an incident in November 2017 resulted in a contractor stopping its 800 staff from working on the Project for two days, costing OPG over \$700,000. There had already been eight incidents that year of workers dropping tools and parts when working at heights.

We made seven recommendations, consisting of 18 action items, to address our audit findings.

We received a commitment from OPG that it would take action to address our recommendations.

Standing Committee on Public Accounts

On April 10, 2019, the Standing Committee on Public Accounts (Committee) held a public hearing on our 2018 audit. In December 2019, the Committee tabled a report resulting from this hearing in the Legislature. The Committee endorsed our findings and recommendations, and made six additional recommendations. OPG reported back to the Committee on April 7, 2020. The Committee's recommendations and our follow-up on its recommendations are found in **Chapter 3, Section 3.02** of this volume of our *2020 Annual Report*.

Status of Actions Taken on Recommendations

We conducted assurance work between April 2020 and July 2020. We obtained written representation from OPG that effective October 6, 2020, it has provided us with a complete update of the status of

the recommendations we made in the original audit two years ago.

Ontario Power Generation Estimates Project Will Meet Time and Cost Estimates, but Should Remain Diligent Until Project Completed

Recommendation 1

To ensure that the Darlington Nuclear Generating Station Refurbishment Project (Project) is completed in a timely and cost-effective manner and that public reporting on Project progress is complete and accurate, we recommend that Ontario Power Generation continue to:

- *reassess Project risks on a regular basis and update time estimates, cost estimates and contingency amounts accordingly;*

Status: In the process of being implemented by October 2026.

Details

At the time of our 2018 audit, OPG estimated that the Project would be completed on time (February 2026) and within its total estimated cost (\$12.8 billion) that was publicly announced in January 2016. However, we noted that a number of significant risks remained, which required OPG to be vigilant in order to keep to its budget and timeline for the Project.

In our follow-up, we found that OPG has reassessed Project risks on a regular basis and has updated time estimates and cost estimates accordingly. For example:

- Risk specialists at OPG regularly review, assess, and update the risks associated with specific work of the Project such as risks related to staff safety and risks of taking longer to complete complex work.
- Apart from risk assessments, OPG performs weekly project reviews to assess issues related to schedule, execution and cost performance.

- OPG reviews cost and contingency forecasts for each specific work of the Project on a monthly basis. The forecasts incorporate an analysis of trends of current work progress as well as the discrete risks associated with the remaining work.

As well, OPG senior management has reported the Project's status to the OPG executive and the Darlington Refurbishment Committee on a monthly basis. In addition, OPG senior management has reported the Project's progress, risks and forecasts to OPG's Board of Directors on a quarterly basis. The Board's Independent Oversight Advisor independently verifies key cost and scheduling risks, and assesses the accuracy of OPG senior management's reporting of the Project's status.

As a result of the Ontario government's March 17, 2020, declaration of an emergency under the *Emergency Management and Civil Protection Act* related to COVID-19, OPG decided to delay the start of work on each of the remaining units that need to be refurbished (Unit 3, Unit 1 and Unit 4) by four months. The Project is now expected to be completed in October 2026, instead of February 2026, as OPG initially estimated. Of this eight-month delay, half was due to the COVID-19 pandemic and the remaining half was due to the rescheduled completion date of Unit 2. OPG continues to assess and seek ways to manage the impact of the COVID-19 pandemic on the total cost of the Project, which is otherwise continuing to be done within the original \$12.8 billion budget.

OPG will continue to reassess Project risks on a regular basis and update time estimates, cost estimates and contingency amounts accordingly until October 2026 when the Project is expected to be completed.

- *review and apply lessons learned from completed Project work to the remaining work on the Project;*

Status: In the process of being implemented by October 2026.

Details

In our 2018 audit, our review of OPG's planning process for the Project noted that OPG had been able to keep the Project within its original time and cost estimates mainly as a result of applying lessons learned from different sources.

