

CAPITAL PROJECTS – NUCLEAR OPERATIONS

1.0 PURPOSE

This evidence provides a project listing and the business case summaries (“BCS”) that support the capital expenditures and the in-service amounts for the Nuclear business unit (excluding Darlington Refurbishment which is addressed in Exhibit D2-2) during the test period. These capital expenditures reflect the nuclear capital budget presented in Ex. D2-1-2.

2.0 CAPITAL PROJECTS LISTING

A tiered reporting structure, consistent with the OEB’s filing guidelines, has been used to present the evidence for all capital projects that have budgeted expenditures in the test period, or in-service amounts during the bridge year or test period. Specifically:

- **Tier 1:** Individual projects with a total cost of \$20M or more. For these projects, summary level information is provided in Ex. D2-1-3 Table 1 and business case summaries are provided in Attachment 1 to this exhibit. Business case summaries are not provided for security-related projects, however Attachment 1 provides a brief description of security-related projects included on Ex. D2-1-3 Table 1. There are 38 Tier 1 projects comprising three categories: Ongoing Projects from EB-2013-0321; Completed/Deferred/Cancelled Projects from EB-2013-0321; and, New Projects approved since EB-2013-0321. Further information on these projects is provided in section 3.0 below.

All of the Tier 1 projects listed in Ex. D2-1-3 Table 1 with five exceptions have a final in-service date before or during the test period. The exceptions are as follows:

- 31412 - Darlington Class II Uninterruptible Power Supplies Replacement
- 31716 - Darlington Neutron Overpower & Ion Chamber Amplifier Replacement
(Reactor Regulating System, Shutdown System 1 & Shutdown System 2)
- 80022 - Darlington OH180 Aging Management Hardware Installation
- 80078 - Darlington Digital Control, Common Process and Sequence of Events
Monitoring Computer Aging Management
- 73566/80144 - Darlington Primary Heat Transport Pump Motor

Replacement/Overhaul

- **Tier 2:** Individual projects with a total cost of \$5M to \$20M, for which summary level information is provided in Ex. D2-1-3 Tables 2a through 2e. There are 74 Tier 2 projects.
- **Tier 3:** Individual projects with a total cost of less than \$5M, for which aggregated information is provided in Ex. D2-1-3 Table 3. There are 71 Tier 3 projects.

There are a further 77 projects in the project portfolio (unallocated) category (as described in Ex. D2-1-2), which are projects in the project identification or project initiation phases. These projects are presented in Ex. D2-1-3 Tables 5a and 5b. OPG expects that during the test period, some of these projects (or other projects yet to be identified) will move from the project identification and initiation phases into the project definition or execution phase as part of the ongoing portfolio management process. As indicated in Ex. D2-1-3 Tables 5a and 5b, preliminary forecasts indicate that 14 of these projects will have a total project cost greater than \$20M.

3.0 PROJECT-SPECIFIC INFORMATION - TIER 1 PROJECTS

3.1 New Projects

Nineteen Tier 1 projects are listed in Ex. D2-1-3 Table 1 as new projects that have been approved for execution since EB-2013-0321. Project #49247 (Pickering Unit 1 & 4 Fuel Channel East Pressure Tube Shift/Reconfigure) was identified as a Tier 2 project in EB-2013-0321 based on an initial estimate at that time and has since been combined with Project #41023 to become a Tier 1 project based on an updated estimate. Business case summaries are provided in Attachment 1 to this exhibit. Details of these 19 new projects and Project #41023/49247 are as follows:

Project #31518 Darlington Restore Emergency Service Water and Firewater Margins:

This project is to increase the supply of firewater by installing diesel-powered pumps. Under the current arrangement, the firewater demand, which is supplied from the emergency service water system, would exceed design levels and could result in impaired flows to nuclear safety loads. Modifications to upgrade the fire protection system include the

1 installation of a significant number of additional sprinkler heads. In the event of a main steam
2 line break, the sprinklers in the incident and adjacent unit would open. The total project cost
3 is \$47.1M with an initial definition phase release of \$28.4M. Planned final in-service date is
4 September 2016.

