COMPARISON OF NUCLEAR OUTAGE OM&A

1.0 PURPOSE

This evidence presents period-over-period comparisons of outage OM&A by station for 2016-2026 in support of the approval of OPG's forecast outage OM&A for the IR term.

2.0 OVERVIEW

Outage OM&A costs are impacted by the frequency, duration and scope of planned outages, as well as specific outage initiatives requiring support work.

Period-over-period variances are presented in Ex. F2-4-2, Table 1 and are explained below, along with the extent to which the above factors influence outage OM&A in the 2022-2026 IR term.

3.0 PERIOD-OVER-PERIOD CHANGES – IR TERM

<u>2022 Plan versus 2021 Budget</u>

Planned outage OM&A in 2022 is $279.1M, which is $152.0M or 35.3% lower than the 2021 Budget of $431.2M. The variance is attributable to Darlington outages ($156.0M or 63.6% decrease) and Capacity Refurbishment Variance Account ("CRVA") eligible costs ($26.6M or 45.1% decrease), partially offset by Pickering outages ($30.5M or 24.1% increase).

The reportable variances are as follows:

- Darlington planned outage costs are lower due to one short post-Refurbishment outage in 2022 as compared to two regular planned outages and one short post-Refurbishment outage in 2021, partially offset by an increase in routine station inspection and maintenance work for Unit 1 during the refurbishment cyclical outages (Darlington station decrease $129.5M or 63.8% and related Operations and Project Support decrease $26.5M or 62.6%).
- Pickering planned outage costs are higher primarily due to the Pickering Vacuum Building Outage scheduled in 2022 (Pickering station increase $24.0M or 25.2% and related Operations and Project Support increase $6.6M or 20.8%).

- Fuel Channel Life Extension Ongoing (consequential) planned outage costs are $4.6M or 18.2% higher primarily due to Pickering Unit 5 outage scope including a Single Fuel Channel Replacement and Scrape in 2022.
- Pickering Extended Operations planned outage costs are $32.5M or 100.0% lower primarily due to the completion of outage OM&A expenditures for this program in 2021.
- Pickering Optimized Shutdown planned outage costs are $1.3M or 105.9% higher primarily attributable to ramp up of this work program for Pickering Unit 5 outage scope.

<u>2023 Plan versus 2022 Plan</u>

Planned outage OM&A in 2023 is $361.2M, which is $82.1M or 29.4% higher than the 2022 planned amount of $279.1M. The variance is primarily attributable to Darlington outages ($97.7M or 109.2% increase), partially offset by CRVA eligible costs ($15.7M or 48.4% decrease).

The reportable variances are as follows:

- Darlington planned outage costs are higher due to one major planned outages in 2023 as compared to one short post-Refurbishment outage in 2022 (Darlington station increase $85.5M or 116.1% and related Operations and Project Support increase $12.3M or 77.4%).
- Pickering planned outage costs are stable with a combination of an increase due to conducting three regular planned outages in 2023 as compared to two regular planned outages in 2022 (increase in related Operations and Project Support $12.5M or 33.0%), offset by a decrease primarily due to the Pickering Vacuum Building Outage and spindle refurbishment in 2022 (Pickering station decrease $12.5M or 10.5%).
- Fuel Channel Life Extension Ongoing (consequential) planned outage costs are $15.3M or 51.5% lower due to Pickering Unit 5 outage scope including a Single Fuel Channel Replacement and Scrape in 2022.

<u>2024 Plan versus 2023 Plan</u>

Planned outage OM&A in 2024 is $212.4M, which is $148.8M or 41.2% lower than the 2023 planned amount of $361.2M. The variance is primarily attributable to Darlington outages ($92.5M or 49.4% decrease) and Pickering outages ($53.4M or 33.9% decrease).

The reportable variances are as follows:

- Darlington planned outage costs are lower in 2024 due to one short post-Refurbishment outage in 2024 as compared to one regular planned outage in 2023 (Darlington station decrease $77.1M or 48.5% and related Operations and Project Support decrease $15.4M or 54.8%).
- Pickering planned outage costs decrease due to conducting two regular planned outages in 2024 as compared to three regular planned outages in 2023 (Pickering station decrease $29.2M or 27.4% and related Operations and Project Support decrease $24.2M or 47.8%).
- Fuel Channel Life Extension Ongoing (consequential) planned outage costs are $14.2M or 98.2% lower due to continued winding down of this program with Pickering Unit 6 and Unit 8 outage scope completed in 2023.
- Pickering Optimized Shutdown planned outage costs are $11.3M or 506.7% higher primarily attributable to Unit 5 and Unit 7 inspection scope.