In our follow-up, we found that OPG and its contractors participated in a Lessons Learned program, where lessons learned from previous Project work are identified, documented, actioned, and incorporated into the planning work for subsequent units. In 2019, over 50 meetings were held to identify lessons learned and changes that could be incorporated into future Project work. This process has generated over 3,900 individual lessons learned, resulting in over 1,160 actions to be taken. As of June 2020, over 850 of these actions had been completed. For example, the planning phase of Unit 2 had experienced late delivery of certain materials, which delayed the completion of some Project work by six months. Based on this experience, OPG expedited the delivery of these materials during the planning phase of Unit 3. In another case, delays occurred with work on Unit 2 as a result of a valve and drain line being plugged. OPG then started cleaning the drain lines before working on the subsequent unit to prevent the issue from reoccurring, and so there were no such delays experienced on Unit 3.

OPG will continue to review and apply lessons learned from completed Project work to the remaining work on the Project until October 2026 when the Project is expected to be completed.

- *publicly report its progress against Project targets at least quarterly.*

Status: In the process of being implemented by October 2026.

Details

In our 2018 audit, we found that, since 2017, OPG had been publicly reporting on a quarterly basis certain performance measures related to the Project (such as how the Project is meeting the cost and

time estimates that were publicly announced in January 2016). Publicly reporting the progress of the Project continuously against the cost and time estimates was important to keep the Project on time and on budget.

In our follow-up, we found that OPG has publicly reported on the status of the Project via its website on a quarterly basis. For the first quarter of 2020, OPG reported the Project remains on budget and on track for completion in 2026. However, as previously mentioned, the Project is now expected to be completed in October 2026 instead of February 2026, in part because OPG decided to delay the start of work on each of the remaining three units by four months as a result of the COVID-19 pandemic. In addition to the Project's cost and schedule, the public reporting provides details on the Project's quality of work, safety and environmental impact.

OPG will continue to publicly report Project progress against targets, at least quarterly, until October 2026 when the Project is expected to be completed.

Pending Shortage of Skilled Trades and Potential Retirement of Experienced Executives and Management Staff Remain a Significant Risk to Completing Project on Time and on Budget

Recommendation 2

To ensure that the Darlington Nuclear Generating Station Refurbishment Project (Project) has enough skilled tradespeople to perform the necessary refurbishment work, we recommend that Ontario Power Generation (OPG):

- *complete a forecast of the future supply of skilled trades identified as being at risk of shortage to determine the impact of this risk on the Project, and take action to prevent or mitigate such risk;*
Status: In the process of being implemented by October 2026.

Details

In our 2018 audit, we found that OPG faced the risk that there would not be sufficient experienced skilled trades working on the Project, which could increase the risk of errors being made and delays on the Project.

In our follow-up, we found that in 2018, OPG developed a Trades Capacity Initiative to collect supply and demand data on skilled trades, make the best use of the current supply of trades, and build up new sources of trades via outreach activities.

In February 2020, OPG updated its forecasts for skilled trades (boilermakers, millwrights, pipefitters and carpenters) using information from Bruce Power related to its nuclear reactor life extension project work as well as information from non-nuclear industries in Ontario. This process identified that boilermakers remained the skilled trade of highest demand.

OPG has taken mitigating actions to address this risk. For example:

- OPG created a demand and supply model in collaboration with Bruce Power and the International Brotherhood of Boilermakers, which is a trade union in the United States and Canada for boilermakers, to clarify the need for boilermakers on the Project.
- OPG participated in a pre-apprentice program with Durham College and the International Brotherhood of Boilermakers to train 95 graduates to work as boilermaker apprentices. These recruits will be available to both OPG and Bruce Power for their respective nuclear projects.
- OPG, together with other employers (including Bruce Power) in Ontario's nuclear industry, applied to the federal government to hire boilermakers from outside Canada as temporary foreign workers. The federal government approved this application in November 2019.
- OPG applied lessons learned from past Project work to scheduled Project work for Unit 3, so that the peak and average staff headcounts needed at specific periods of time will be lower overall.

OPG is collaborating continuously with Bruce Power and the Electrical Power Systems Construction Association to review industry-wide demand and supply of skilled trades for nuclear work in Ontario until October 2026 when the Project is expected to be completed.

