

## DEPRECIATION AND AMORTIZATION

### 1.0 PURPOSE

This evidence describes OPG's depreciation and amortization policy and presents the depreciation and amortization expense for the nuclear facilities.

### 2.0 OVERVIEW

OPG is seeking approval of IR term revenue requirements for the nuclear facilities that include depreciation and amortization expense of \$553.0M in 2022, \$471.5M in 2023, \$578.7M in 2024, \$521.6M in 2025, and \$568.6M for 2026, as shown in Ex. F4-1-1 Table 2. Exhibit F4-1-1 Table 2 also presents the depreciation and amortization expense for the historical and bridge years for the nuclear facilities.

In its EB-2016-0152 Decision and Order (p. 86), the OEB stated it had no concerns with OPG's proposal to conduct an independent review of asset service lives after the completion of Darlington Unit 2 refurbishment. Given the anticipated timing of the application, OPG engaged Concentric Advisors, ULC ("Concentric") in 2019 to provide an independent review and assessment of the asset service life estimates for OPG's prescribed nuclear assets based on the net book values as at December 31, 2019 (the "2019 Depreciation Study") and the assets placed in service upon the return to service of Darlington Unit 2 in June 2020. The 2019 Depreciation Study is provided in Attachment 1.

Section 3.0 describes OPG's depreciation and amortization expense, summarizes OPG's depreciation and amortization policy and review process, and outlines the results of the 2019 Depreciation Study, the recommendations of the OPG's Depreciation Review Committee ("DRC") including the changes to the Pickering station accounting end-of-life ("EOL") dates made effective December 31, 2017, and the impact of these recommendations on depreciation and amortization expense.

As discussed in Section 3.5, consistent with past practice, OPG does not propose to reflect any future changes in the Pickering station EOL dates in this application. Instead, OPG

1 proposes a deferral account to capture the revenue requirement impacts of such changes  
2 over the IR term, on terms similar to the deferral accounts established in EB-2015-0374 and  
3 EB-2018-0002 for prior changes in station EOL dates for the prescribed nuclear facilities.<sup>1</sup>  
4

5 Section 4.0 discusses the trend in depreciation and amortization expense over the period  
6 2016-2026.

7  
8 The depreciation expense for the Bruce assets is presented in Ex. G2-2-1.  
9

### 10 **3.0 DEPRECIATION AND AMORTIZATION EXPENSE**

11 OPG continues to determine depreciation and amortization expense in the same manner as  
12 presented in EB-2016-0152 and prior payment amounts proceedings.  
13

14 Allocation of depreciation expense is not required to attribute depreciation and amortization  
15 expense to the regulated facilities. Approximately 99 per cent of OPG's in-service fixed and  
16 intangible assets are associated with specific generation facilities or plant groups. The  
17 remaining in-service fixed and intangible assets, such as information technology assets,  
18 continue to be either directly associated with a line of business or to be held centrally for use  
19 by both regulated and unregulated businesses. For the use of assets held centrally,  
20 generating businesses (both regulated and unregulated) continue to be charged an asset  
21 service fee for the use of these assets. This charge is reported as an OM&A cost. The asset  
22 service fees are described in Ex. F3-2-1, including for the new corporate campus planned in  
23 Clarington.  
24

#### 25 **3.1 Depreciation and Amortization Policy and Review Process**

26 OPG's depreciation and amortization policy and treatment of asset retirements is unchanged  
27 from that presented in EB-2016-0152 and EB-2013-0321.  
28

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<sup>1</sup> The proposed deferral account is discussed further at Ex. H1-1-1, Section 6.2.

1 Depreciation and amortization rates for the various classes of OPG's in-service fixed and  
2 intangible assets continue to be based on their estimated service lives using the straight-line  
3 method. The service life of an asset class is limited by the service life of the station(s) to  
4 which it relates. An average EOL date is established for depreciation purposes for all units at  
5 a particular station, which is typically based on estimated EOL dates for each operating unit  
6 of the station. For the Pickering station, separate EOL dates continue to be maintained for  
7 Units 1 and 4 and for Units 5-8. The determination of the station EOL dates for depreciation  
8 purposes involves an assessment of the condition and expected remaining life of certain key  
9 components (referred to as life-limiting components), in conjunction with an estimate of the  
10 expected operation of the station, which includes economic viability considerations. For the  
11 nuclear stations, life-limiting components are: fuel channels, steam generators, feeder pipes  
12 and reactor components.

13

14 The net book value of the prescribed nuclear facilities and the Bruce assets continues to  
15 include asset retirement costs ("ARC") relating to OPG's asset retirement obligation ("ARO")  
16 for nuclear decommissioning and nuclear waste management liabilities ("nuclear liabilities").  
17 Accordingly, the depreciation and amortization expense also includes the depreciation of  
18 ARC. The depreciation of ARC forms part of the revenue requirement impact for the recovery  
19 of the nuclear liabilities as discussed and presented in Ex. C2-1-1.

20

21 The current EOL dates for depreciation purposes for the prescribed nuclear facilities and the  
22 Bruce stations are provided below in Chart 1. As discussed in EB-2018-0002, effective  
23 December 31, 2017, OPG extended the station EOL dates of Pickering Units 1 and 4 and  
24 Pickering Units 5-8. These changes impact the depreciation and amortization expense for  
25 the historical and bridge years and the IR term and are discussed in Section 3.4. Chart 1  
26 below shows the station EOL dates in effect at the time of EB-2016-0152 (i.e. those effective  
27 December 31, 2015) and those reflected in OPG's 2020-2026 Business Plan and this  
28 application (i.e. those effective December 31, 2017).

29

1 **Chart 1: Station End-of-Life Dates at December 31, 2015 and December 31, 2017**

	<b>Effective December 31, 2015</b>	<b>Effective December 31, 2017</b>
Darlington	December 31, 2052	December 31, 2052
Pickering Units 1 & 4	December 31, 2020	December 31, 2022
Pickering Units 5-8	December 31, 2020	December 31, 2024
Bruce A (Units 1-4)	December 31, 2052	December 31, 2052
Bruce B (Units 5-8)	December 31, 2061	December 31, 2061

2

3 In EB-2013-0321, the OEB accepted the results of an independent assessment of OPG's  
 4 asset service life estimates and nuclear station EOL dates (the "EB-2013-0321 Depreciation  
 5 Study") performed by Concentric (then operating as Gannett Fleming Canada ULC),  
 6 predicated on OPG's continued application of the average life group method.<sup>2</sup> As in EB-  
 7 2016-0152, OPG continues to apply the average life group method for the purposes of  
 8 calculating depreciation expense, as most recently recommended by Concentric in finding  
 9 that this approach "results in a reasonable recovery of OPG's capital investment over time".<sup>3</sup>

10

11 As part of its due diligence process, OPG continues to convene an internal DRC to examine  
 12 the service lives of fixed and intangible assets and therefore the calculation of depreciation  
 13 and amortization expense. The DRC is comprised of business representatives as well as  
 14 staff from the Finance and Regulatory Affairs functions. The DRC considers available  
 15 engineering, technical, operational and financial assessments/information as part of its  
 16 regular review of the service lives of generating stations (including the Bruce stations) and a  
 17 selection of asset classes with the general objective of reviewing all significant asset classes  
 18 for the regulated assets over a five-year cycle. Periodic independent reviews of the service  
 19 life estimates of significant asset classes for the regulated assets are also performed, as  
 20 recommended by Concentric.<sup>4</sup>

<sup>2</sup> EB-2013-0321 Decision with Reasons, p. 98

<sup>3</sup> Attachment 1, p. 3-1.

<sup>4</sup> EB-2013-0321 Ex. F4-1-1, Attachment 1, p I-7.

1 The DRC's scope and recommendations continue to be submitted for approval to OPG's  
2 senior executives, including the Chief Financial Officer, the Chief Administrative Officer and  
3 the business leaders of Nuclear and Hydroelectric operations (the Approvals Committee).  
4 Approved DRC recommendations are used to calculate the depreciation and amortization  
5 expense that is reflected in OPG's financial statements and business plan. Any changes to  
6 asset service lives resulting from the DRC process are typically implemented prospectively  
7 as of the end of the review year or the beginning of the following year. As part of the EB-  
8 2013-0321 Depreciation Study, OPG's DRC review process was found by Concentric to be  
9 procedurally sound and meeting generally accepted regulatory objectives regarding  
10 depreciation.<sup>5</sup> In its 2019 Depreciation Study, Concentric again found the DRC process "to  
11 be procedurally sound, reasonable and resulting in valid depreciation rates and generating  
12 station lives that accurately reflect the consumption of average service life of OPG's  
13 regulated assets."<sup>6</sup>

14  
15 The DRC recommendations are discussed in Section 3.3.

### 17 **3.2 Independent Depreciation Study**

18 As discussed above, OPG engaged Concentric in 2019 to conduct an independent  
19 assessment of depreciation rates and generating station lives for the regulated nuclear  
20 facilities based on the net book values as at December 31, 2019 and the assets placed in  
21 service upon the return to service of Darlington Unit 2 from refurbishment in June 2020.

22  
23 The results of the study are summarized as follows:<sup>7</sup>

24  
25 In reviewing depreciation rates for OPG's nuclear plant accounts and having regard  
26 to the plant associated with the return to service of Unit 2 at Darlington NGS,  
27 Concentric supports the average service lives currently in use, subject to  
28 recommended changes for the following accounts:

- 29 • Nuclear – Shutdown Cooling System Heat Exchangers – Pickering: from 25  
30 years to 30 years; and

---

<sup>5</sup> EB-2013-0321 Ex. F4-1-1, Attachment 1, pp. I-3 and I-4

<sup>6</sup> Attachment 1, p. 1-3.

<sup>7</sup> Attachment 1, pp. 1-3 and 1-4

- 1 • Nuclear – Building Electric Service Supply – Pickering 1&4 and Bruce: from 40  
2 years to 55 years.
- 3 • Nuclear – Fuel Channel Assemblies: from 28 years to 30 years;
- 4 • Nuclear – Calandria Tubes – Pickering 5-8 and Darlington: from 28 years to  
5 30 years;
- 6 • New Account: Nuclear – Instrumentation and Control – Darlington  
7 Refurbishment: 30 years; and,
- 8 • New Account: Nuclear – Service Water and Fire Protection System –  
9 Darlington Refurbishment: 30 years.

10 Concentric also believes that the life span dates currently in place for depreciation  
11 purposes for the regulated nuclear generating assets are reasonable for use in this  
12 study, recognizing that OPG is in the midst of implementing plans for optimizing the  
13 planned shutdown dates for the Pickering NGS.  
14  
15

16 OPG has accepted and, effective January 1, 2021, will implement the above  
17 recommendations from the study pending formal approval through the 2020 DRC process.  
18 OPG's forecast depreciation and amortization expense in this application incorporates the  
19 estimated impact of these changes effective January 1, 2021, which is a decrease of  
20 approximately \$5M annually.  
21

22 With respect to the process followed by OPG to componentize the assets placed in service  
23 upon returning Darlington Unit 2 to service, Concentric drew the following conclusion:<sup>8</sup>  
24

25 In conjunction with the above asset class changes, Concentric finds the process used  
26 by OPG to componentize the capital amount placed in service upon completion of  
27 refurbishment for Unit 2 of Darlington NGS in June 2020 to result in reasonable and  
28 valid depreciation rates going forward.  
29  
30

### 31 **3.3 Depreciation Review Committee Recommendations**

32 Since EB-2016-0152, the DRC was convened four times, annually from 2016 to 2019. For  
33 the nuclear assets, the DRC recommended, and the Approvals Committee approved, the  
34 following three changes to asset class lives, in addition to the extension of the Pickering EOL  
35 dates discussed in Section 3.4 below:

---

<sup>8</sup> Attachment 1, pp. 1-4.