<u>2025 Plan versus 2024 Plan</u>

Planned outage OM&A in 2025 is $192.6M, which is $19.8M or 9.3% lower than the 2024 planned amount of $212.4M. The variance is attributable to Pickering outages ($104.0M or 100.0% decrease) and CRVA eligible costs ($13.8M or 100.0% decrease), partially offset by Darlington outages ($97.9M or 103.4% increase).

The reportable variances are as follows:

- Darlington planned outage costs are higher due to one regular planned outage and two short post-Refurbishment outages in 2025 as compared to one short post-Refurbishment outage in 2024, partially offset by a decrease in routine station inspection and maintenance work for Unit 1 during the refurbishment cyclical outages (Darlington station increase $75.0M or 91.5% and related Operations and Project Support increase $23.0M or 180.6%).
- Pickering planned outage costs are lower due to no regular planned outages at Pickering after 2024 (Pickering station decrease $77.5M or 100.0% and related Operations and Project Support decrease $26.4M or 100.0%).
- Pickering Optimized Shutdown planned outage costs are $13.5M or 100.0% lower due to the conclusion of this work program

2026 Plan versus 2025 Plan

Planned outage OM&A in 2026 is $61.3M, which is $131.2M or 68.2% lower than the 2025 planned amount of $192.6M. The variance is attributable to Darlington outages.

The reportable variances are as follows:

- Darlington planned outage costs are lower due to one short post-Refurbishment outage in 2026, as compared to one regular planned outage and two short post-Refurbishment outages in 2025, partially offset by preparation costs for the 2027 VBO (Darlington station decrease $99.1M or 63.2% and related Operations and Project Support decrease $32.1M or 90.1%).

4.0 PERIOD-OVER-PERIOD CHANGES – BRIDGE YEARS

2021 Budget versus 2021 OEB Approved

Planned outage OM&A in 2021 is $431.2M, which is $122.6M or 39.7% higher than the 2021 OEB Approved Budget of $308.5M. The variance is attributable to Darlington outages ($181.1M or 281.4% increase) and CRVA eligible costs ($57.5M increase), partially offset by Pickering outages ($115.9M or 47.8% decrease).

The reportable variances are as follows:

- Darlington planned outage costs are higher due to moving the Unit 1 major planned outage from 2020 to 2021 and adding a Unit 4 regular planned outage as a result of the deferred Darlington Refurbishment Program ("DRP") schedule (see Ex. E2-1-2; Darlington station increase $149.0M or 275.2% and related Operations and Project Support increase $32.1M or 314.2%).
- Pickering planned outage costs are lower primarily due to moving the Pickering Vacuum Building Outage from 2021 to 2022 and reducing regular planned outages from three to two in line with the 30-month outage cycle (Pickering station decrease $73.9M or 43.7% and related Operations and Project Support decrease $42.0M or 57.2%).
- Fuel Channel Life Extension Ongoing planned outage costs are $23.7M higher primarily attributable to the addition of Waterlancing and Scrape Sample Analysis for Darlington

Unit 4 and Pickering Unit 7 and Unit 8 as well as moving the Darlington Unit 1 regular planned outage from 2020 to 2021.

- Pickering Extended Operations planned outage costs are $32.5M higher primarily due to Unit 7 and Unit 8 inspection work moved from 2020 to 2021 (there were no outage OM&A costs forecast in 2021 OEB Approved). Total Pickering Extended Operations actual and budgeted OM&A/capital expenditures over the period 2016-2021 are forecast to be aligned to the estimate in EB-2016-0152 of $307M.
- Pickering Optimized Shutdown planned outage costs are $1.2M higher primarily attributable to the introduction of this work program for Unit 7 and Unit 8 inspection work.

<u>2021 Budget versus 2020 Budget</u>

Planned outage OM&A in 2021 is $431.2M, which is $139.1M or 47.6% higher than the 2020 planned amount of $292.1M. The variance is attributable to Darlington outages ($191.6M or 355.9% increase), partially offset by Pickering outages ($43.5M or 25.5% decrease) and CRVA eligible costs ($9.0M or 13.2% decrease).