5
6 **Project #31524 Darlington Station Roofs Replacement:** This project is to replace flat roofs
7 on the main powerhouse and other protected area buildings. The roofs are approaching the
8 end of their service lives and need to be replaced. The total project cost is \$38.3M with an
9 initial definition phase release of \$0.8M. Initial planned final in-service date is December
10 2018. However, the 2016 capital project portfolio budget is currently oversubscribed (i.e. the
11 number of approved projects exceeds available funding). As a result, this project has been
12 deferred and a revised in-service date has not yet been determined.

13
14 **Project #31532 Darlington Powerhouse Water Air Conditioning Units Replacement:**
15 This project is to replace water air conditioning units which are approaching end of useful
16 service life and are no longer reliable. Existing units are failing resulting in increased
17 maintenance expense and increased risk of forced outage. The total project cost is \$20.0M
18 with an initial partial release of \$11.3M. Planned final in-service is December 2019.

19
20 **Project #31535 Darlington Water Treatment Plant Replacement:** This project is to replace
21 the water treatment plant, which has been in-service since 1987 and is approaching the end
22 of its 30 year design life. High quality demineralised water is required for station operation.
23 While the plant is operating satisfactorily, operational experience from other stations
24 indicates that their water treatment plants were replaced before the 30 year mark due to
25 declining performance. The total project cost is \$57.8M with an initial definition phase release
26 of \$5.2M. Initial planned final in-service is November 2019. However, the 2016 capital project
27 portfolio budget is currently oversubscribed (i.e. number of approved projects exceeds
28 funding). As a result, this project has been deferred and a revised in-service date has not yet
29 been determined.

30

1 **Project #31542 Darlington Transformer Multi-Gas Analyzer Installation:** This project is to
2 install multi-gas analyzers on all main output, system service and unit service transformers.
3 Currently OPG relies on manual analysis of transformer oil to detect and measure the
4 concentration of fault gases allowing actions to be taken to correct incipient failures before
5 they happen. The use of multi-gas analysers will improve early indication of impending
6 electrical faults to minimize potential damage to transformers, improve grid reliability and
7 allow OPG to meet its commitment to operate consistent with industry standards. The total
8 project cost is \$22.7M with a full release of \$22.7M. Planned final in-service is March 2018.

9
10 **Project #31544 Darlington Radiation Detection Equipment Obsolescence:** This project is
11 to replace a number of radiation detection and monitoring systems where the equipment is
12 obsolete or life-expired with limited spares available. This equipment is required by the
13 station Power Reactor Operating License and must be replaced. The total project cost is
14 \$46.9M with an initial definition phase release of \$1.2M. Planned final in-service is December
15 2021.

16
17 **Project #31552 Darlington Condenser Circulating Water and Low Pressure Service**
18 **Water Travelling Screens Replacement:** This project is to replace the travelling screens
19 used to filter out debris from the water flowing into the station from Lake Ontario. Travelling
20 screens move in a loop to allow the screens to flush the debris off. The original equipment
21 manufacturer specified an expected service life of 25 years on the original screens, and
22 inspection of the underwater sections of the travelling screen assemblies has revealed
23 significant degradation. If not replaced, failure of a screen could result in derating if a
24 condenser circulating water pump has to be shut down. The total project cost is \$37.6M with
25 a partial execution phase release of \$27.5M. Planned final in-service is June 2018.

26
27 **Project #31710 Darlington Shutdown Cooling Heat Exchanger Replacement:** This
28 project is to replace the shutdown cooling heat exchangers, which are used to cool the
29 reactor upon shutdown. The baffle supports and shells have degraded due to microbial
30 induced corrosion. Failure of the supports could lead to leaking tubes and emissions of
31 tritiated heavy water to Lake Ontario. The heat exchangers have a service life of 30 years.

1 The total project cost is \$56.1M with an execution phase release of \$38.8M. Planned final in-
2 service is May 2019.

3
4 **Project #31716 Darlington Neutron Overpower & Ion Chamber Amplifier Replacement**
5 **(Reactor Regulating System, Shutdown System 1 & Shutdown System 2):** This project
6 is to replace the obsolete amplifiers used to boost the very small signals from the in-core
7 neutron detectors and ion chambers. These signals are used by the reactor regulating
8 system, the shutdown system 1 and the shutdown system 2 to control reactor power or shut
9 it down if required. The total project cost is \$17.7M with a full definition phase release of
10 \$5.5M. Planned final in-service is July 2022.