- 1 • In 2016, the DRC recommended a reduction in the average service life for asset class  
2 15511000 (Nuclear – Station Service Main Transformers and AC Power Distribution  
3 System – Pickering Units 5- 8 and Darlington) from 55 years to 40 years based on  
4 plant condition and engineering assessments.
- 5 • In 2016, the DRC recommended establishing a separate asset class for security  
6 fencing with an average service life of 20 years that was previously included in asset  
7 class 15120000 (Nuclear – Yard Facilities) with a 50-year average service life. This  
8 change recognized the shorter design life of fencing compared to other assets in the  
9 class.
- 10 • In 2017, the DRC recommended a reduction in the average service life for asset class  
11 15411000 (Nuclear – Turbine Blades & Diaphragms – Pickering) from 40 years to 15  
12 years based on engineering assessments and comparison against other nuclear  
13 generating facilities.

14  
15 These changes had a minimal aggregate impact on nuclear depreciation and amortization  
16 expense, estimated at less than \$2M per year decrease, and are reflected in the depreciation  
17 and amortization expense in this application. The changes were reflected in the asset service  
18 life estimates reviewed by Concentric as part of the 2019 Depreciation Study, which did not  
19 recommend any further changes to these asset classes.

20  
21 The Nuclear DRC recommendations for 2016 through 2019 are provided in Attachments 2-5  
22 to this schedule.

### 23 24 **3.4 Historical Changes in Nuclear Station End-Of-Life Dates**

25 The only change made to nuclear station EOL dates for depreciation and amortization  
26 purposes since EB-2016-0152 was an extension of the Pickering EOL dates for Units 1 and  
27 4 and Units 5-8, effective December 31, 2017. The previous and current nuclear station EOL  
28 dates can be found in Chart 1 provided in Section 3.1.

29  
30 In 2017, the DRC concluded that OPG had achieved sufficient high confidence to extend the  
31 EOL dates for Pickering Units 1 and 4 to December 31, 2022 and for Pickering Units 5-8 to

1 December 31, 2024. Previously and in EB-2016-0152, the EOL dates were set at  
2 December 31, 2020. The DRC made this conclusion on the basis of the high technical  
3 confidence associated with the programs and provisions in place to assure fitness-for-service  
4 of fuel channel components (including through the results of the Fuel Channel Life  
5 Assurance project) and an assessment of the status of the then-pending operating license  
6 application to the Canadian Nuclear Safety Commission (“CNSC”).<sup>9</sup> These EOL dates were  
7 adopted for accounting purposes effective December 31, 2017.

8  
9 In connection with these changes, OPG recorded an adjustment to the ARO for the nuclear  
10 liabilities and associated ARC balances as of December 31, 2017, in accordance with US  
11 GAAP. This adjustment is further discussed in Ex. C2-1-1, Section 6.0.

12  
13 Pursuant to OPG’s EB-2018-0002 accounting order application made as required by the EB-  
14 2016-0152 Payment Amounts Order, the OEB established the Impact Resulting from  
15 Changes to Pickering Station End-of-Life Dates (December 31, 2017) Deferral Account to  
16 record, effective January 1, 2018, the revenue requirement impact on the prescribed facilities  
17 arising from changes to nuclear liabilities and depreciation and amortization expense as a  
18 result of the above changes in the Pickering station EOL dates. The account is to continue  
19 recording this revenue requirement impact until the effective date of the next payment  
20 amounts order incorporating these changes to the Pickering EOL dates in nuclear payment  
21 amounts. The deferral account is further discussed in Ex. H1-1-1, section 5.22.

22  
23 As provided in EB-2018-0002 and set out in Ex. H1-1-1, the changes in the Pickering  
24 stations EOL dates resulted in a total decrease in non-ARC depreciation and amortization  
25 expense of \$295.7M based on forecast asset values reflected in the EB-2016-0152 payment  
26 amounts over 2018-2021.<sup>10</sup> This was partially offset by the increase in ARC depreciation

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<sup>9</sup> In August 2018, OPG obtained a ten-year license renewal for the Pickering GS from the CNSC, valid until August 31, 2028. (Ex. F2-1-1).

<sup>10</sup> See Ex. H1-1-1, Table 13, line 5. As noted in EB-2018-0002, Interrogatory Schedule-1 Staff-1, p. 3, lines 26-29, these impacts, which are being recorded in the Impact Resulting from Changes to Pickering Station End-of-Life Dates (December 31, 2017) Deferral Account, are determined by applying the revised Pickering station EOL dates to recalculate the corresponding OEB-approved values reflected in the EB-2016-0152 revenue



1 expense of \$98.5M over the same period, inclusive of the corresponding year-end 2017  
2 ARO/ARC adjustment.<sup>11</sup>

3

4 Based on the actual net book value of the assets as at December 31, 2017, the changes in  
5 the Pickering station EOL dates and the year-end ARO/ARC adjustment resulted in an  
6 estimated reduction in depreciation and amortization expense of approximately  
7 \$78M annually.<sup>12</sup>

8

### 9 **3.5 Future Changes in Nuclear Station End-Of-Life Dates**

10 As discussed in Ex. F2-1-1, section 4.0, OPG's Pickering Optimized Shutdown plan includes  
11 operating all six units at Pickering through 2024, at which point two units would be shut down  
12 (one in September 2024 and one in December 2024) and the remaining four units would  
13 operate until the end of 2025. This represents an extension of the planned operating period  
14 beyond the current accounting EOL dates of December 31, 2022 for Units 1 and 4 and  
15 December 31, 2024 for Units 5-8.

16

17 The achievement of the plan to operate Units 5-8 beyond 2024 is subject to the results of  
18 ongoing technical assessments and requires the CNSC's approval. The accounting EOL  
19 date for Units 5-8 is expected to be reassessed in the future based on the status of this work  
20 and the CNSC approval process. This approach is consistent with OPG's past practice and  
21 application of US GAAP for its financial statement purposes. Accordingly, these future  
22 changes are not reflected in the 2020-2026 Business Plan or this application.

23

24 The operation of Pickering Units 1 and 4 to December 31, 2024 does not require further  
25 CNSC approval and OPG has now achieved high confidence, for depreciation purposes, that  
26 the units are expected to operate to December 31, 2024. The high confidence was achieved  
27 in 2020 based on inspection and analysis work completed on key components. The 2020  
28 DRC is expected to recommend extending the EOL date for Units 1 and 4 to December 31,

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requirement, holding other variables constant. This means that the impacts are calculated using the OEB-  
approved forecast of in-service assets for the EB-2016-0162 IR term.

<sup>11</sup> Ex. H1-1-1, Table 13, line 4.

<sup>12</sup> Ex. A2-1-1, Attachment 7, p. 20.

1 2024, effective December 31, 2020, for financial accounting purposes. As was the case in  
2 EB-2015-0374 and EB-2018-0002, OPG is not able to provide the total revenue requirement  
3 impact associated with these changes at this time, primarily because the final year-end  
4 information required to calculate the December 31, 2020 ARO/ARC adjustment is not yet  
5 available. Accordingly, these change are not reflected in the 2020-2026 Business Plan or this  
6 application.

7  
8 As further discussed in Ex. H1-1-1, section 6.2, OPG proposes to address the revenue  
9 requirement impacts associated with the Pickering station EOL dates changes as of  
10 December 31, 2020 and such future accounting changes related to Pickering Optimized  
11 Shutdown in a new deferral account to be established effective January 1, 2021, on terms  
12 similar to the deferral accounts established in EB-2015-0374 and EB-2018-0002.

#### 13 14 **4.0 NUCLEAR DEPRECIATION AND AMORTIZATION EXPENSE TRENDS**

15 Overall, the depreciation and amortization expense for the prescribed nuclear facilities  
16 increases from 2016 to 2026 largely due to the impact of in-service additions for the  
17 Darlington Refurbishment Project (“DRP”) and other capital projects entering rate base for  
18 the Darlington station, (see Ex. D2-2-9, Ex. D2-1-3 and Ex. D3-1-2).

19  
20 The increase in depreciation and amortization expense in 2017 was due to capital in-service  
21 additions for the Pickering station as well as the increase in ARC to reflect the year-end 2016  
22 nuclear liabilities adjustment for the approved 2017-2021 Ontario Nuclear Funds Agreement  
23 (“ONFA”) Reference Plan.<sup>13</sup>

24  
25 As discussed above, the extension of the Pickering station EOL dates effective December  
26 31, 2017 resulted in a decrease in nuclear depreciation and amortization expense in 2018  
27 over 2017. Forecast nuclear depreciation and amortization expense increases in 2020 as  
28 capital assets of approximately \$4.8 billion are placed in service upon completion of the

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<sup>13</sup> The impacts of the 2017 ONFA Reference Plan adjustment to the ARO and ARC balances was reflected in the EB-2016-0152 Payment Amounts Order, as discussed in Ex. C2-1-1.

1 Darlington Unit 2 refurbishment in June 2020 and increases further in 2021 to reflect the full  
2 year depreciation effect of this in-service amount.

3

4 The variability in forecast nuclear depreciation and amortization expense over 2023-2026  
5 reflects: Pickering units reaching their current assumed EOL dates of December 31, 2022 for  
6 Units 1 and 4 and December 31, 2024 for Units 5-8,<sup>14</sup> and capital assets of approximately  
7 \$2.5 billion, \$1.9 billion and \$2.0 billion being placed in service upon completion of Darlington  
8 Units 3, 1 and 4 refurbishments in 2024, 2025 and 2026, respectively. The significant  
9 decrease in ARC depreciation expense by 2025 is due to the full depreciation of the  
10 Pickering portion of the balance by the EOL dates. The non-DRP Darlington plant  
11 depreciation expense increases from \$34.2M in 2016 to \$173.2M in 2026, reflecting the  
12 planned capital program.

13

14 As discussed in Ex. D2-2-2, for the purposes of setting payment amounts in this application,  
15 OPG proposes to limit the DRP-related net plant in rate base for projects completed prior to  
16 2022 (other than the Heavy Water Storage and Drum Handling Facility) to the values  
17 approved in EB-2016-0152 as of December 31, 2021, with the revenue requirement impact  
18 of the differences continuing to be recorded in the Capacity Refurbishment Variance Account  
19 ("CRVA").<sup>15</sup> In conjunction with a lower proposed rate base as of the beginning of the IR  
20 term, this results in lower proposed depreciation and amortization expense. The depreciation  
21 and amortization values for the historical and bridge years reflect the actual/forecasted DRP-  
22 related amounts.