- *work with Bruce Power Limited Partnership (Bruce Power) continuously and closely to manage the demand for staffing resources during the period when both OPG and Bruce Power have refurbishment work under way, and adjust the Project's work plans where appropriate;*

Status: In the process of being implemented by October 2026.

Details

In our 2018 audit, we found that starting in 2020, OPG would be in competition with Bruce Power Limited Partnership (Bruce Power) for skilled trades such as boilermakers and millwrights. For more than six years, from 2020 to 2026, both OPG and Bruce Power would be refurbishing their stations at the same time.

In our follow-up, we found that OPG and Bruce Power have collaborated to assess the risk of skilled trades not being available and develop strategies to mitigate this. Both organizations' project leadership teams have been meeting on a bi-weekly basis to discuss schedule, risks, and performance of their respective nuclear refurbishment work.

Both organizations will also continue to work together in managing the demand for staffing resources throughout the period of their respective refurbishment work until October 2026 when the Project is expected to be completed. For example, in January 2020, both organizations decided to collaborate each quarter to determine their shared need for various skilled trades.

- *collaborate with other stakeholders (such as the federal and provincial governments, trade unions and colleges) to increase the supply*

of skilled trades (particularly boilermakers) needed on the Project.

Status: In the process of being implemented by October 2026.

Details

In our 2018 audit, our review of OPG's data and analysis found that OPG identified a potential shortage of boilermakers as one of its biggest risks to the Project. We noted that the Project would require about 260 boilermakers in 2018 and that this would more than double to almost 550 in 2021.

In our follow-up, we found that OPG has collaborated with a number of stakeholders to improve awareness and interest in skilled trades. For example:

- In March 2019, OPG entered into a sponsorship agreement with Skills Ontario, which partners with school boards, colleges, small businesses, large companies, labour groups and governments to provide opportunities for youth to explore and develop careers in the skilled trades and technologies.
- OPG worked with the federal government to obtain approval for hiring boilermakers outside Canada to work as temporary foreign workers.
- OPG collaborated with the provincial government to train apprentices at Durham College and further support apprenticeships required on the Project.
- OPG reached out to school boards by participating in career fairs and information sessions for both students and educators. These sessions help promote awareness of career opportunities in the skilled trades. For example, in April 2019, OPG presented to educators from the Peterborough Victoria Northumberland and Clarington Catholic District School Board to make them aware of local apprenticeship opportunities and how students can pursue them. In October 2019, OPG also presented to over 600 students from across Durham Region and Northumberland

County to discuss job opportunities for women in traditionally male-dominated fields of science, technology and skilled trades.

- In October 2019, OPG participated in the Durham Region Autoworkers Job Fair that connected individuals affected by an automotive plant's restructuring with training and job opportunities in the nuclear industry.

OPG will continue to look for opportunities for collaboration with stakeholders that can lead to an increase to the supply of skilled trades on the Project until October 2026 when the Project is expected to be completed.

Recommendation 3

To ensure that Ontario Power Generation (OPG) has competent and experienced staff working on the Darlington Nuclear Generating Station Refurbishment Project (Project) throughout the life of the Project, we recommend that OPG identify and train staff to be able to take over work being done by the existing staff (especially executives and management staff) who work primarily on the Project and are eligible to retire before the completion of the Project.

Status: In the process of being implemented by October 2026.

Details

In our 2018 audit, we found that OPG estimated over 30% of its management staff and nearly all of its executives from its Darlington Refurbishment group working on the Project would be eligible to retire by 2025 (before the Project's expected completion). While OPG identified internal candidates, who could take over most of these positions, it had not yet done this for 13 positions, including six management staff eligible to retire by the end of 2018.

In our follow-up, we found that OPG developed and conducted succession planning education sessions throughout 2019 for its non-executive management staff. The purpose of these sessions was to provide staff with a better understanding of the value of succession planning as well as the associated processes that help maintain an adequate and

appropriate talent pool of staff across the corporation, including for the duration of the Project.

OPG has identified successors for key management and executive management positions, and for roles that require specialized skills or significant experience to be proficient. Apart from enhancing its internal succession strategies, OPG has also taken external candidates into consideration to diversify staff experiences.