11
12 **Project #38948 Darlington Zebra Mussel Mitigation Improvements:** This project is to
13 install modifications at Darlington to improve the control of zebra mussel infestations in the
14 service water systems. Large colonies of zebra mussels in these systems restrict the flow of
15 cooling water to important process and safety systems. The total project cost is \$21.5M with
16 an execution full release of \$21.5M. Planned final in-service is July 2016.

17
18 **Project #73706 Darlington Highway 401 and Holt Road Interchange:** This project is to
19 improve traffic flow and capacity at the Holt Road interchange by replacing the existing
20 partial interchange with a new interchange with additional access points. This project is cost-
21 shared with the Ministry of Transport with OPG's share of the project cost being \$28.6M.
22 Planned final in-service is December 2016.

23
24 **Project #80022 Darlington OH180 Aging Management Hardware Installation:** This
25 project is to replace 1,336 OH180 programmable controllers installed at Darlington. OH180
26 programmable controllers are used to control the majority of process systems, electrical
27 distribution system breakers and the class 3 transfer system. The circuit boards within the
28 units are approaching end of life and need to be replaced to avoid future failures. The total
29 project cost is \$47.2M with an initial definition release of \$1.4M. Planned final in-service is
30 December 2022.

31

1 **Project #80078 Darlington Digital Control, Common Process and Sequence of Events**

2 **Monitoring Computer Aging Management:** This project is to replace certain components of
3 Darlington digital control, common process and sequence of event computers. Most of the
4 obsolete computer components were custom designed for Darlington, using 1980s
5 technology, which can no longer be supported. The replacement of the majority of these
6 computer components is a regulatory commitment, and is necessary to preserve system
7 configuration and functionality and maintain capability of interfacing with existing computer
8 equipment prior to, during and post refurbishment. The total project cost is \$47.3M (plus
9 additional inventory of spares of \$9.1M) with an initial partial release of \$1.7M. Planned final
10 in-service is June 2025.

11
12 **Project #80111 Darlington Generator Stator Core Spare:** This project is to purchase a
13 generator stator core as a spare. Darlington's existing generator stator cores are showing
14 signs of degradation and are not expected to reach end of the post-refurbishment period
15 without major failure or a significant maintenance/refurbishment. OPG does not currently
16 have a spare and in the event of a catastrophic failure of the unit, OPG would be at risk of a
17 forced outage of up to two years duration. Purchasing a spare generator stator core will allow
18 OPG to swap it with an existing stator core for replacement/refurbishment. The total project
19 cost is \$35.0 with a full release of \$35.0M. Planned final in-service is July 2019.

20
21 **Project # 82816 Darlington Vault Cooling Coil Replacement:** This project is to reduce risk
22 to Darlington operations by replacing life expired vault cooling coils. Vault cooling coils
23 provide cooling to the reactor vault under operating conditions and remove heat under a loss
24 of coolant accident condition. The total project cost is \$26.3M with an partial release of
25 \$11.9M. Planned final in-service is September 2020.

26
27 **#73566/80144 Darlington Primary Heat Transport Pump Motor Replacement/Overhaul:**
28 This project is to replace/refurbish the sixteen primary heat transport ("PHT") pump motors
29 and spare at Darlington, which are approaching the end of their service lives. Primary heat
30 transport pump motors are 100 per cent duty with no installed redundancy. Failure of any
31 one of the operating motors (there are four PHT motors per unit) will result in a forced outage

1 and could result in an extended outage depending on availability of spare motors. In June
2 2015, OPG experienced an unbudgeted planned outage of 25.75 days (lost production of
3 0.54 TWh) to replace one PHT pump motor, which was showing high levels of degradation.
4 Additionally, there was a forced outage in December 2015 due to a PHT pump motor
5 mechanical failure. Current condition assessments indicate a medium to very high risk of
6 failure on the remaining PHT pump motors and priority will be given to replacing those
7 motors with the highest risk of failure. The total project cost is \$129.5M with a partial release
8 of \$53.8M. Planned final in-service is December 2022.