---

<sup>14</sup> In line with the current station EOL dates, most of the forecast Pickering capital additions from 2020-2024 are assumed to be fully depreciated in 2022 for Pickering Units 1 and 4 and 2024 for Pickering Units 5-8.

<sup>15</sup> OPG proposes to address any resulting DRP-related balances in the CRVA in a future application, which would allow an assessment of the recoverability of DRP-related variances, if any, in the context of the overall performance of the four-unit refurbishment.

**ATTACHMENTS**

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- Attachment 1: Concentric Report: Assessment of Regulated Nuclear Asset Depreciation Rates and Generating Station Lives – December 2020
- Attachment 2: 2019 Depreciation Review Committee Recommendations for Nuclear
- Attachment 3: 2018 Depreciation Review Committee Recommendations for Nuclear
- Attachment 4: 2017 Depreciation Review Committee Recommendations for Nuclear
- Attachment 5: 2016 Depreciation Review Committee Recommendations for Nuclear



# **ASSESSMENT OF REGULATED NUCLEAR ASSET DEPRECIATION RATES AND GENERATING STATION LIVES**

**DECEMBER 2020**

Prepared for Ontario Power Generation

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December 28, 2020

Ontario Power Generation  
700 University Avenue  
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Attention: Matt Kirk  
Senior Manager, Regulatory Research & Analysis

Dear Mr. Kirk;

Pursuant to your request, we conducted a review and assessment of the regulated life estimates related to the Ontario Power Generation nuclear generation assets as of December 31, 2019. Our report presents a description of review undertaken by Concentric as well as our recommendations for a small number of revisions to the average service life estimates. Concentric completed a similar study of the hydroelectric generation assets in December 2019.

We gratefully acknowledge the assistance of Ontario Power Generation personnel in the completion of the review.

Should you have any questions or concerns, please do not hesitate to contact me directly at 587.997.6489

Yours truly,

Concentric Advisors, ULC

A handwritten signature in blue ink, appearing to read "LEK", is written over a faint circular stamp or watermark.

Larry E. Kennedy  
Vice President

LEK/ta  
Project: 70061

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## SECTION 1

# 1 BASIS OF STUDY

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## 1.1 Introduction and Scope

Concentric Advisors, ULC (“Concentric” or “Concentric Advisors”) has been retained by Ontario Power Generation (“OPG”) to review the average service life estimates of its regulated nuclear generation assets based on December 31, 2019 asset values and of the plant associated with the return to service of Unit 2 refurbishment at the Darlington Nuclear Generating Station (“Darlington NGS”) in June 2020. This report sets forth the findings of our independent review.

The average service life estimates recommended in this report are considered in OPG’s depreciation review process in establishing the asset depreciation rates and generating station lives for the Property, Plant and Equipment (“PP&E”) of OPG’s prescribed facilities, including directly assigned corporate PP&E balances. As the depreciation and amortization expense for regulated revenue requirement purposes includes intangible assets, average service lives for intangible assets were also included in this analysis. As further discussed in section 3.3.2, a significant new addition was made to the PP&E of OPG’s regulated assets upon returning to service Unit 2 of the Darlington NGS.

The facilities for which average service lives were analyzed consist of two nuclear generation facilities, the Darlington NGS and the Pickering Nuclear Generating Station (“Pickering NGS”). As part of this study, Concentric Advisors reviewed the operating considerations and typical station configurations of these nuclear generation facilities. This included a review of notes from site tours taken in prior studies and detailed operational staff discussions.

## 1.2 Background

In March 2007, Concentric Advisors (then operating as Gannett Fleming) submitted a report titled “Review of the Ontario Power Generation Inc. Depreciation Review Process” (the “2007 Report”). The 2007 Report presented a summary of the findings of an independent review of the processes, procedures and methods used by OPG to review its depreciation expense. The 2007 Report indicated that “Gannett Fleming has found that the processes, procedures and methods followed by Ontario Power Generation Inc. adequately meet regulatory objectives regarding depreciation generally accepted by Canadian regulatory authorities.”<sup>1</sup> Additionally, Gannett Fleming found that “OPG’s current Depreciation Review Process results in the depreciation expense component of the revenue requirement that reasonably and appropriately reflects the consumption of the average service life of OPG’s regulated assets. Gannett Fleming also views that, overall, the Depreciation Review Committee (“DRC”) process is adequate in meeting the generally accepted regulatory objectives regarding depreciation for regulated North American utilities.”<sup>2</sup> Overall, the 2007 Report concluded that the procedural foundation upon which OPG’s DRC had developed average service life estimates was robust and appropriate. The 2007 Report contributed, in part, to the Ontario Energy Board’s (“OEB”) acceptance of OPG’s depreciation expense in the EB-2010-0008 proceeding

<sup>1</sup> Cover letter to the 2007 Report

<sup>2</sup> 2007 Report, page III-2.



Subsequently, Gannett Fleming was retained by OPG to complete independent comprehensive assessments of depreciation rates and generating station lives of OPG's prescribed hydroelectric and nuclear assets based on December 31, 2010 and, most recently, December 31, 2012 asset values and for the Niagara Tunnel placed in service in 2013. These assessments were documented by Gannett Fleming in reports titled "Assessment of Regulated Asset Depreciation Rates and Generating Station Lives" dated December 16, 2011 ("2011 Report") and November 29, 2013 ("2013 Report"), respectively.

Both the 2011 Report and the 2013 Report found that "the currently approved average service life estimates continued to be based on a procedurally sound and reasonable DRC process" and that "to a large extent, the work prepared over the past several years by the DRC [continued] to be a reliable information source."<sup>3</sup> Both reports noted that OPG had continued to calculate depreciation rates based on the Average Life Group Procedure – Whole Life Technique, using the straight-line method of depreciation for virtually all plant comprising regulated assets.

As part of the 2011 Report and the 2013 Report, Gannett Fleming reviewed the average service life estimates for each depreciable group and the generating station lives based on their professional judgement, taking into consideration the results of the DRC process, the company's practices and outlook as they relate to plant operation, asset condition and retirement, the service life estimates of peer electric generation companies (as applicable), and the experience of Gannett Fleming in selecting average service lives for similar plant. In adopting this approach to their assessment, Gannett Fleming noted that "[i]n the specific circumstances of the OPG average service life estimation, the volume of historic retirement transactions available to be analyzed is not sufficient to undertake a detailed study of retirement history" and "[a]s such, a retirement rate analysis was not completed by Gannett Fleming."<sup>4</sup>

The 2011 Report and the 2013 Report recommended a small number of revisions to the average service life estimates for OPG's hydroelectric assets, which were adopted in full by OPG. Gannett Fleming also concluded that "the use of life span dates is appropriate for the OPG nuclear generation plants" and "that the factors considered and methods used by the DRC in the assessment of life span dates remain appropriate and consistent with common regulatory practices and should continue to be used in future reviews."<sup>5</sup>

Gannett Fleming also recommended that each "account should be subjected to a complete depreciation study which re-evaluates its average service life estimates periodically", noting "that the practice of OPG to review its various asset accounts and depreciation service lives over an approximate five-year cycle [through the DRC process] meets this common depreciation practice."<sup>6</sup>

The 2011 Report and 2013 Report were filed with the OEB in OPG's 2014-2015 payment amounts proceeding, EB-2013-0321, in satisfaction of the OEB's direction regarding an independent depreciation study. In its EB-2013-0321 decision, the OEB accepted the results of the 2011 Report

<sup>3</sup> 2013 Report, page I-7

<sup>4</sup> 2013 Report, page II-11

<sup>5</sup> 2013 Report, page II-14

<sup>6</sup> 2013 Report, page II-11

as updated by the 2013 Report for both nuclear and hydroelectric assets, including OPG's continued use of the average life group method to determine depreciation expense, and approved the depreciation expense as filed for inclusion in OPG's payment amounts.<sup>7</sup>

In line with the recommended cycle of approximately five years for a periodic depreciation study, no independent depreciation assessment was filed by OPG in EB-2016-0152, the most recent cost-based nuclear payment amounts OEB proceeding. In the EB-2016-0152 decision, the OEB accepted OPG's proposal to conduct an independent depreciation review for the regulated nuclear assets after completion of Unit 2 refurbishment at the Darlington NGS.<sup>8</sup>

### 1.3 Summary of Results

Concentric has reviewed the DRC process and again finds it to be procedurally sound, reasonable and resulting in valid depreciation rates and generating station lives that accurately reflect the consumption of average service life of OPG's regulated assets. Overall, Concentric finds that the work prepared by the DRC continues to be an overall reliable source of information in conducting this 2020 Depreciation Rates Assessment.

Concentric also finds that OPG's practice of reviewing significant asset accounts and depreciation service lives over an approximate five-year cycle under the DRC process continues to meet the recommended practice of continued surveillance to maintain the use of appropriate depreciation rates, when supplemented by a periodic comprehensive independent assessment.

Concentric also finds OPG's continued use of the Straight-Line Method and the Average Life Group Procedure – Whole Life Technique to determine depreciation expense to be reasonable, and its use of, and approach to determining life span dates for the Darlington NGS and Pickering NGS are valid.

In reviewing depreciation rates for OPG's nuclear plant accounts and having regard to the plant associated with the return to service of Unit 2 of Darlington NGS, Concentric supports the average service lives currently in use, subject to recommended changes for the following accounts:

- Nuclear – Shutdown Cooling System Heat Exchangers – Pickering: from 25 years to 30 years;
- Nuclear – Building Electric Service Supply – Pickering 1&4 and Bruce: from 40 years to 55 years;
- Nuclear – Fuel Channel Assemblies: from 28 years to 30 years;
- Nuclear – Calandria Tubes – Pickering 5-8 and Darlington: from 28 years to 30 years; and
- New Account: Nuclear – Instrumentation and Control – Darlington Refurbishment: 30 years.
- New Account: Nuclear – Service Water and Fire Protection System – Darlington Refurbishment: 30 years

Concentric also believes that the life span dates currently in place for depreciation purposes for the regulated nuclear generating assets are reasonable for use in this study, recognizing that OPG

<sup>7</sup> EB-2013-0321 Decision and Order, page 98

<sup>8</sup> EB-2016-0152 Decision and Order, page 86

is in the midst of implementing plans for optimizing the planned shutdown dates for the Pickering NGS.

In conjunction with the above asset class changes, Concentric finds the process used by OPG to componentize the capital amount placed in service upon completion of refurbishment for Unit 2 of Darlington NGS in June 2020 to result in reasonable and valid depreciation rates going forward.