The reportable variances are as follows:

- Darlington planned outage costs are higher due to two regular planned outages and one short post-Refurbishment outage in 2021, as compared to no major outages in 2020 (Darlington station increase $155.2M or 323.8% and related Operations and Project Support increase $36.4M or 616.3%).
- Pickering planned outage costs are lower due to conducting two regular planned outages in 2021 as compared to three such outages in 2020 (Pickering station decrease $47.3M or 33.1%), partially offset by Unit 8 Single Fuel Channel Replacement in 2021 (related Operations and Project Support increase $3.8M or 13.6%).
- Fuel Channel Life Extension Ongoing (consequential) planned outage costs are $8.5M or 50.5% higher primarily attributable to Pickering for Unit 5 Single Fuel Channel Replacement pre-requisites for the 2022 outage and Unit 7 Waterlancing and Scrape Sample Analysis.
- Pickering Extended Operations Enabling planned outage costs are $18.6M or 36.3% lower primarily attributable to conducting two regular planned outages in 2021 as compared to

three such outages in 2020. Total Pickering Extended Operations actual and budgeted OM&A/capital expenditures over the period 2016-2021 are forecast to be aligned to the estimate in EB-2016-0152 of $307M.

- Pickering Optimized Shutdown planned outage costs are $1.1M higher due to Unit 7 and Unit 8 inspection work in 2021.

<u>2020 Budget versus 2020 OEB Approved</u>

Planned outage OM&A in 2020 is $292.1M, which is $102.4M or 26.0% lower than the 2020 OEB Approved Budget of $394.4M. The variance is attributable to Darlington outages ($124.7M or 69.9% decrease) and CRVA eligible costs ($25.9M or 27.6% decrease), partially offset by Pickering outages ($48.3M or 39.6% increase).

The reportable variances are as follows:

- Darlington planned outage costs are lower primarily due to moving the Unit 1 major planned outage from 2020 to 2021, as discussed above (Darlington station decrease $102.7M or 68.2% and related Operations and Project Support decrease $22.0M or 78.8%).
- Pickering planned outage costs are higher due to costs incurred for spindle refurbishment (Pickering station increase $42.3M or 42.2% and related Operations and Project Support increase of $6.0M or 27.6%).
- Fuel Channel Life Extension Ongoing (consequential) planned outage costs are $8.3M or 99.4% higher primarily attributable to higher Single Fuel Channel Replacement costs for Darlington Unit 3 than originally planned for Darlington Unit 1.
- Pickering Extended Operations Enabling planned outage costs are $34.4M or 40.3% lower primarily due to the further definition post-2016 of scope, which resulted in a decrease in Pickering Extended Operations outage OM&A offset by increases in Pickering Extended Operations Base OM&A and Pickering Extended Operations Capital in 2020 (Ex. F2-3-1), and timing of expenditures as Unit 7 and Unit 8 inspection work was moved from 2020 to 2021.

2020 Budget versus 2019 Actual

Planned outage OM&A in 2020 is $292.1M, which was $27.8M or 10.5% higher than the 2019 Actual amount of $264.3M. The variance is attributable to Pickering outages ($58.9M or 52.9% increase) and CRVA eligible costs ($21.0M or 44.8% increase), partially offset by Darlington outages ($52.1M or 49.2% decrease).

The reportable variances are as follows:

- Darlington planned outage costs are lower due to no regular planned outages in 2020, as compared to one such outage in 2019 (Darlington station decrease $42.7M or 47.1% and related Operations and Project Support decrease $9.5M or 61.6%).
- Pickering planned outage costs increase due to conducting three regular planned outages and a spindle refurbishment in 2020 as compared to two regular planned outages in 2019 (Pickering station increase $54.5M or 61.9% and related Operations and Project Support increase $4.4M or 18.9%).
- Fuel Channel Life Extension Ongoing (consequential) planned outage costs are $5.5M or 24.8% lower primarily attributable to Darlington Unit 4 inspection and maintenance work undertaken in 2019.
- Pickering Extended Operations planned outage costs are $26.4M or 107.1% higher primarily due to conducting three regular panned outages and a spindle refurbishment in 2020 as compared to two regular planned outages in 2019.

5.0 PERIOD-OVER-PERIOD CHANGES – HISTORICAL YEARS

2019 Actual versus 2019 OEB Approved

Actual outage OM&A in 2019 was $264.3M, which was $151.0M or 36.4% lower than the 2019 OEB Approved Budget of $415.3M. The variance is attributable to CRVA Eligible Costs ($70.3M or 60.0% decrease), Pickering outages ($50.2M or 31.0% decrease) and Darlington outages ($30.5M or 22.4% decrease).