9
10 **Project #40976 Pickering B Fuel Handling Reliability Modifications:** This project is to
11 replace life-expired mechanical and control components and install modifications to improve
12 the reliability of the Pickering B fuel handling systems. Problems with the fuel handling
13 systems have resulted in forced generation losses. This project will help OPG achieve its
14 forced loss rate targets in the test period. The total project cost is \$37.3M with an execution
15 phase release of \$30.9M. Planned final in-service is July 2017.

16
17 **Projects #41023 and #49247 Pickering Unit 1 & 4 Fuel Channel East Pressure Tube**
18 **Shift/Reconfigure:** This project is to develop tooling for the repositioning and reconfiguration
19 of the fuel channel assemblies in Pickering Units 1 and 4. The pressure tubes, under the
20 influence of the neutron flux as well as pressure and temperature, elongate over time. The
21 pressure tubes are fixed at one end and are allowed to grow out at the other end. To ensure
22 that the end fittings stay on their bearings, the fuel channels have to be repositioned or
23 reconfigured. The total cost is \$38.6M which consists of a full release for execution of
24 \$28.8M, with a superceding release for an additional \$9.8M to authorize the change in
25 scope, from repositioning the majority of fuel channels to reconfiguring all fuel channels, in
26 Units 1 and 4. The planned final in-service is March 2016.

27
28 **Project #41027 Pickering Fukushima Phase 2 Beyond Design Basis Event Emergency**
29 **Mitigation Equipment:** This project is to provide portable equipment and install
30 modifications to manage water and protect containment long term following a beyond design
31 basis event. This project is required to meet Canadian Nuclear Safety Commission ("CNSC")

expectations following the close-out of the licensee actions following the incident at the Fukushima Daiichi Nuclear Power Plant in March 2011. The total project cost is \$46.3M with an execution phase release of \$5.8M. Planned final in-service is June 2017.

Project #66600 Pickering IMS Machine Delivered Scrape: This project is to develop tooling to perform pressure tube scrape sampling that can be delivered to the sample location using the universal delivery machine. Scrape sampling removes a thin sliver of pressure tube material from the inside of a pressure tube, which can then be analysed for properties such as dissolved hydrogen content. This is required for reactor fitness for service evaluations. This tooling will allow for sampling to be done without having to drain the fuel channel, resulting in less worker dose and shorter outage durations. The total project cost is \$24.9M with a partial release of \$14.1M. Planned final in-service is May 2017.

3.2 Completed Projects

Two Tier 1 projects have been completed since EB-2013-0321. Project #49285 Pickering Modify/Replace Fiber Reinforced Plastic Components During 2010 Vacuum Building Outage was completed over budget (\$24.5M versus \$17.7M) due to additional scope, including installation of scaffolding, power supplies, craning and rigging, and additional safety monitoring equipment and personnel not identified in the original release. Project #49109 Pickering B Standby Generator Governor Upgrade was completed under budget (\$22.8M versus \$23.3M). Business case summaries are provided in Attachment 1 to this exhibit.

3.3 Deferred/Cancelled Projects

One Tier 1 project continues to be deferred. The Feeder Repair by Weld Overlay project (#62568) was deferred in May 2010. A business case summary is provided in Attachment 1 to this exhibit.

3.4 Project Variance Explanations

There are six ongoing Tier 1 projects for which total forecast project cost variances currently exceed ten per cent, as follows:

Project #34000 Darlington Auxiliary Heating System:

The auxiliary heating system (“AHS”) project involves the replacement of the life expired original station construction era boiler house at the Darlington site. Auxiliary heating is required as backup in order to protect station systems in the event that there is a power outage and loss of electricity and heating in the power plant on cold days. The project was undertaken to address a long standing CNSC concern regarding the adequacy and reliability of the backup heating available in the event of a four unit outage during the winter. The new AHS facility would provide a source of reliable back-up steam to the Darlington Nuclear Generating Station main heating steam in the event of a four unit shutdown, thereby mitigating potential major equipment damage due to freezing. The AHS project was reclassified to the Nuclear Operations Project Portfolio in 2015, as discussed in Ex. D2-1-10.

During EB-2013-0321, OPG updated the forecasted total project cost of the AHS project to \$85.1M as set out in an execution release BCS. OPG also provided a forecast in-service amount of \$75.3M in 2015.