OPG's performance management process requires all regular management staff to have an Individual Development Plan, including those that have been identified as potential successors. Employees work collaboratively with their leaders to identify specific areas for training and development. These efforts ensure that they continue to develop and improve in their current role and/or become ready to be the successful candidate for a future role in which they have been identified as a potential candidate.

OPG will continue to identify and train Project staff until October 2026 when the Project is expected to be completed.

OPG Incurred Additional Costs as Contractors Did Not Perform up to Expectations but Contractors Continue to Be Eligible to Receive Their Full Profit

Recommendation 4

To ensure that contractors working on the Darlington Nuclear Generating Station Refurbishment Project (Project) only receive profit if their performance meets Ontario Power Generation's (OPG's) expectation and that the Project is completed on time and on budget, we recommend that OPG:

- continue to provide contractors with additional assistance when the contractors are unable to successfully achieve OPG's cost and time targets for Project work;

Status: In the process of being implemented by October 2026.

Details

In our 2018 audit, we found that since external contractors were responsible for performing the majority of the Project work, contractors with poor performance or not performing up to OPG's expectations could result in cost overruns and delays. In some cases, OPG provided additional assistance to support contractors to perform Project work more efficiently, which helped the Project remain on time and within its cost estimate.

In our follow-up, we found that OPG has continued to work with contractors and provide them with additional assistance as deemed necessary. In 2019, OPG created a collaborative "War Room" between its staff and contractors to review documents live, which has allowed OPG to inform contractors of its expectations in real time. This has improved the quality of documentation and expedited the process of reviewing and approving documentation. OPG has also implemented a strategy to identify most capable staff from both OPG and contractors, so that they can work together to improve efficiency and avoid delays of Project work. This strategy is expected to save the Project about \$12 million for work on Unit 3 alone.

OPG will continue to provide contractors with additional assistance as deemed necessary until October 2026 when the Project is expected to be completed.

- *track and consider taking action to recover the cost of additional support provided to contractors above what was expected when contracts with the contractor were signed;*

Status: In the process of being implemented by October 2026.

Details

In our 2018 audit, we found that OPG 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.

In our follow-up, we found that OPG has continued to provide additional support to contractors through secondments. OPG indicated that seconding, or letting its staff work for the contractors, leverages unique plant-specific expertise while also reducing training and travel costs as its staff being seconded tend to live locally.

OPG has tracked the number of its staff being seconded and anticipated about five to eight of its staff will be seconded to contractors for Unit 3, which is estimated to be completed in January 2024. These staff are expected to earn a total of about \$3 million over the time period they are seconded to the contractor, which OPG would pay whether the staff were OPG or contractor personnel.

OPG will continue to track the costs associated with the support provided to contractors and retains contractual rights to recover these costs, as deemed appropriate, until October 2026 when the Project is expected to be completed.

- *take any assistance and support provided to contractors into consideration when evaluating contractors' performance and determining contractors' profit.*

Status: In the process of being implemented by October 2026.

Details

In our 2018 audit, we found that while OPG estimated that it will spend overall almost \$50 million more on Project oversight and support than it initially estimated (including costs associated with providing additional support to contractors), it has not considered these additional incurred costs when determining the amount of profit to pay the contractors.

In our follow-up, we found that OPG has reserved the right to take support provided to contractors into consideration when evaluating contractors' performance or determining profit.

As of June 2020, OPG has not reduced its payments to contractors as a result of seconding OPG staff to support the contractors. OPG believes in this

collaborative approach of seconding a relatively small number of its staff (only about five to eight for Unit 3) to help the contractors because it results in no additional cost to OPG. (Staff who are seconded to contractors continue to receive their salary from OPG without additional billings for the work they perform for the contractor.) It also helps ensure that contractors do not hesitate to take on support provided by seconded staff from OPG whereas they might hesitate to hire additional contractors if it will reduce their profits.

OPG will continue to take any assistance and support provided to contractors into consideration when evaluating contractors' performance and determining contractors' profit until October 2026 when the Project is expected to be completed.