The reportable variances are as follows:

- Darlington planned outage costs are lower primarily due to more pre-requisite work executed in 2018 for the 2019 Unit 4 regular planned outage (Darlington station decrease $28.0M or 23.6% and related Operations and Project Support decrease $2.6M or 14.3%).
- Pickering planned outage costs decrease due to conducting two regular planned outages rather than three such outages in 2019 under the 30-month outage cycle (Pickering station decrease $40.6M or 31.5% and related Operations and Project Support decrease $9.6M or 29.1%).
- Fuel Channel Life Extension Ongoing (consequential) planned outage costs are $6.3M or 22.1% lower primarily attributable to the deferral of the Single Fuel Channel Replacement for Pickering Unit 5.
- Pickering Extended Operations planned outage costs are $64.0M or 72.2% lower primarily due to significant scope for only one regular planned outage rather than two such outages in 2019, along with the deferral of the Single Fuel Channel Replacement for Unit 5 until 2022, as well as a further definition post-2016 of scope, which resulted in a decrease in Pickering Extended Operations outage OM&A offset by increases in Pickering Extended Operations Base OM&A and Pickering Extended Operations Capital in 2019 (Ex. F2-3-1).

<u>2019 Actual versus 2018 Actual</u>

Actual outage OM&A in 2019 was $264.3M, which was $80.6M or 23.4% lower than the 2018 Actual amount of $344.9M. The variance is attributable to Pickering outages ($61.9M or 35.7% decrease), Darlington outages ($43.5M or 29.1% decrease), partially offset by CRVA eligible costs ($24.8M or 112.2% increase).

The reportable variances are as follows:

- Darlington planned outage costs are lower in 2019 due to significant pre-requisite costs in 2018 for the 2019 Unit 4 regular planned outage, along with reduced Unit 2 refurbishment cyclical outage work (Darlington station decrease $46.3M or 33.8%), partially offset by related Operations and Project Support (increase $2.8M or 22.2%) due to inspection scope differences between the regular planned outages in each year.

- Pickering planned outage costs decrease due to conducting two regular planned outages in 2019 as compared to three such outages in 2018 (Pickering station decrease $33.1M or 27.3% and related Operations and Project Support decrease $28.8M or 55.3%).
- Fuel Channel Life Extension Ongoing planned outage costs are $9.5M or 73.9% higher primarily attributable to a Single Fuel Channel Replacement for Darlington Unit 3 and Waterlancing for Pickering Unit 5 and Darlington Unit 4 in 2019.
- Pickering Extended Operations planned outage costs are $15.4M or 164.7% higher primarily due to more significant scope for the Unit 5 regular planned outage in 2019.

<u>2018 Actual versus 2018 OEB Approved</u>

Actual outage OM&A in 2018 was $344.9M, which was $48.9M or 12.4% lower than the 2018 OEB Approved Budget of $393.8M. The variance is attributable to CRVA eligible costs ($41.7M or 65.4% decrease) and Pickering outages ($11.3M or 6.1% decrease), partially offset by Darlington outages ($4.1M or 2.9% increase).

The reportable variances are as follows:

- Darlington planned outage costs are higher primarily due to incurring pre-requisite costs for the 2019 Unit 4 regular planned outage, partially offset by contractor savings related to turbines and crew size for the Unit 3 outage (Darlington station increase $13.2M or 10.7%). Darlington station increases were partially offset by related Operations and Project Support (decrease $9.1M or 41.9%) primarily due to less inspection and maintenance support required for the Unit 3 outage and for Unit 2 refurbishment cyclical outage.
- Pickering planned outage costs decrease primarily as a result of the Unit 7 regular planned outage and the Unit 5 regular planned outage pre-requisites deferred from 2018 to 2019 under the 30-month outage cycle, partially offset by the Unit 6 regular planned outage deferred from 2017 to 2018 (Pickering station decrease $18.8M or 13.4%), partially offset by related Operations and Project Support for 2019 pre-requisite costs (increase $7.5M or 16.7%).
- Fuel Channel Life Extension Ongoing (consequential) planned outage costs are $13.8M or 51.8% lower primarily attributable to the deferral of Pickering Unit 7 regular planned outage to 2019.

- Pickering Extended Operations Enabling planned outage costs are $28.0M or 75.0% lower primarily due to a further definition post-2016 of scope, which resulted in a decrease in Pickering Extended Operations outage OM&A offset by increases in Pickering Extended Operations Base OM&A and Pickering Extended Operations Capital in 2018 (Ex F2-3-1).