The expected final forecast project completion cost, including the demolition of the construction boilerhouse slated for October 2016, has increased by \$14.4M to \$99.5M, as set out in the full release BCS included in Attachment 1, Tab 11 to this exhibit. This increase is for additional funding to complete the construction of the AHS and commissioning, demolition of the construction boilerhouse and close out. The in-service amount is \$94.2M in 2016. The increase is a result of several factors with the most significant being higher than anticipated engineering-procurement-construction contract costs resulting from the following:

- Approved project change authorizations due to design and construction scope changes (+\$3.9M)
- Under-estimation of vendor engineering, construction and commissioning support (+\$5.8M)
- Under-estimated fabrication and installation sub-contractor costs (+\$4.3M)
- Increased labour costs, e.g., lengthened schedule for completion (+\$2.7M)
- Increased internal project management and support costs (\$1.7M)
- Increased material costs (+\$1.0M)

- Increased interest due to the longer construction schedule (+\$0.3M)

These cost increases were offset by reduced project contingency (-\$5.3M).

Project #25619 Darlington Operations Support Building Refurbishment: The operations support building ("OSB") (also reclassified from the DRP per Ex. D2-1-10) houses various technical services (e.g., site security, site information technology, telephone network hubs) essential to the business operations of Darlington pre- and post-refurbishment. The OSB was constructed in 1982, with a third floor added in 1988. An assessment by an external engineering firm found that many of the existing building systems are or would life expire by 2015 and concluded that the preferred alternative was refurbishment of the building.

During EB-2013-0321, OPG provided an updated forecast in-service amount of \$45.1M in 2015. This was based on a forecast total project cost of the OSB refurbishment project of \$47.7M (including contingency) as set out in the partial release BCS included in Attachment 1, Tab 1 to this exhibit.

The forecast project completion cost of the OSB is now \$62.7M, which consists of a full release for execution of \$53.0M with a superceding release for an additional \$9.7M. This increase is primarily due to increased engineering, procurement and construction ("EPC") contract costs (+\$8.8M) arising from under-estimation of effort to complete contract scope, including scope additions for electrical distribution equipment upgrades, additional telephone and information technology cable and hardware, upgrades to fire separation barriers and other minor changes.

In-service amounts are \$55.1M in 2015 and \$3.6M 2016.

Project #25609, Security Physical Barrier System: A supplemental release of \$67.2M for an additional \$17.7M over the full release of \$49.5M was primarily due to:

- Settlement of a claim by a subcontractor to the EPC vendor (+\$7.0M)
- Higher costs to complete portions of the project (+\$1.1M)

- Design rework (+\$0.4M)
- Resolution of CNSC audit findings (+\$1.3M)
- Additional OPG support and interest cost (+\$0.4M)

This project is now in close-out.

Project #33977 Darlington Digital Control Computer Replacement / Refurbishment / Upgrades: A supplemental release of \$24.9M for an additional \$2.8M over the full release of \$22.1M was primarily due to:

- Additional interest due to project delays (+\$1.3M)

Project #36001 Darlington Primary Heat Transport Pump Motor Capital Spares: A supplemental release of \$30.8M for an additional \$18.8M over the full release of \$12.0M was primarily due to a decision to expand the project to acquire additional PHT pump motors as a result of the rapid degradation of existing motors. A PHT motor failure in 2015 resulted in a prolonged forced outage while a spare was installed. OPG has assessed PHT pump motor failure as a major risk and this required an acceleration of the pump motor refurbishment program.

Projects #41023 and #49247 Pickering Unit 1 & 4 Fuel Channel East Pressure Tube Shift/Reconfigure: A supplemental release of \$38.6M for an additional \$9.8M over the full release of \$28.8M was primarily due to an increase in scope resulting from changing the project strategy from repositioning to reconfiguration. Increased costs (+\$9.8M) were due to:

- Increase in scope resulting from changing the project strategy from repositioning to reconfiguration
- Additional material costs for the positioning hardware
- Additional project management costs
- Reclassification of reconfiguration cost from project OM&A to Capital
- Additional project contingency

Explanations of project variances are included within the business case summaries for these projects, which are provided in Attachment 1 to this exhibit.