Insufficient Action to Prevent Recurring Safety Incidents Affects Worker Safety and Project Costs and Timelines

Recommendation 5

To ensure that the number of safety incidents on the Darlington Nuclear Generating Station Refurbishment Project (Project) remains as low as possible, we recommend that Ontario Power Generation:

- *perform a review of its process for reviewing safety incidents to determine why previously identified corrective actions (such as those related to falling objects) have not effectively reduced the number of safety incidents occurring on the Project;*

Status: Fully implemented.

Details

In our 2018 audit, we found that while the severity of safety incidents on the Project had been low, the frequency of safety incidents was mostly unchanged. Project staff's rate of safety incidents remained about the same since 2016 (when actual refurbishment work started) at about 0.5 safety incidents for every 200,000 hours worked between

2016 and the first half of 2018. This was higher than OPG's targets of 0.24 in 2016 and 0.37 in 2017 and 2018.

In our follow-up, we found that in December 2019, OPG performed an analysis of all 2018 and 2019 safety incidents to assess the effectiveness of corrective actions applied in response to specific safety events. This analysis identified that the overall number of safety incidents deemed as having a "High Maximum Reasonable Potential for Harm" had dropped from 13 in 2017 to four in 2018 and five in 2019. For example:

- the number of safety incidents involving working at heights dropped from seven in 2017 to one in 2018 and two in 2019;
 - the number of safety incidents involving material handling dropped from two in 2017 to zero in 2018 and zero in 2019; and
 - the number of safety incidents involving falling objects changed from three in 2017 to one in 2018 and three in 2019.
- *develop new initiatives to address safety concerns related to the Project and meet its safety performance targets;*

Status: In the process of being implemented by October 2026.

Details

In our 2018 audit, we found that to address safety concerns, OPG rolled out a number of safety-improvement initiatives in early 2017, which included communicating its expectations on nuclear safety to its staff and contractors' staff. However, these initiatives had not significantly reduced OPG's rates and number of safety incidents. Therefore, OPG needed to further strengthen its safety-improvement initiatives throughout the remainder of the Project to prevent or reduce safety incidents in order to protect staff working on the Project.

In our follow-up, we found that in May 2019, OPG rolled out an enhanced proactive safety awareness and planning initiative. Under this initiative, OPG staff use past data and lessons learned to

assess upcoming Project work, identify areas of higher risk, and develop targeted programs aimed at preventing safety incidents.

OPG has also made other changes in 2019, including providing staff with new gloves and cut-resistant liners, to improve safety for staff working on the Project. Consequently, the number of first aid and medically treated injuries has dropped, from six before these changes to three (as of June 2020).

In both 2018 and 2019, OPG had a target rate of 0.37 safety incidents for every 200,000 hours worked. The actual rate of incidents was 0.38 in 2018 and 0.52 in 2019, above the target in both years. For 2020, the target incident rate was changed to 0.40 and the actual rate was 0.27 (as of June 2020), which was below the target.

In order to meet its safety performance targets, OPG will continue to develop new initiatives to address safety concerns related to the Project until October 2026 when the Project is expected to be completed.

- *modify its process to investigate safety incidents that are the same or similar in order to identify their common cause in order to take action to prevent their recurrence.*

Status: Fully implemented.

Details

In our 2018 audit, we found that OPG investigated individual incidents, but could do more to prevent recurring incidents (such as staff dropping tools from above ground that nearly hit others). For example, an incident occurred when a worker dropped a bag containing pieces of metal from over 35 feet above ground, almost hitting a worker. There had already been eight incidents that year with a common cause (where workers had dropped tools and parts when working at heights above ground) and this incident could have resulted in a serious injury or the death of a worker.

In our follow-up, we found that in September 2018, OPG modified its process of investigating

safety incidents. Specifically, it developed a new guideline on how to use its Learning Focus Groups to analyze the context of a safety incident to see if improvements can be made to organizational processes to reduce the reoccurrence of the incident. A facilitator works with staff involved in the safety incident to understand exactly how the incident occurred in order to identify improvements. This approach has been used as part of OPG's assessment of safety incidents involving material handling; two such incidents in 2017 were assessed as having a "High Maximum Reasonable Potential for Harm", while there were no such further events in 2018, 2019 or 2020 (as of June 2020).