## SECTION 2

### 2 PLAN OF STUDY

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This study is presented in the following order:

Section 1:	Presents the Scope of the Study and provides background of prior study conclusions with a brief summary of the depreciation study results
Section 2:	Contains statements with respect to the plan and the basis of the study
Section 3:	Discusses development of average service life estimates, and presents descriptions of the methods used and factors considered in the service life study
Section 4:	Presents study results by depreciable group in Table 1

#### 2.1 Information Provided by OPG

OPG has provided Concentric with required information, as of December 31, 2019, for all accounts being studied. This information has been compiled from the plant accounting records and includes the following:

- current balances by vintage year for each account (aged balances). The balances provide the amount of investment sorted by installation year currently in operation. This file is only inclusive of current plant in service and does not include any retirement information;
- retirement transactions for all accounts. The transactions include information regarding the transaction year of the retirement, the installation year of the asset being retired, and the original cost of the asset being retired; and
- copies of the most recent DRC reviews for all nuclear plant asset accounts.

#### 2.2 Procedures Performed

The above data was reviewed and reconciled to Company control schedules to ensure accuracy and reasonableness. These checks include that the surviving investment by account equals (or can be reconciled to) the Company's gross plant in service and accumulated depreciation ledger balances.

In addition, Concentric performed the following procedures to form the basis of the results of this study:

- confirm accounting policies being followed in accordance with US generally accepted accounting principles ("US GAAP");
- conduct interviews with OPG personnel to obtain understanding of nuclear plant operations;
- review of DRC recommendations and supporting documentation; and
- review of prior working papers and supporting documents from the 2011 Report and the 2013 Report.

## SECTION 3

### **3 DEVELOPMENT OF DEPRECIATION RATES**

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#### 3.1 Depreciation

Depreciation, as applied to depreciable electric plant, means the loss in service value not restored by current maintenance, incurred in connection with the consumption or prospective retirement of electric plant in the course of service from causes which are known to be in current operation and against which the utility is not protected by insurance. Among the causes to be given consideration are wear and tear, decay, action of the elements, inadequacy, obsolescence, changes in the art, changes in demand and requirements of public authorities, and, in the case of certain electric companies, the exhaustion of natural resources.<sup>9</sup>

Depreciation, as used in accounting, is a method of distributing fixed capital costs, less net salvage, over a time period by allocating annual amounts to expense. Each annual amount of such depreciation expense is part of that year's total cost of providing electric utility service. Normally, the time over which the fixed capital cost is allocated to the cost of service, is equal to the time over which an item renders service – that is, the item's service life. The most prevalent method of allocation is to distribute an equal amount of cost to each year of service life. This method is known as the Straight-Line method of depreciation.

OPG continues to determine depreciation using the Straight-Line method for virtually all plant comprising regulated assets, based on the Average Life Group Procedure – Whole Life Technique. The Average Life Group Procedure is the most commonly used depreciation procedure for North American utilities, whereby one average service life estimate is applied to all assets and vintages within the asset class. The Whole Life Technique calculates depreciation on the basis of recovering the original cost of the investment over the entire life of an asset or group of assets with no provision for accumulated depreciation true-ups or depreciation rate adjustments. As such, a common life estimate is applied to each of the asset vintages, and each of the assets within each vintage. Concentric finds that the application of the Straight-Line method and the Average Life Group Procedure – Whole Life Technique results in a reasonable recovery of OPG's capital investment over time and recommends their continued application.

For the regulated nuclear asset classes, depreciation continues to be based on the lesser of the generation station life and asset class life. The generation station life is determined using a life span date for each of the Pickering NGS and Darlington NGS, as discussed in section 3.2.7. Asset retirement costs capitalized in connection with asset retirement obligations recognized pursuant to US GAAP and certain other asset classes are depreciated to the life span dates.

<sup>9</sup> Federal; Energy Regulatory Commission -Part 201- Uniform System of Accounts Prescribed for Electric Companies Subject to the Provisions of the Electric Act Definitions

## 3.2 Estimation of Generating Asset Lives

### 3.2.1 Average Service Life

The use of an average service life for property groups that include large numbers of similar assets implies that the various units in the group have different lives. Thus, the average life may be obtained by determining the separate lives of each of the units, or by constructing a life estimate that considers the retirements of units which survive at successive ages. As in the 2011 Report and the 2013 Report, the average service life estimates in this study were reviewed by Concentric Advisors using judgment which considered a number of factors, including:

- Understanding of the processes used in the development of the current average service life estimates through the completion of the 2007 Report reviewing the DRC process and through the completion of the 2011 Report and the 2013 Report assessing depreciation rates;
- Understanding of the assets currently in service through discussions with company staff, including representatives of the nuclear generation operating units;
- Previous physical site tours of nuclear generation sites;
- Review of current accounting practices and procedures applied and their consistency with those in place at the time of the 2013 Report;
- Review of analyses provided to DRC, up to the results of the 2019 DRC process; and
- The general experience and professional judgment of Concentric Advisors.

### 3.2.2 Prior Assignments and Review of the DRC Process

As described in section 1.2, Concentric Advisors (then operating as Gannett Fleming) was previously retained in 2007 to review the practices and procedures used by the DRC to review depreciation expense, and, in 2011 and 2013, for the completion of depreciation studies for OPG's regulated assets. The 2007 review resulted in a report submitted to OPG management and filed by OPG in OEB proceeding EB-2007-0905. The 2013 depreciation study resulted in a report submitted to OPG management and filed by OPG in OEB proceeding EB-2013-0321. These prior reviews provided Concentric with an understanding of the type of generation plant in service at OPG, the processes used by OPG in the determination of service life estimates, and the OEB's regulatory oversight. In addition to updated information provided by OPG for this current review, Concentric considered information from these prior studies.

### 3.2.3 Operating Discussions and Site Tours

Discussions with operations representatives provided Concentric with an understanding of the type of assets in service for nuclear service. Previous site tours provided Concentric Advisors with the necessary background to make an assessment of the physical installations of the OPG plant, and to understand the type of plant in service and the operating conditions of the facilities. Operational interviews were undertaken to understand the historic operating conditions that have led to retirement of plant in the past and to understand the current condition of the assets which may impact future retirement plans.

In conducting the 2013 depreciation study, Gannett Fleming toured the following generation sites:

- Darlington Nuclear Generating Station; and
- Pickering Nuclear Generating Station

While it is standard practice to tour facilities being studied, the COVID-19 pandemic resulted in restrictions and increased safety risks associated with global travel and non-essential plant site access throughout 2020, making it impractical to safely tour OPG's nuclear facilities. As such, Concentric relied on the understanding of the facilities gained from the site tours conducted in 2013 to inform this study.

Throughout the depreciation study process, virtual interviews of the operational representatives were undertaken by Concentric. The interviews covered the following topics, including, where applicable, inquiries regarding operational or other changes since the 2013 Report:

- Operating history of both nuclear generating stations;
- Replacement history of major plant components and review of significant retirement and life management programs at both plants;
- General operating experience of the major plant components;
- Review of any life restricting operational issues;
- Review of any issues that have emerged during the DRC process;
- Review of instances where advancements in technology may cause changes to average service life indications; and
- Review of the expected life span dates for all units at both plants.

### 3.2.4 Review of Accounting Policies

Concentric held discussions with finance management representatives during prior assignments to understand OPG's depreciation and accounting policies and practices in accordance with US GAAP. As part of the current assignment, Concentric confirmed with finance management representatives that there had been no changes to these policies and practices since the 2013 Report, including as they relate to capitalization thresholds, asset retirement obligations and treatment of retirement transactions.<sup>10</sup>

### 3.2.5 Analysis and Results of DRC Reviews

OPG is the world's largest operator of CANada Deuterium Uranium ("CANDU") nuclear units, has some of the oldest CANDU units, and has the most extensive operational knowledge of all CANDU operators in the world. OPG is heavily involved in technical exchanges with other CANDU operators,

<sup>10</sup> As previously noted in the 2013 Report (page II-7), OPG's accumulated depreciation accounts do not include embedded gains or losses from previous retirement transactions, as OPG books all such gains and losses to the income statement in the year of retirement in accordance with the provisions of US GAAP. As a result, there is no need to test the adequacy of accumulated depreciation balances. Concentric believes that the nature of the large plant components and small amount of retirement transactions continue to make this policy viable and reasonable for OPG.

and closely monitors equipment degradation issues in order to assess potential impacts on OPG's units. OPG is often the "lead" utility in terms of the knowledge of degradation issues that may impact unit and component lives. In the particular circumstance of the CANDU nuclear installations, OPG internal staff is recognized as experts in the technology.

The DRC has continued to complete detailed reviews of the average service life expectations for OPG's plant accounts. The DRC's technical reviews are conducted by internal experts in the specific areas associated with the different types of plant accounts, leveraging operational and industry experience. As part of the current assignment and the 2011 Report and 2013 Report, Concentric reviewed these analyses which provided a significant background on the physical condition of the assets, a meaningful history of the manner in which plant assets have provided electric generation service in the past, and identified major upcoming replacement or retirement programs.

Since the completion of the 2013 Report, the DRC completed a detailed review of the average service life expectations for virtually all plant accounts comprising the company's investment in the regulated nuclear business. This included one complete five-year review cycle (2013-2017) for regulated nuclear asset depreciation rates and, most recently, a review of plant accounts comprising over 60 percent of the regulated nuclear investment as part of the current five-year review cycle.<sup>11</sup> The DRC process resulted in a small number of changes to asset class depreciation rates since the 2013 Report, which were reviewed by Concentric as part of this assignment.

### 3.2.6 Professional Judgement

The use of professional judgment in the development of average service life estimates is a practice that is appropriate and has been used for many years before North American regulatory jurisdictions. When available, the use of statistical analysis of the historic retirement transactions combined with the use of professional judgment, including physical site inspections, review of accounting procedures and practices, use of operational staff interviews, review of prior studies, and review of the approved life estimates of peer companies, provides the most complete method of service life analysis. However, the use of professional judgment alone also provides an appropriate basis for developing average service life estimates, when appropriate factors are considered, and has been accepted as a valuable depreciation analysis tool in many North American jurisdictions.

As previously noted by Concentric in the 2013 Report, in the specific circumstances of the OPG average service life estimation, the volume of historic retirement transactions available to be analyzed is not sufficient to undertake a detailed actuarial study of retirement history. As such, a retirement rate analysis was not completed by Concentric Advisors.

### 3.2.7 Life Span Dates

Life expectancy of electric generation plant assets is impacted not only by physical wear and tear of the assets but also by economic factors including the feasibility of the economic replacement of major operating components or the economic viability of the plant as a whole. In circumstances where the replacement of major operating components is not economically feasible, the life of the major

<sup>11</sup> Percentage excludes asset retirement costs and certain other asset classes with service lives tied directly to the life span dates, which are inherently reviewed each time the life span dates are assessed.



component can be the determining factor of the generation plant and all of the assets within the plant. As such, the remaining depreciation life of electric generation plant assets is the lesser of the physical life expectation of the asset or the period to the end of the life span of the generation plant as a whole.

The use of life span dates for determining depreciable lives for regulated electric generation plant is common throughout many North American regulatory jurisdictions. The basis for the determination of the life span date is usually based on one or more of the following:

- the physical life estimation of the major and vital components of the generating plant;
- the duration of operating licenses;
- precedent and policy of the regulatory jurisdiction;
- expiration of the supply source for which the generation plant is dependent; and
- expiration of market demand upon which the generation plant is dependent.