<u>2018 Actual versus 2017 Actual</u>

Actual outage OM&A in 2018 was $344.9M, which was $27.4M or 8.6% higher than the 2017 Actual amount of $317.4M. The variance is attributable to Pickering outages ($26.8M or 18.3% increase) and Darlington outages ($13.3M or 9.8% increase), partially offset by CRVA eligible costs ($12.7M or 36.4% decrease).

The reportable variances are as follows:

- Darlington planned outage costs are higher primarily due to pre-requisite costs for the 2019 Unit 4 major outage incurred in 2018 (Darlington station increase $13.4M or 10.8%).
- Pickering planned outage costs increase due to conducting three regular planned outages in 2018 as compared to two such outages in 2017 (Pickering station increase $17.0M or 16.4% and related Operations and Project Support increase $9.8M or 23.1%).
- Fuel Channel Life Extension Ongoing planned outage costs are $18.8M or 59.5% lower primarily attributable to Darlington Unit 1 costs related to Single Fuel Channel Replacement and other inspection scope in 2017.
- Pickering Extended Operations planned outage costs are $6.1M or 190.0% higher primarily due to conducting three regular planned outages in 2018 as compared to two regular planned outages in 2017.

<u>2017 Actual versus 2017 OEB Approved</u>

Actual outage OM&A in 2017 was $317.4M, which was $77.1M or 19.5% lower than the 2017 OEB Approved Budget of $394.6M. The variance is attributable to Pickering outages ($45.4M or 23.7% decrease) and Darlington outages ($36.4M or 21.1% decrease), partially offset by CRVA eligible costs ($4.8M or 15.8% increase).

The reportable variances are as follows:

- Darlington planned outage related Operations and Project Support costs decrease $24.4M or 65.8% primarily due to less inspection and maintenance support required for the Unit 1 regular planned outage and for Unit 2 refurbishment cyclical outage work.
- Pickering planned outage costs decrease primarily as a result of the Unit 6 regular planned outage deferred from 2017 to 2018 (Pickering station decrease $30.2M or 22.5% and related Operations and Project Support decrease $15.2M or 26.5%).
- Fuel Channel Life Extension Ongoing planned outage costs are $23.6M or 297.2% higher primarily attributable to Darlington Unit 1 costs related to Single Fuel Channel Replacement and other inspection scope in 2017.
- Pickering Extended Operations Enabling planned outage costs are $18.9M or 85.4% lower primarily due to a further definition post 2016 of scope, which resulted in a decrease in Pickering Extended Operations outage OM&A offset by increases in Pickering Extended Operations Base OM&A and Pickering Extended Operations Capital in 2017 (Ex. F2-3-1).

<u>2017 Actual versus 2016 Actual</u>

Actual outage OM&A in 2017 was $317.4M, which was $10.8M or 3.5% higher than the 2016 Actual amount of $306.7M. The variance is attributable to CRVA eligible costs ($34.8M increase) and Darlington outages ($20.8M or 18.0% increase), partially offset by Pickering outages ($44.8M or 23.4% decrease).

The reportable variances are as follows:

- Darlington planned outage costs increase in 2017 primarily due to refurbishment cyclical outage work on Unit 2 in late 2016 (Darlington station increase $33.3M or 36.9%), partially offset by scope differences between the regular planned outages for inspection and maintenance support (related Operations and Project Support decrease $12.5M or 49.6%).
- Pickering planned outage costs decrease due to conducting two major outages in 2017 as compared to three major outages in 2016 (Pickering station decrease $24.2M or 18.8% and related Operations and Project Support decrease $20.7M or 32.8%).
- Fuel Channel Life Extension Ongoing planned outage costs are $31.6M higher primarily due to significant Darlington Unit 1 costs related to Single Fuel Channel Replacement and other inspection scope in 2017.

- Pickering Extended Operations planned outage costs are $3.2M higher primarily due to commencing the work program for outages in 2017.

2016 Actual versus 2016 Budget

Actual outage OM&A in 2016 was $306.7M, which was $14.5M or 4.5% lower than the 2016 Budget of $321.2M. The variance is primarily attributable to Darlington outages ($9.8M or 7.9% decrease) and Pickering outages ($4.4M or 2.3% decrease).

The reportable variances are as follows:

- Darlington planned outage related Operations and Project Support costs are $6.4M or 20.3% lower primarily due to timing and scope of Unit 2 refurbishment cyclical outage work and cost savings related to the Unit 4 regular planned outage.