Post-payment Audits Need to Be Continued to Identify and Prevent OPG's Overpayments to Contractors

Recommendation 6

To ensure Darlington Nuclear Generating Station Refurbishment Project (Project) contractors are paid only for eligible expenses that have actually been incurred, we recommend that Ontario Power Generation:

- *continue to perform post-payment audits regularly on Project contractor payments and recover any overpayments identified in these audits from contractors;*

Status: In the process of being implemented by October 2026.

Details

In our 2018 audit, we noted that OPG hired external auditing firms to perform post-payment audits and assess whether it paid contractors working on the Project accurately according to the terms of the contracts. Since these audits resulted in the recovery of almost \$4 million in overpayments to contractors, OPG needed to continue to conduct these audits to encourage contractors to remain focused on accuracy when billing OPG for work performed

and to help OPG identify overpayments throughout the duration of the Project.

In our follow-up, we found that since our 2018 audit, the external auditing firms retained by OPG have performed four post-payment audits to identify overpayments to contractors.

- An audit in April 2019 examined over \$430 million of payments to a contractor between August 1, 2016, and November 30, 2017. This audit found an estimated overpayment of about \$11,000.
- Another audit in January 2020 reviewed over \$280 million payments to a contractor between January 1, 2017 and December 31, 2018. The audit identified an estimated overpayment of about \$5,000.
- The third audit in February 2020 reviewed over \$70 million of payments to a contractor between February 2014 and July 2018. The audit found an estimated overpayment of about \$400,000.
- The most recent audit in March 2020 examined over \$780 million of payments made to a contractor between January 2016 and February 2018. The audit identified about \$550,000 in potential overpayments, which OPG was still investigating.

OPG has recovered or was in the process of recovering overpayments identified through these audits. As of June 2020, there were three post-payment audits in progress and three additional post-payment audits were planned to begin by the end of 2020.

In addition, OPG has developed a post-payment audit plan to identify an audit cycle that should be followed through the completion of the Project. Based on its audit plan, OPG will continue to retain external auditing firms to perform post-payment audits regularly on contractor payments and recover any overpayments identified from contractors until October 2026 when the Project is expected to be completed.

- *where cost-effective, make changes based on the results of the post-payment audits to its contractor invoicing and payment processes to reduce the likelihood that overpayments occur.*

Status: In the process of being implemented by October 2026.

Details

In our 2018 audit, we found that based on the results of the post-payment audits, OPG modified its contractor invoicing and payment processes to reduce the likelihood of additional overpayments to contractors. For example, OPG developed a process that requires contractors' project management staff to obtain prior approval from OPG before obtaining a living-out allowance (for staff who have to stay away from home due to Project work). As post-payment audits continued to identify other areas where overpayments to contractors occurred, OPG needed to continue making changes to its invoicing and payment processes in order to prevent or minimize overpayments.

In our follow-up, we found that OPG has not yet made any process changes based on the results from the most recent post-payment audits. Overall, the amount of overpayments identified through these audits has been immaterial (accounting for less than 0.1% of total payments being audited) and has not uncovered any systematic deficiencies that would require further revisions to the existing contractor invoicing and payment processes. Since November 2019, lessons learned meetings were held with staff involved in post-payment audits biannually to identify any findings from the audits that would reduce the likelihood of future overpayments occurring.

OPG informed us that it will continue to retain external auditing firms to perform regular post-payment audits for all major contracts of the Project. It will also further enhance its preventative controls, where cost-effective, to reduce the likelihood of overpayments and identify areas for improvement until October 2026 when the Project is expected to be completed.

Prerequisite Project Work Costs over \$725 Million More Than Initially Estimated and Will Be Completed Later Than Planned

Recommendation 7

To ensure that mistakes made during prerequisite project work on the Darlington Nuclear Generating Station Refurbishment Project (Project) are not repeated, we recommend that Ontario Power Generation continues to:

- perform detailed planning of Project work diligently and appropriately before allowing its senior management team to release funding for refurbishment work during the remainder of the Project;

Status: In the process of being implemented by August 2023.