Through periodic DRC reviews, OPG regularly assesses if there are any potential indicators of changes in life span dates for each of the regulated nuclear plants. The life span dates are primarily determined through a review of the expected life of the significant components at each nuclear site, taking into account regulatory licensing and other requirements. Additionally, the life span dates are influenced by the period through to any required major unit refurbishment, as the plant's continued operation is dependent upon the ability to economically refurbish it for continued use. It is the experience of Centric that the depreciation schedules for most North American nuclear generation plants are dependent upon appropriately developed life span dates, and it continues to be Centric's view that the use of life span dates is appropriate for the OPG nuclear generation plants. OPG's practice of using a single life span date for all generating units at each nuclear station is consistent with that of other nuclear operators in North America.<sup>12</sup>

The most recent change in the life span dates of OPG's regulated nuclear generation plants at the time of writing was implemented at the end of 2017, following the DRC's conclusion that there was sufficient confidence to extend the life span dates for the Pickering NGS to December 31, 2022 for Units 5-8 (formerly Pickering A) and December 31, 2024 for Units 1 and 4 (formerly Pickering B).<sup>13</sup> In making this conclusion, the DRC considered, among others, the technical confidence associated with the programs and provisions in place to assure fitness-for-service of life-limiting fuel channel components, as well as the status of work in support of obtaining regulatory approvals from the Canadian Nuclear Safety Commission ("CNSC").

At the time of this depreciation study, OPG has announced a plan to further optimize the shutdown dates of the Pickering NGS, such that Unit 1 and 4 would operate to 2024 and Units 5-8 through to the end of 2025. For the 2019 year-end, the DRC concluded that there was insufficient confidence to affect a change in the depreciation life span dates based on this plan, taking into account the status of the associated technical and regulatory work. In particular, the 2019 DRC considered the status of the technical work to confirm the applicable units' fitness-for-service to achieve the additional life

<sup>12</sup> OPG maintains separate life span dates for Pickering Units 1 and 4 and Pickering Units 5-8, which were formerly considered and known as the Pickering A and Pickering B stations

<sup>13</sup> Units 2 and 3 of Pickering NGS are permanently shut down.

beyond 2024. Additionally, it is noted that operation of the Pickering units after December 31, 2024 is subject to CNSC's regulatory approval. Finally, the 2019 DRC observed that while the operation of Units 1 and 4 to 2024 does not require further regulatory approvals from the CNSC and falls within the design of the current programs and provisions in place to assure the fitness-for-service for fuel channel components, sufficient technical confidence related to the continued fitness-for-service of certain steam generators at Unit 4 had not yet been achieved.

Concentric has reviewed the 2019 and prior DRC's analysis in establishing the above life span dates and concludes that they are reasonable for use in this study. Concentric is also of the view that the factors considered and methods used by the DRC in the assessment of life span dates remain appropriate and consistent with common regulatory practices and should continue to be used in future reviews. Concentric understands that there is an ongoing review of the Pickering NGS life span dates by the DRC for the 2020 year-end following the same approach, and that it has not yet concluded at the time of writing.

As recognized in the 2013 Report, a major refurbishment program is currently underway at the four-unit Darlington nuclear site. The four units are scheduled to return to service over the 2020 to 2026 period. It is expected that the refurbishment will allow the safe and reliable operation of the Darlington NGS units for another 30 years. On this basis, the DRC previously extended the station's average life span date until December 31, 2052.

At the time of this depreciation study, the refurbishment of the first unit, Unit 2, has been completed and the refurbishment of the second unit, Unit 3, has commenced. OPG has indicated that there were no findings during the Unit 2 refurbishment process that would indicate any physical or economical reasons to change the current average life span date of December 31, 2052. As such, Concentric believes that continued use of the December 31, 2052 date for the Darlington NGS remains reasonable for depreciation purposes. As part of continued surveillance, Concentric recommends that the station's average life span date be re-confirmed after the four-unit refurbishment project has been completed.

### 3.3 Average Service Life Assessments

#### 3.3.1 Plant Accounts as of 2019 Year-End

Concentric has reviewed the average service life estimates for all regulated nuclear generation plant and asset categories, based on December 31, 2019 asset values. The service life estimates recommendations were based on informed professional judgment, which incorporated a review of management's plans, policies and outlook, and a general knowledge of the electric industry.

Based on the review, Concentric supports continued use of the average service lives as set out in Section 4, Table 1 of this study. This represents OPG's currently approved average service lives as of the date of writing, with recommended changes to the life estimates for the two accounts noted below and the three accounts identified in section 3.3.2 in the context of the Darlington Unit 2 refurbishment componentization review:

ACCOUNT 15352000 – NUCLEAR– SHUTDOWN COOLING SYSTEM HEAT EXCHANGERS - PICKERING

2019 Gross Book Value	Investment %	Previously Approved Life	Concentric Recommended Life
\$2,729,204	0.05%	25	30

The 2013 Report recommended a 25-year average service life for this asset class. Due to its relatively small size, the DRC has not reviewed this account in recent years. The assets in this account are similar to the assets in Account 15352100 – Nuclear – Shutdown Cooling System Heat Exchangers – Darlington, which a 30-year life has. Concentric recommends lengthening the average service life of this account to 30 years to be in line with Account 15352100.

ACCOUNT 15530000 – NUCLEAR – BUILDING ELECTRICAL SERVICE SUPPLY – PICKERING 1&4 AND BRUCE

2019 Gross Book Value	Investment %	Previously Approved Life	Concentric Recommended Life
\$2,392,224 <sup>14</sup>	0.04%	40	55

The 2013 Report recommended a 40-year average service life. Due to its relatively small size, the DRC has not reviewed this account in recent years. The assets in this account are similar to the assets in Account 15531000 – Nuclear – Building Electrical Supply – Pickering and Darlington, which has a 55-year life<sup>5-8</sup>. Concentric recommends lengthening the average service life of this account to 55 years to be in line with Account 15531000.

### 3.3.2 Darlington Unit 2 Refurbishment

In June 2020, OPG returned to service Unit 2 of the Darlington NGS following refurbishment, placing in service approximately \$4.8 billion of plant additions. The Darlington refurbishment program (“DRP”) capital expenditures began in 2010 with the commencement of the definition phase, culminating in the completion of a detailed programmatic and first unit (Unit 2) execution schedule and budget and, in October 2016, commencement of the Unit 2 refurbishment outage. Concentric understands that the plant additions associated with the Unit 2 return-to-service include the full amount of definition phase capital costs incurred since project inception, as well as the Unit 2 execution expenditures.

In addition to refurbishment work on the units themselves, Concentric understands that the scope of the DRP includes certain discrete pre-requisite and other projects that are expected to remain useful to OPG’s current and future operations irrespective of the refurbishment. As these projects were placed in service before the refurbishment of the first unit in recognition of their immediate benefit to the station, they do not form part of the \$4.8 billion in capital additions upon Unit 2 completion.

As part of this assignment, Concentric reviewed the average service life estimates applied by OPG to the capital amounts placed in-service upon Unit 2 completion. In performing this part of the assignment, Concentric reviewed OPG’s filed evidence in EB-2016-0152 related to the DRP, held discussions with OPG’s operational staff to gain an understanding of the major components of the

<sup>14</sup> Value shown is for Pickering NGS only, as the Bruce nuclear generation stations are not rate regulated

refurbishment work, and held discussions with OPG’s finance staff to gain an understanding of the process used to componentize the Unit 2 capital in-service amount. Concentric also considered the stated objective of the refurbishment, which is to enable each of the generation units to operate for approximately 30 additional years. This expectation is embedded in the station’s average life span date of December 31, 2052.

The in-service plant additions associated with the Unit 2 return to service (including definition phase costs) are grouped into two categories of components: Major Work Bundles and OPG Functional Support. Major Work Bundles are groupings of work scope, each consisting of a number of individual projects, defined by OPG for effectively contracting and managing the work. The work undertaken through the Major Work Bundles consists of the replacement and rehabilitation of components, inspections, and the completion of upgrades directly related to unit refurbishment. As noted in OPG’s EB-2016-0152 rate filing, the Major Work Bundles are: (1) Retube and Feeder Replacement; (2) Turbine Generator; (3) Fuel Handling and Defueling; (4) Steam Generator; and (5) Balance of Plant.<sup>15</sup> OPG Functional Support refers to work carried out by groups within OPG’s internal project support organizations, including oversight, coordination, and integration among contractors and ongoing station operations. Interest capitalized on the project is recorded directly to each of these components.

In determining the component breakdown into specific asset classes, OPG reviewed the individual projects within each Major Work Bundle against established asset classes based on the technical assessment of the costs incurred for each of the projects within the Major Work Bundle. OPG’s accounting records provided the necessary detail to isolate and evaluate each project’s costs. For example, Unit 2 Steam Generator EPC project work was analyzed and directly costed to 15351100 Nuclear – Steam Generators – Darlington asset class. As part this componentization process, OPG also assessed the need for any new asset classes to be established. The OPG Functional Support costs associated with the Unit 2 refurbishment were allocated to the asset classes proportionally to Major Work Bundle projects.

The technical assessments were undertaken by subject matter experts including by respective key refurbishment project managers, and were reviewed and ultimately approved by senior DRP executives and finance controllers.

Through this process and subject to the 2020 DRC confirmation, OPG has identified two asset class changes and two new asset classes in order to align with the expectation that certain components replaced through the refurbishment will be in service for the full 30-year lifespan of the Unit 2 reactor. Concentric has reviewed the basis for these changes and recommends that they be adopted by OPG going forward. The four changes are as follows:

ACCOUNT 15314000 – NUCLEAR – FUEL CHANNEL ASSEMBLIES - P5-8 and DG

2019 Gross Book Value	Unit 2 In Service Amount	Previously Approved Life	Concentric Recommended Life
nil	\$555,129,636	28	30

<sup>15</sup> EB-2016-0152 Ex. D2-2-1, page 3

ACCOUNT 15323000 – NUCLEAR – CALANDRIA TUBES – P5-8 and DG

2019 Gross Book Value	Unit 2 In Service Amount	Previously Approved Life	Concentric Recommended Life
nil	\$303,700,183	28	30

NEW ACCOUNT – NUCLEAR – INSTRUMENTATION AND CONTROL – DARLINGTON REFURBISHMENT

2019 Gross Book Value	Unit 2 In Service Amount	Previously Approved Life	Concentric Recommended Life
N/A	\$107,140,898	N/A	30

NEW ACCOUNT – NUCLEAR – SERVICE WATER AND FIRE PROTECTION SYSTEM – DARLINGTON REFURBISHMENT

2019 Gross Book Value	Unit 2 In Service Amount	Previously Approved Life	Concentric Recommended Life
N/A	\$98,709,243	N/A	30

Overall, Concentric finds the process used by OPG to componentize the Unit 2 capital in-service amount to result in reasonable and valid depreciation rates going forward. The process was based on sound principles and appropriate inputs, including technical assessments, sufficient granularity of cost records, consideration of overall project objectives and review of existing asset class applicability. Concentric also supports the rational approach taken to distribution of common project costs that were not directly tied to specific components.