4.0 CAPITAL PROJECT IN-SERVICE INFORMATION

OPG's actual and forecast in-service capital additions for the period 2013-2021 are summarized in Ex. D2-1-3 Table 4. The forecast in-service amounts in the bridge year and test period represent a combination of projected in-service amounts for specific (Tier 1, 2 and 3) projects as presented in Ex. D2-1-3 Tables 1, 2a through 2e, and 3, and a supplemental in-service amount, which is a forecast of in-service declarations that can be expected in the bridge and test years consisting of the following:

- Undefined projects: The supplemental in-service amount is primarily a forecast of in-service amounts for currently undefined projects that make up the portfolio projects (unallocated) portion of capital expenditures. The supplemental in-service amount assumes currently undefined projects will eventually become approved projects, and therefore, consistent with the project specific in-service forecast amount, excludes any project contingency amounts.
- Late completion: The timing of in-service project-specific (Tier 1, 2 and 3) forecast amounts could change as completed work packages for specific projects may be deemed ready for service later than forecast. In the 2016 bridge year, the in-service amounts for approved projects currently total \$513.4M but the in-service forecast assumes there will be delays totalling \$47.4M. This adjustment shows up as a negative supplemental in service amount in 2016

Exhibit D2-1-3 Table 4 includes actual to forecast (or OEB Approved) variance analyses for 2013, 2014 and 2015, which are discussed in section 4.1 below. For completeness, Table 4 also includes planned minor fixed asset expenditures, which are placed in-service in the year of acquisition.

4.1 In-Service Amount Variance Explanations

Accurate forecasting of in-service amounts is challenging due to numerous factors that affect both the amount of the in-service declaration and its timing. In-service amounts vary year-over-year, driven by the level of capital expenditures and the timing of project installations which are frequently tied to specific unit or station outages.

1
2 In-service amounts are also directly affected by project cancellation decisions. After a project
3 is cancelled, alternative replacement projects will be pursued. However, it isn't always
4 possible to advance an alternative project to the installation stage (e.g., if the work requires a
5 specific outage for execution). When alternative capital projects cannot be advanced to
6 replace the cancelled project, the in-service amount in a future year may be less than
7 forecast.

8
9 With respect to project timing, if a project that is forecast for completion in a particular year is
10 delayed by even a month or two such that it carries into the following year, it has a significant
11 impact on in-service amounts for both years.

12
13 Exhibit D2-1-3 Table 4 indicates that 2013 actual amounts were over budget (+\$23.0M).
14 2014 actual amounts were under the 2014 OEB Approved amount (-\$9.7M) and 2015 actual
15 in-service amounts were above the 2015 OEB Approved amount (+\$62.4M), or an average
16 of \$25.2M above budget or OEB Approved over the three years.

17
18 Due to the difficulties with in-service forecasting on an annual basis as discussed above, the
19 large number of projects typically undertaken by OPG Nuclear, and the multi-year schedule
20 for many of the projects, OPG is of the view that a prudent approach would be to assess in-
21 service forecasts and variances over the five-year test period rather than on an annual basis.

22
23 Further details regarding in-service variances are provided below.

24
25 **2015 Actual versus 2015 OEB Approved**

26 Actual in-service amounts were higher (+\$62.4M) than OEB Approved due primarily to the
27 reclassification of projects formerly in the scope of Darlington Refurbishment to Nuclear
28 Operations (+\$60.1M). Darlington (+\$99.3M), Pickering (+59.1M) and the Nuclear Support
29 Divisions (+\$2.4M) placed more than budget amounts in-service, offset by elimination of the
30 supplemental in-service budget (-\$99.1M). Minor fixed asset in-service amounts were slightly
31 higher than budget (+\$0.6M).

At Darlington, in-service declarations by projects included in EB-2013-0321 (+\$80.0M) were higher than the OEB Approved amounts. In-service amounts for new projects (+\$19.3M) accounted for the rest of the total Darlington variance. The notable variances from the previous submission were as follows:

- Project #25619, Darlington Operations Support Building Refurbishment (+\$55.1M) which was reclassified from Darlington Refurbishment in 2014. In EB-2013-0321, the planned in-service amount was \$29.7M. The increased in-service amount (+\$25.4M) was due to under-estimation of the effort required by the EPC vendor, addition of heating, ventilation and air conditioning scope to meet code, other scope changes and delays in the execution schedule requiring extra labour to complete (also see discussion of this project in section 3.4 above).
- Project #33955, Darlington Shutdown System Computer Aging Management (+\$15.1M) due to delays in equipment delivery as well as hardware and software performance issues during testing, which delayed the installation of the new equipment until the end of 2014 and early 2015, which was more than a year later than planned.
- Project #36001, (+\$6.7M) due to delayed delivery of the last spare motor, originally scheduled for delivery in 2014.
- Project #33973, Darlington Standby Generator Controls Replacement (+\$4.1M) due to delays in starting the installation work and greater than anticipated issues with the installation and commissioning of the first installation into 2014, which delayed installation on the next standby generator into 2015.
- Project #31508, Darlington Fukushima Phase 1 Beyond Design Basis Event Emergency Mitigation Equipment (+\$2.6M) due to delays in the design and installation of emergency make-up standpipes and installation of connections for portable post-accident monitoring equipment.
- Project #33258, Darlington Replacement of Emergency Power Supply Uninterruptible Power Supply (+\$1.4M) due to station operating constraints that limit the timing of installation of the uninterruptible power supplies.

At Pickering, in-service declarations for projects included in EB-2013-0321 (+\$36.6M) were higher than the OEB Approved amounts. In-service amounts for new projects (+\$22.5M) accounted for the rest of the total Pickering variance. The notable variances from the previous submission were as follows:

- Project #41023 49247, Pickering Unit 1 & 4 Fuel Channel East Pressure Tube Shift/Reconfigure (+\$22.0M) due to the change in project strategy from repositioning the fuel channels to reconfiguring the fuel channels.
- Project #49154, Pickering B Replacement of Obsolete Instrumentation and Control Equipment (+\$4.3M) due to design completion and late material delivery moving installation into 2015 and 2016.
- Project #40680, Pickering B Main Generator Automatic Voltage Regulator and Protective Relay Upgrade (+\$3.9M) due to delayed completion of the 2014 Unit 7 Outage, which pushed commissioning of the automatic voltage regulator into 2015.
- Project #49267, Pickering Standby Boiler Capacity Improvement (+\$2.5M) due to deferral of boiler retubing from 2014 to 2015 as a result of budget constraints.
- Project #49296, Pickering A Class II Emergency Lighting (+\$2.1M) due to delays resulting from outage rescheduling and unrelated equipment failures which pushed final installation and commissioning from 2014 to 2015.

In the Nuclear Support Divisions, the variance was primarily due to new project in-service declarations (+\$2.0M) with minor increases in the projects included in EB-2013-0321 making up the remainder.

2014 Actual versus 2014 OEB Approved

Actual in-service amounts were lower (-\$9.7M) than OEB Approved due to factors including delays in completion of engineering, emerging issues preventing advancement of work and rescheduling of outage windows. Pickering (+\$19.9M) and the Nuclear Support Divisions (+\$19.6M) placed higher than budget amounts in-service whereas Darlington placed less in service (-\$12.8M).

At Darlington, the notable variances were as follows:

- Project #33621, Darlington Secondary Control Area Air Conditioning Unit Replacement (-\$7.3M) due to discovery of a design issue that required resolution before replacement work could continue. The measured emergency service water flow to the air conditioning units was found to be lower than design, requiring additional design and installation scope to resolve.
- Project #31403, Active Liquid Waste System Upgrade (-\$6.7M) due to vendor quality concerns which led to cancellation of the contract for the chemical addition portion of the project and a one year deferral to address capital spending constraints, which delayed the in-service from 2014 to 2017.
- Project #31426, Fuel Handling Inverter Replacement (-\$4.3M) due to delaying the installation schedule by one year to better align with the fuel handling refurbishment schedule.

At Pickering, the notable variances were as follows:

- Project #49158 49299, Darlington Fukushima Phase 1 Beyond Design Basis Event Emergency Mitigation Equipment (+\$6.1M) due to delays in engineering deliverables and rescheduling of outage windows.
- Project #49284, Administration Building Rehabilitation (+\$4.1M) due to increased scope to address deficiencies found in the heating, ventilation and air conditioning equipment as well as the fire sprinkler system, which moved completion of the project into 2014.
- Project #46605, Passive Autocatalytic Recombiners (-\$7.4M) due to early completion of the installation work.