Details

In our 2018 audit, we found that OPG staff did not develop accurate initial cost and time estimates for most of the prerequisite projects during the planning process because they did not have a detailed understanding of the complexity and specific technical requirements of the work when the estimates were made. As a result, a number of prerequisite projects were not appropriately scoped, which contributed significantly to the underestimation of project costs and cost overruns (totalling over \$725 million).

In our follow-up, we found that OPG has used a phased planning process that incorporates validation and approval points to show that key elements each plan are considered adequate before proceeding. OPG management reviews the detailed plan of each team working on the Project to ensure that it is complete and provides a full understanding of the schedule and budgets, and that it is supported by a risk analysis. Specifically, the plans must include:

- the project scope, including all inherent risks;
- associated estimates for cost and schedule;
- the lessons learned from work on previous units;

- relevant nuclear industry experience; and
- the resources required to complete the work.

This review has provided OPG senior management with an assurance that the Project's teams are ready to execute the work detailed in the plans.

OPG will continue to perform detailed planning of Project work diligently and appropriately before allowing its senior management to release funding for refurbishment work on subsequent units. OPG expects that the detailed planning work on the final unit to be refurbished (Unit 4) will be completed in August 2023.

- review the evaluation scorecards for the remaining Project work not yet contracted and adjust the weightings applied to technical criteria and bid price as necessary to appropriately consider the importance of technical criteria when selecting contractors;

Status: In the process of being implemented by October 2026.

Details

In our 2018 audit, we found five prerequisite projects (out of 17) where OPG selected contractors that submitted lower bid prices but scored lower on the technical criteria than the competing contractors. Collectively, these five prerequisite projects are expected to cost about \$500 million more than originally estimated. If OPG had scoped these prerequisite projects appropriately by obtaining a detailed understanding of their complexities and placed greater weighting on technical criteria when selecting contractors, it would have saved money and avoided delays.

During our follow-up, we found that OPG revised its procedures for procurement activities in July 2018 and is following them. For example, if an OPG internal group requisitions a contractor, it must now collaborate with OPG's supply chain group to determine the evaluation criteria and weightings for a competitive procurement (such as weighting of technical criteria over bid price).

These criteria and weightings must then be fully disclosed to all participants.

Subsequent to our 2018 audit, OPG has undertaken one competitive procurement related to engineering oversight work for the remaining units that need to be refurbished. The updated procedures were followed, including disclosure of the evaluation criteria and weightings (75% for technical criteria and 25% for bid price).

OPG will continue to periodically review its procedures for procurement activities, including determining the proper weighting of technical criteria as part of its future competitive procurements, as necessary.

- *review and apply lessons learned on project management approaches from completed Project work (including those recommended by advisors) to the remaining work on the Project.*
Status: In the process of being implemented by October 2026.

Details

In our 2018 audit, we found that based on the reports issued by different external oversight parties on the Project, one of the main causes for cost overruns and delays of prerequisite work was OPG's "hands off" approach to project management and its poor oversight of external contractors. In response to the concerns raised by various oversight parties, OPG made changes to improve its oversight and project management approach for the remainder of the Project.

In our follow-up, we found that OPG has continued to review and apply lessons learned from completed Project work to enhance its project

management processes and controls. OPG has also applied recommendations made by its external advisors, including establishing a centralized group that is responsible for ensuring consistency in project management practices throughout the Project. OPG transitioned some of its staff to this centralized group throughout 2019 and finalized specific responsibilities for each staff member in this group in 2020.

OPG has also developed standardized processes and tools based on the industry's best practices, such as the practices of the Project Management Institute and the Construction Industry Institute. In 2019, OPG provided training to over 100 staff (including project managers) on how to use a new reporting system that allowed for Project reports to be generated in a consistent manner by all Project teams.

In addition, OPG has applied lessons learned from completed Project work to the remaining work on the Project. For example, there were some delays in the work on Unit 3 because different OPG internal and contractor work groups created change requests that covered the same area of work. As a result, OPG changed its process for Units 1 and 4 so that the responsibility for making change requests was allocated to only one work group, which should help eliminate multiple change requests covering the same type of work.

OPG told us it will continue to review and apply lessons learned on project management approaches from completed Project work (including those recommended by advisors) to the remaining work on the Project until October 2026 when the Project is expected to be completed.