Additionally, Concentric understands that the 2020 DRC review contemplates initiation of a process to identify and as necessary review any significant existing Darlington assets with remaining lives shorter than the 30-year post refurbishment life assumption for the reactors. The objective of this process is to confirm, over a period of time, that the depreciation periods for the assets expected to support post-refurbishment operations continue to be appropriately aligned with the station's life span date. While our review did not identify any changes necessary in this regard, Concentric supports this additional detailed validation exercise as part of ongoing surveillance given the significance of the refurbishment program to OPG's future nuclear operations.

SECTION 4

## **4 RESULTS OF STUDY**

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### **4.1 Results**

The following tables provides summaries, by each asset group, of the net book value as of December 31, 2019, and the recommended average service life of each asset group.

**Ontario Power Generation Inc.**

**TABLE 1 - ESTIMATED SURVIVOR CURVE, ORIGINAL COST,  
 ANNUAL DEPRECIATION ACCRUALS RELATED TO UTILITY PLANT AS OF DECEMBER 31, 2019  
 DEPRECIATION RELATED TO RECOVERY OF ORIGINAL COST OF INVESTMENT**

ASSET CLASS #	DESCRIPTION	DECEMBER 31, 2019 NBV	CURRENT	RECOMMENDED
15000110	Nuclear - Intangibles P5-8 and DG	\$ 10,180,470	55	55
15100000	Nuclear - Land	\$ 4,223,096	N/A	N/A
15110000	Nuclear - Site Improvement	\$ 23,866,048	75	75
15120000	Nuclear - Yard Facilities	\$ 6,079,470	50	50
15121000	Nuclear - Electronic Site Security System	\$ 30,944,194	15	15
15122000	Nuclear - Security and Other Fencing	\$ 32,131,786	20	20
15200000	Nuclear - Buildings and Structures	\$ 362,953,986	55	55
15210000	Nuclear - Roofing	\$ 22,545,181	25	25
15300000	Nuclear - Reactor Vessels - P1&4 and BG	\$ 732,439	40	40
15311000	Nuclear - Fuel Channel Assemblies - Pickering	\$ 34,670	25	25
15314000	Nuclear - Fuel Channel Assemblies - P5-8 and DG	-	28	100
15323000	Nuclear - Calandria Tubes - P5-8 and DG	-	28	100
15330000	Nuclear - Reactivity Control Units	\$ 1,537,359	40	40
15340000	Nuclear - Process Systems	\$ 651,945,512	55	55
15341100	Nuclear - Moderator Heat Exchangers - Pickering	\$ 4,874,514	25	25
15352000	Nuclear - Shutdown Cooling System Heat Exchangers - Pickering	\$ 283,357	25	30
15352100	Nuclear - Shutdown Cooling System Heat Exchangers - Darlington	\$ 114,717,460	30	30
15360000	Nuclear - Irradiated Fuel Bays - P1&4 and BG	\$ 90,009	40	40
15361000	Nuclear - Irradiated Fuel Bays - P5-8 and DG	\$ 31,132,943	65	65
15370000	Nuclear - Tritium Removal Facility - DG	\$ 20,023,054	30	30
15400000	Nuclear - Turbines, Auxiliary Equipment, Steam Reheater Tube - P1&4 and BG	\$ 15,585,467	40	40
15411100	Nuclear - Turbines, Auxiliary Equipment, Steam Reheater Tube - P5-8 and DG	\$ 9,945,089	55	55
15421000	Nuclear - Generator Rotors, Stators and Auxiliary Systems - P5-8 and DG	\$ 11,907,444	55	55
15430000	Nuclear - Exciters	\$ 17,080	30	30
15450000	Nuclear - Condenser Tubing	\$ 13,485,680	30	30
15460000	Nuclear - Auxiliary Systems - P1&4 and BG	\$ 17,013,750	40	40
15461000	Nuclear - Auxiliary Systems - P5-8 and DG	\$ 27,786,078	55	55
15500000	Nuclear - Main Power Output System	\$ 34,906,028	35	35
15501000	Nuclear - Revenue Metering - Main Power Output, Instrumentation and Control - PICK/DARL	\$ 1,954,961	30	30
15510000	Nuclear - Station Service Main Transformers and AC Power Distribution Systems - P1&4 and BG	\$ 4,304,778	40	40
15511000	Nuclear - Station Service Main Transformers and AC Power Distribution Systems - P5-8 and DG	\$ 33,380,807	55	55
15521000	Nuclear - Station Service Main Transformers and Power Distribution Systems	\$ 36,792,642	20	20
15530000	Nuclear - Building Electrical Service Supply - P1&4 and BG	\$ 746,708	40	55
15531000	Nuclear - Building Electrical Service Supplies - P5-8 and DG	\$ 11,070,621	55	55
15541000	Nuclear - Electrical Auxiliary System -P5-8 & DG	\$ 651,454	55	55
15550000	Nuclear - Reactor Building Cabling -P1&4 and BG	\$ 7,045,451	40	40
15560000	Nuclear - AC Standby Power - P1&4 and BG	\$ 12,069,919	40	40
15561000	Nuclear - AC Standby Power - P5-8 and DG	\$ 136,242,487	55	55
15600000	Nuclear - Instrumentation and Control	\$ 213,589,174	15	15
15700000	Nuclear - Circulating Water - P1&4 and BG	\$ 12,119,027	40	40
15701000	Nuclear - Service Water and Fire Protection System	\$ 235,748,257	25	25
15710000	Nuclear - Water Treatment Plant	\$ 5,478,533	20	20
15711000	Nuclear - Circulating Water - P5-8 and DG	\$ 4,688,083	55	55
15720000	Nuclear - Common Service Systems	\$ 311,585,332	35	35
15721000	Nuclear - Common Service Systems Air Compressors	\$ 241,043	20	20
15990000	Nuclear - Alternate Spares	\$ 1,267,185	100	100
15991000	Nuclear - Major / Strategic Spares	\$ 113,952,520	100	100
15991200	Nuclear - Large Circulating Water Motors - Over 200 HP	\$ 96,400,180	30	30
16210000	Administrative and Service Buildings - Permanent Buildings, Roads and Site Improvements	\$ 185,788,281	50	50
16211000	Administrative and Service Buildings -Buildings - Leased	\$ 1,889,511	10	10
16230000	Administrative and Service Buildings -Buildings - Frame & Metal Clad	\$ 100,062,968	25	25
16310000	Administrative and Service Buildings -Nuclear Training Simulators	\$ 25,346,777	45	45
16311000	Administrative and Service Buildings -Nuclear Simulators - Design Upgrades	-	10	10
16500000	Administrative and Service Buildings -Distribution Systems	\$ 506,551	35	35
16540000	Administrative and Service Buildings -Administrative Telecom Equipment	\$ 278,643	7	7
16550000	Administrative and Service Buildings -LAN Cable	\$ 31,444	10	10
16551000	Administrative and Service Buildings -LAN Control Devices	\$ 152,355	5	5
16560100	Administrative and Service Buildings - Intangibles Administration System Software	\$ 9,938,035	5	5
16630000	Administrative and Service Buildings - Building Systems & Equipment	\$ 3,658,916	20	20
18460000	Communications - Data Acquisition Equipment, Human Machine Interface Equipment	-	15	15
18500000	Communications - Radio Equipment	\$ 193,636	15	15
18540000	Communications - Administrative Telecom Equipment	\$ 13,966,420	7	7
18541000	Communications - Administrative Telecom Equipment - Revenue Metering	-	7	7
18630000	Communications - Optical Wire	\$ 2,187	25	25
18633000	Communications - Optical Wire -Revenue Metering	\$ 16,183	30	30
COMP1	Computers	\$ 100,773	5	5
OFFICE1	Office Furniture and Fixtures	-	3	3
SERV1	Minor Fixed Assets - Service Equipment	\$ 181,678,797	10	10
SERV2	Darlington Refurbishment Removal Tools	\$ 51,041,782	10	10
T&WE1	Transportation and Work Equipment	\$ 5,789,015	10	10
NEW	Nuclear - Instrumentation and Control - Darlington Refurbishment	-	N/A	30
NEW	Nuclear - Service Water and Fire Protection System - Darlington Refurbishment	-	N/A	30
<b>TOTAL PLANT</b>		<b>\$ 3,268,713,600</b>		
Asset Retirement Costs (ARC)		\$ 447,205,035		
<b>Grand Total</b>		<b>\$ 3,715,918,635</b>		

**MEMORANDUM**

**March 2020**

*2019 Depreciation Review Committee Recommendations – Nuclear*

**2019**  
**DEPRECIATION REVIEW COMMITTEE**  
**RECOMMENDATIONS**  
**FOR**  
**NUCLEAR**

***MARCH 2020***



**MEMORANDUM**

**March 2020**

***2019 Depreciation Review Committee Recommendations – Nuclear***

**PURPOSE AND SUMMARY**

This memorandum is intended to obtain approval for the recommendations resulting from the 2019 Depreciation Review Committee (DRC) review of the average service lives of the selected asset classes and the station service lives for OPG's nuclear facilities. The nuclear facilities are the Pickering Nuclear Generating Station, the Darlington Nuclear Generating Station and the Bruce Nuclear Generating Stations.

**BACKGROUND**

The DRC convenes annually to review the service lives for depreciation purposes of OPG's major facilities and a selection of asset classes in those facilities, with the general objective of reviewing all significant asset classes over a five year period. OPG's practice of reviewing asset classes over an approximate five-year cycle to re-evaluate the average service life estimates was considered appropriate by Gannett Fleming ULC (GF), an external consultant. In the recommendation section of the report dated November 29, 2013 that was accepted by the Ontario Energy Board (OEB) as part of OPG's application for 2014/15 payment amounts, GF noted "[c]ontinued surveillance and periodic revisions are required to maintain use of appropriate average service lives and depreciation rates. Each [asset class] account should be subjected to a complete depreciation study to re-evaluate its average service life estimates periodically. Gannett Fleming notes that the practice of OPG to review its various asset accounts and depreciation service lives over an approximate five-year cycle meets this common depreciation practice."

This is the second year of the DRC's current five year review period, with the next independent study for the nuclear assets anticipated to take place in 2020, allowing for the substantial in-service additions associated with the refurbishment of Unit 2 at the Darlington Generating Station (GS) to be reviewed. In its December 2017 decision and order on OPG's 2017-2021 rate application, the OEB indicated that it did not have concerns with an approach that aligned the timing of the next independent study with the return to service of Unit 2 at Darlington GS.

**SCOPE OF 2019 DRC REVIEW FOR NUCLEAR**

**Station Service Lives**

The DRC has confirmed with the nuclear business units that no new information became available in 2019 that would require any change in the station end-of-life (EOL) dates of the nuclear stations. The following average nuclear station EOL dates are recommended to remain effective from December 31, 2019.

Darlington	December 31, 2052
Pickering Units 1 and 4	December 31, 2022
Pickering Units 5-8	December 31, 2024
Bruce A	December 31, 2052
Bruce B	December 31, 2061

The current approved Pickering EOL reflect high technical confidence in OPG's previously announced plan for extending the station's operation up to 2024, based on the programs and provisions in place to assure fitness-for-service of fuel channel components. Fuel channels were determined to be the overall life-limiting component of the station's continued operation. The current operating licence from the Canadian Nuclear Safety Commission allows for commercial operation of the station to December 31, 2024.