The variance in Nuclear Support Divisions was primarily due to the following:

- Project #25609, Security Physical Barrier System (+\$7.0M) resulting from the settlement of a claim by a subcontractor to the EPC vendor.
- Project #62552, Inspection Qualification (+\$1.0M) due to slippage in procurement of test samples originally scheduled for delivery in 2013.

2013 Actual versus 2013 Budget

1 In-service amounts were greater than budget (+\$23.0M) due to completion of work originally
2 scheduled to be completed in previous years and new projects. Pickering (+\$40.5M) and the
3 Nuclear Support Divisions (+\$10.4M) placed higher than budget amounts in-service whereas
4 Darlington (-\$18.3M) was under budget.

5
6 At Darlington, the primary reason for the variance was the delay in delivery of the first two
7 Darlington primary heat transport pump motor capital spares (-\$15.0M). Other notable
8 variances were as follows:

- 9 • Project #33955, Darlington Shutdown System Computer Aging Management (-
10 \$10.5M) due to reallocation of resources to a higher priority project and delays in
11 delivery of critical components due to manufacturing issues.
- 12 • Project #33973, Darlington Standby Generator Controls Replacement (-\$8.9M) due to
13 a later than planned start of installation and a longer than planned installation and
14 commissioning period while unexpected issues were resolved.
- 15 • Project #31428, Darlington Fuel Handling Reactor Area Bridge Independent Power
16 and Control System (+\$5.3M) due to delays in completing design work that pushed
17 the first installation from 2012 into 2013.
- 18 • Project #31712, Darlington Instrument Air Compressor and Shutdown Cooling Pump
19 Motor Cooler Strainer Installation (+\$3.8M) was a fast-track installation started in late
20 2012 to address a World Association of Nuclear Operators ("WANO") area for
21 improvement.
- 22 • Project #33815, Darlington Fuel Handling Computer Replacement (+\$3.5M) due to
23 completion of installation work originally scheduled for 2012.
- 24 • Project #31508, Darlington Fukushima Phase 1 Beyond Design Basis Event
25 Emergency Mitigation Equipment (+\$3.4M) due to completion of the initial phase of
26 modifications to provide connections for the emergency equipment.

27
28 At Pickering, the notable variances were as follows:

- 29 • Project #46605, Pickering Passive Auto-Catalytic Recombiners (+\$12.9M) due to an
30 increase of installation scope following the Fukushima Daiichi incident in March 2011

1 and delays in awarding installation contracts in 2012, which resulted in an increase in
2 the in-service amount in 2013.

- 3 • Project #49284, Pickering Administration Building Rehabilitation (+\$12.0M) due to
4 increases in scope to address deficiencies found in the existing systems during
5 installation, and delays in completing work planned for 2012.
- 6 • Project #49247, Pickering Unit 1 & 4 Fuel Channel East Pressure Tube
7 Shift/Reconfigure (+\$5.3M) due to delayed delivery of the new hardware required by
8 a change in strategy from repositioning to reconfiguration.
- 9 • Project #40984, Pickering A Emergency Coolant Injection Strainer Capacity Margin
10 (+\$5.2M) was a new capital project approved in 2012. The project was incorrectly
11 classified as project OM&A when first approved.
- 12 • Project #46634, Pickering A Fuel Handling Single Point of Vulnerability Equipment
13 Reliability Improvement Project (+\$4.6M) due to partial completion of work originally
14 planned for 2012.

15
16 The variance in Nuclear Support Divisions was primarily due to the following:

- 17 • Project #25609, Security Physical Barrier System (+\$7.2M) resulting from resolution
18 of action items arising from a post-commissioning audit by the CNSC.
- 19 • Project #27979, Upgrades to Warehouse Structures (+\$1.6M) due to delayed
20 completion of warehouse upgrades from 2009 to 2013.
- 21 • Project #62570, OPG Chemistry Data Acquisition and Display System Replacement
22 (+\$1.1M) due to delayed designs and software testing planned for completion in
23 2012.

ATTACHMENTS

Attachment 1: Business Case Summaries and Supporting Information

Note: Business Case Summaries included in Attachment 1 are marked "Confidential" or "Internal Use Only", however, OPG has determined them to be non-confidential either in their entirety or with redactions as indicated.