**MEMORANDUM**

**March 2020**

***2019 Depreciation Review Committee Recommendations – Nuclear***

OPG has completed preliminary assessments which demonstrated that further optimization of the end of operations dates for the Pickering GS units is safe, technically feasible and would result in incremental economic and other benefits to the province and to OPG. As a result, for the 2019 DRC recommendations, consideration was given to the potential to extend the Pickering EOL dates based on OPG’s plan for a further optimized shutdown sequence of the units, in 2024 for Units 1 and 4 and in 2025 for Units 5-8. The plan is based on a business case that demonstrates that the optimization will deliver incremental value to customers through economic and operational benefits to Ontario’s electricity system.

Although the business case has been approved by OPG’s Board of Directors and is supported by the Independent Electricity System Operator, the DRC concluded that OPG does not yet have the required high confidence to extend the accounting EOL dates beyond the current approved accounting dates. This recommendation is based on the status of regulatory work in support of obtaining CNSC’s regulatory approval, through a public hearing process, necessary for operation of the station beyond December 31, 2024 and the status of the technical work to confirm the applicable units’ fitness-for-service to achieve the additional life beyond 2024, including further assurance of fitness-for-service for fuel channel components. As part of the regulatory approval process, OPG would have to demonstrate safe operation of the units through the extended period of operation by following certain criteria set forth as part of the Licence conditions granted to OPG.

While the operation of Units 1 and 4 to 2024 does not require further regulatory approvals from the CNSC and falls within the design of the current programs and provisions in place to assure the fitness-for-service for fuel channel components, the DRC noted that high technical confidence related to the continued fitness-for-service of certain steam generators at Unit 4 has not yet been achieved. Inspection and analysis work to confirm such high confidence is currently targeted for completion by 2021 at the latest. Steam generators are considered to be a life-limiting component.

The 2020 DRC review will consider the status of regulatory and technical work related to the operation of the station beyond December 31, 2024, as well as the status of the technical high confidence with respect to the operation of Units 1 and 4 to 2024, to determine if the required confidence to extend the current accounting EOL dates has been demonstrated.

**Asset Class Review**

Seven nuclear Major and one nuclear Minor fixed asset classes were selected for the 2019 DRC review. The asset classes reviewed were determined based on a selection of higher value asset classes (greater than \$5M) that had not been reviewed by the DRC as part of the current review cycle and assets identified for review by business unit/site contacts based on operational knowledge.

The asset classes selected for review were as follows:

<b>Asset Class</b>
15121000 – Nuclear Electronic Site Security Systems
15352100 – Nuclear Shutdown Cooling Heat Exchangers – Darlington
15370000 – Nuclear Tritium Removal Facility – Darlington
15400000 – Nuclear Turbines, Auxiliary Equipment, Steam Reheater Tubes – PA & BG
15450000 – Nuclear Condenser Tubing – Pickering & Bruce A
15461000 – Nuclear Auxiliary Systems – PB & Darlington
15701000 – Nuclear Service Water & Fire Protection System

**MEMORANDUM**

**March 2020**

**2019 Depreciation Review Committee Recommendations – Nuclear**

<b>Asset Class</b>
Removal Tools for Darlington Refurbishment

Excluding asset retirement costs and other asset classes with service lives that are tied directly to the overall station service lives, 64% of the total in-service net book value of the fixed asset classes of the nuclear business as at December 31, 2019 have been covered by the 2018 and 2019 DRC reviews. Asset classes with services lives tied directly to the overall station services lives are considered to be reviewed each time the DRC reviews the station end of life dates.

**SUMMARY OF RECOMMENDATIONS**

**Sources of Information**

The main sources of information considered by the DRC in developing the recommendations included:

- reviews conducted primarily by technical staff in the nuclear business unit;
- information obtained from past DRC reviews; and
- industry experience

**Asset Class Review**

The 2019 DRC review of the average service lives of the nuclear facilities determined that the currently approved average service life estimates for all reviewed asset classes remain appropriate. These recommendations were reviewed with and endorsed by business and technical staff responsible for overseeing the nuclear assets. Below is a summary of conclusions for the reviewed asset classes:

<b>Asset Class</b>	<b>Recommendation</b>
15121000 – Nuclear Electronic Site Security Systems	Retain the current service life of 15 years
15352100 – Nuclear Shutdown Cooling Heat Exchangers – Darlington	Retain the current service life of 30 years
15370000 – Nuclear Tritium Removal Facility – Darlington	Retain the current service life of 30 years
15400000 – Nuclear Turbines, Auxiliary Equipment, Steam Reheater Tubes – PA & BG	Retain the current service life of 40 years
15450000 – Nuclear Condenser Tubing – Pickering & Bruce A	Retain the current service life of 30 years
15461000 – Nuclear Auxiliary Systems – PB & Darlington	Retain the current service life of 55 years
15701000 – Nuclear Service Water & Fire Protection System	Retain the current service life of 25 years
Removal Tools for Darlington Refurbishment	Retain the current service life ending in 2024

**MEMORANDUM**

**March 2020**

**2019 Depreciation Review Committee Recommendations – Nuclear**

**DRC MEMBERS AND APPROVALS COMMITTEE**

The DRC includes representatives from the operating business units as well as representatives having experience in finance and accounting, investment planning, and rate regulation.

The Approvals Committee is responsible for approving the DRC recommendations and, as it relates to the nuclear business, is comprised of the following individuals:

<b>Name</b>	<b>Position</b>
Dominique Minière	President, Nuclear
John Mauti	Chief Financial Officer and Senior Vice President, Finance
Chris Ginther	Chief Administrative Officer

The DRC is comprised of the following members:

<b>Name</b>	<b>Position</b>
Barbara Kerr	Vice President, Controllership
Michael Gore	Director, External Reporting and Accounting Policy
Harvey Hui	Senior Manager, Accounting and Reporting
Nadira Singh	Vice President, Business Planning and Reporting
Lyndsey Arseneau	Director, Ontario Regulatory Affairs
Angelo Pavia	Senior Manager, Investment Management, Nuclear Finance

The Key Technical Contacts are:

<b>Name</b>	<b>Position</b>
Angelo Pavia (Technical Coordinator for Nuclear)	Senior Manager, Investment Management, Nuclear Finance

**MEMORANDUM**

**December 2018**

*2018 Depreciation Review Committee Recommendations – Nuclear*

**2018**  
**DEPRECIATION REVIEW COMMITTEE**  
**RECOMMENDATIONS**  
**FOR**  
**NUCLEAR**

***DECEMBER 2018***

**MEMORANDUM**

**December 2018**

***2018 Depreciation Review Committee Recommendations – Nuclear***

**PURPOSE AND SUMMARY**

This memorandum is intended to obtain approval for the recommendations resulting from the 2018 Depreciation Review Committee (DRC) review of the average service lives of the selected asset classes and the station service lives for OPG's nuclear facilities. The nuclear facilities are the Pickering Nuclear Generating Station, the Darlington Nuclear Generating Station and the Bruce Nuclear Generating Stations.

The 2018 DRC makes the following recommendations for depreciation purposes.

**Station Service Lives**

The DRC has confirmed with the nuclear business units that no new information became available in 2018 that would require any change in the station end-of-life (EOL) dates of the nuclear stations. There is no recommendation for changing the station EOL dates of the nuclear stations. The following average nuclear station EOL dates remain effective from December 31, 2017.

Darlington	December 31, 2052
Pickering Units 1 and 4	December 31, 2022
Pickering Units 5-8	December 31, 2024
Bruce A	December 31, 2052
Bruce B	December 31, 2061

**Selected Nuclear Asset Classes**

<b>Asset Class</b>	<b>Recommendation</b>
15200000 – Nuclear Buildings and Structures	No change to average service life
15340000 – Nuclear Process Systems	No change to average service life
15411100 – Nuclear Turbine Auxiliary Equipment, Steam Reheater Tube – PB&DG	No change to average service life
15421000 – Nuclear Generator Rotors, Stators & Auxiliary Systems – PB & DG	No change to average service life
15561000 – Nuclear AC Standby Power – PB & DG	No change to average service life
15600000 – Nuclear Instruments and Controls	No change to average service life
15720000 – Nuclear Common Service Systems	No change to average service life
15991200 – Nuclear Large Motors	No change to average service life

These asset class average service life recommendations will result in no change to the annual depreciation expense for the nuclear facilities.

## MEMORANDUM

December 2018

### *2018 Depreciation Review Committee Recommendations – Nuclear*

#### BACKGROUND

The DRC convenes annually to review the service lives for depreciation purposes of OPG's major facilities and/or a selection of asset classes in those facilities, with the general objective of reviewing all significant asset classes over a five year period. OPG's practice of reviewing asset classes over an approximate five-year cycle to re-evaluate the average service life estimates was considered appropriate by Gannett Fleming ULC (GF), an external consultant. In the recommendation section of the report dated November 29, 2013 that was accepted by the Ontario Energy Board (OEB) as part of OPG's application for 2014/15 payment amounts, GF noted "[c]ontinued surveillance and periodic revisions are required to maintain use of appropriate average service lives and depreciation rates. Each [asset class] account should be subjected to a complete depreciation study to re-evaluate its average service life estimates periodically. Gannett Fleming notes that the practice of OPG to review its various asset accounts and depreciation service lives over an approximate five-year cycle meets this common depreciation practice." This is the first year of the current five year review period.

OPG plans to conduct the next independent study after the refurbished Darlington Generating Station (GS) Unit 2 is returned to service which is anticipated to be in February 2020. This would allow for the substantial in-service additions associated with the Unit 2 return to service to be reviewed, and more recent information to be provided to the rate-setting process for OPG's next incentive rate-setting term starting in 2022. In its December 2017 decision and order on OPG's 2017-2021 rate application, the OEB indicated that it does not have concerns with this approach.

#### SCOPE OF 2018 DRC REVIEW FOR NUCLEAR

The focus of the 2018 DRC for the nuclear business was on reviewing a selection of nuclear asset class service lives. The review focused on the following main areas:

##### Asset Class Review

Eight nuclear Major Fixed Asset classes were selected for the 2018 DRC review. The asset classes reviewed were determined based on a selection of higher value asset classes (greater than \$5M) that had not been reviewed by the DRC in the last two years and assets identified for review by business unit/site contacts based on operational knowledge.

##### Sources of Information

The main sources of information considered by the DRC in developing the recommendations included:

- reviews conducted primarily by technical staff in the nuclear business unit;
- information obtained from past DRC reviews; and
- industry experience.

**MEMORANDUM**

**December 2018**

***2018 Depreciation Review Committee Recommendations – Nuclear***

**SUMMARY OF RECOMMENDATIONS**

**Asset Class Review**

The 2018 DRC review of the average service lives of the nuclear facilities determined that the currently approved average service life estimates for all reviewed asset classes remain appropriate. These recommendations were reviewed with and endorsed by business and technical staff responsible for overseeing the nuclear assets. Below is a summary of conclusions for the reviewed asset classes:

<b>Asset Class</b>	<b>Recommendation</b>
15200000 – Nuclear Buildings and Structures	Retain the current service life of 55 years
15340000 – Nuclear Process Systems	Retain the current service life of 55 years
15411100 – Nuclear Turbine Auxiliary Equipment, Steam Reheater Tube – PB&DG	Retain the current service life of 55 years
15421000 – Nuclear Generator Rotors, Stators & Auxiliary Systems – PB & DG	Retain the current service life of 55 years
15561000 – Nuclear AC Standby Power – PB & DG	Retain the current service life of 55 years
15600000 – Nuclear Instruments and Controls	Retain the current service life of 15 years
15720000 – Nuclear Common Service Systems	Retain the current service life of 35 years
15991200 – Nuclear Large Motors	Retain the current service life of 30 years

These asset class average service life recommendations will result in no change to the annual nuclear depreciation expense.



**MEMORANDUM**

**December 2018**

**2018 Depreciation Review Committee Recommendations – Nuclear**

**DRC MEMBERS AND APPROVALS COMMITTEE**

The DRC includes representatives from the operating business units as well as representatives having experience in finance and accounting, investment planning, and rate regulation.

The Approvals Committee is responsible for approving the DRC recommendations and, as it relates to the nuclear business, is comprised of the following individuals:

<b>Name</b>	<b>Position</b>
Sean Granville	Chief Nuclear Officer
Ken Hartwick	Chief Financial Officer and Senior Vice President, Finance
Chris Ginther	Chief Administrative Officer

The DRC is comprised of the following members:

<b>Name</b>	<b>Position</b>
Cynthia Domjancic	Vice President, Controllership
Michael Gore	Director, External Reporting and Accounting Policy
Jenny Jorda	Senior Manager, Accounting and Reporting
Alex Kogan	Vice President, Business Planning and Reporting
John Mauti	Vice President, Chief Controller & Accounting Officer
Randy Pugh	Director, Ontario Regulatory Affairs
Stefan Surdu	Senior Manager, Investment Management, Nuclear Finance

The Key Technical Contacts are:

<b>Name</b>	<b>Position</b>
Stefan Surdu (Technical Coordinator for Nuclear)	Senior Manager, Investment Management, Nuclear Finance

**2017**  
**DEPRECIATION REVIEW COMMITTEE**  
**RECOMMENDATIONS**  
**FOR**  
**NUCLEAR**

***DECEMBER 2017***

**MEMORANDUM**

**2017 Depreciation Review Committee Recommendations – Nuclear**

**PURPOSE AND SUMMARY**

This memorandum is intended to obtain approval for the recommendations resulting from the 2017 Depreciation Review Committee (DRC) review of the average service lives of the selected asset classes and the station service lives for OPG's nuclear facilities. The nuclear facilities are the Pickering Nuclear Generating Station, the Darlington Nuclear Generating Station and the Bruce Nuclear Generating Stations.

The 2017 DRC makes the following recommendations for depreciation purposes.

**Station Service Lives**

The DRC recommends an extension of the Pickering units' end-of-life (EOL) date from December 31, 2020 to December 31, 2022 for Units 1 and 4, and December 31, 2024 for Units 5 through 8. There is no recommendation for changing the EOL dates of Darlington, Bruce A or Bruce B. The following average nuclear station EOL dates are recommended to be effective from December 31, 2017:

Darlington	December 31, 2052
Pickering Units 1 & 4	December 31, 2022
Pickering Units 5-8	December 31, 2024
Bruce A	December 31, 2052
Bruce B	December 31, 2061

The change of the Pickering units' EOL dates is expected to have the following illustrative estimated impacts on depreciation expense based on actual asset values as of November 30, 2017 (i.e. including neither the impact of the anticipated year-end 2017 adjustment to the asset retirement obligation (ARO) estimate and asset retirement costs (ARC), nor future capital additions).

(\$M)	2018	2019	2020	2021	2022	2023	2024
Estimated Pickering Depreciation Expense Change Based on November 30, 2017 Asset Values	-120	-120	-120	+125	+125	+55	+55

The impact of the change in the accounting EOL dates on the revenue requirement approved by the Ontario Energy Board (OEB) will be subject to an accounting order application with the OEB. The accounting order will seek the OEB's approval to establish a deferral account to record the revenue requirement impact on the prescribed facilities arising from the anticipated year-end 2017 ARO/ARC adjustment and depreciation and amortization expense beginning January 1, 2018 resulting from the above changes to Pickering EOL dates. Subject to the impact of the year-end 2017 ARO/ARC adjustment, OPG will propose that the revenue requirement impact recorded in the deferral account be based on forecast net book values and forecast capital in-service additions included in the nuclear rate base that will be approved through the EB-2016-0152 Payment Amounts Order.

**Selected Nuclear Asset Classes (Major Fixed Assets)**

Asset Class	Recommendation
15110 - Site Improvements	No change to average service life.
15361 - Irradiated Fuel Bays - PB&DN	No change to average service life.

**MEMORANDUM**

**December 2017**

**2017 Depreciation Review Committee Recommendations – Nuclear**

<b>Asset Class</b>	<b>Recommendation</b>
15411 - Turbine Blades & Diaphragms - PN	Decrease the current average service life from 40 to 15 years.
15460 - Nuclear Auxiliary Systems - PA&BN	No change to average service life.
15521 - Station Service Main Transformers & Power Distribution Systems	No change to average service life.
15550 - Reactor Building Cabling - PA&BN	No change to average service life.
15560 - AC Standby Power - PA&BN	No change to average service life.
15700 - Nuclear Circulating Water - PA&BN	No change to average service life.
15710 - Water Treatment Plant	No change to average service life.
15711 - Nuclear Circulating Water - PB&DN	No change to average service life.
16210 - Admin & Service Bldgs - Permanent Buildings, Roads, Site Improvements	No change to average service life.
16230 - Admin & Service Bldgs - Buildings - Frame & Metal Clad	No change to average service life.
165601 - Admin & Service Bldgs - Buildings - Admin System Software	No change to average service life.

These asset class average service life recommendations are expected to have a minimal impact (i.e. less than \$100,000 per annum) on the annual depreciation expense for the nuclear facilities.

**Minor Fixed Assets (MFA)**

The DRC recommends that the currently approved average service life estimate of 10 years for the MFA asset classes of Service Equipment and Removal Tools for Darlington Refurbishment be retained. The 10-years service life estimate for Removal Tools for Darlington Refurbishment continues to be based on the planned feeder removal time periods for the four Darlington units, consistent with the treatment of removal costs that OPG expenses in the period incurred in accordance with US GAAP. The remaining MFA asset classes, with a net book value totaling approximately \$5M, did not meet the materiality considerations and were not reviewed.

Excluding asset retirement costs, 99% of the total (major and minor) in-service net book value of the fixed asset classes of the nuclear business as at December 31, 2016 have been covered by the 2013 to 2017 DRC reviews.

**BACKGROUND**

The DRC convenes annually to review the service lives for depreciation purposes of OPG's major facilities and/or a selection of asset classes in those facilities with the general objective of reviewing all significant asset classes over a five year period. OPG's practice of reviewing asset classes over an approximate five-year cycle to re-evaluate the average service life estimates was considered appropriate by Gannett Fleming ULC (GF), an external consultant. In the recommendation section of their report dated November 29, 2013 that was accepted by the OEB as part of OPG's application for 2014/15 payment amounts, GF noted that

## MEMORANDUM

### ***2017 Depreciation Review Committee Recommendations – Nuclear***

“[c]ontinued surveillance and periodic revisions are required to maintain use of appropriate average service lives and depreciation rates. Each [asset class] account should be subjected to a complete depreciation study to re-evaluate its average service life estimates periodically. Gannett Fleming notes that the practice of OPG to review its various asset accounts and depreciation service lives over an approximate five-year cycle meets this common depreciation practice.” The current five year review period began in 2013.

The 2013 independent depreciation study performed by GF reviewed the estimated average asset class lives and station service lives for the property, plant and equipment, including intangible assets, of the nuclear and hydroelectric prescribed facilities, including the hydroelectric facilities that were prescribed for regulation beginning in 2014, based on in-service balances as at December 31, 2012, as well as the Niagara Tunnel. GF’s findings in their November 29, 2013 report were accepted by the OEB.

### **SCOPE OF 2017 DRC REVIEW FOR NUCLEAR**

The focus of the 2017 DRC for the nuclear business was on reviewing OPG’s nuclear station service lives as well as a selection of asset class service lives. The review focused on the following main areas:

#### **Nuclear Station Service Lives Review**

As part of the plan to extend Pickering operations beyond 2020, OPG has been undertaking a set of initiatives to confirm that the units would remain fit to operate to 2024. Under the plan announced in early 2016, all six units at the station would operate until 2022, at which point two units (Units 1 & 4) would be shut down and the remaining four units (Units 5-8) would continue to operate to 2024. OPG’s approved business plans have been reflecting resource levels and work programs necessary for the operation of the station to these dates. In 2016, the DRC concluded that it was premature to extend the accounting EOL date of the station from the currently approved date of December 31, 2020, based on the status of technical and regulatory work to confirm the unit’s fitness for service to achieve the additional life at that time. The 2017 DRC assessed whether the current status of this work and other factors indicates that sufficient high confidence has been achieved to extend the accounting EOL date.

Although not a primary focus of this year’s review, the 2017 DRC also considered whether it is aware of any evidence justifying a change in the lives of the Darlington, Bruce A or Bruce B stations.

#### **Asset Class Review (Major Fixed Assets)**

Thirteen nuclear Major Fixed Asset classes were selected for the 2017 DRC review. Eleven asset classes to be reviewed were determined by selecting the higher value asset classes (net book value greater than \$5M) that had not been previously reviewed by the DRC as part of the current review cycle that began in 2013. The business unit/site contacts identified two additional asset classes for review.

#### **Minor Fixed Assets**

Minor Fixed Asset classes are defined as portable assets used in administration, construction, and transport or maintenance / service activities. They are not used directly for the generation of electricity, and do not form integral components of a building or other structures. Material MFA classes that had not been included in previous DRC reviews were reviewed as part of the 2017 DRC. The current methods of depreciation for MFA classes are as follows:

**MEMORANDUM**

**2017 Depreciation Review Committee Recommendations – Nuclear**

Computers <sup>1</sup>	40% Declining Balance <sup>1</sup>
Transportation and Work Equipment	10 Year Straight Line
Service Equipment	10 Year Straight Line
Removal Tools for Darlington Refurbishment	10 Year Straight Line

<sup>1</sup> 40% declining balance over the first three years, then straight line the last two years (total of 5 years)

The net book values of the MFA asset classes Computers and Transportation and Work Equipment directly assigned to the nuclear facilities were nil and \$5M, respectively, as at December 2016. Based on materiality considerations, these asset classes were not included in the 2017 DRC review.

The Service Equipment and Removal Tools for Darlington Refurbishment MFA asset classes reviewed by the 2017 DRC represented approximately 98% of the total Nuclear MFA net book values as at December 31, 2016.

**Sources of Information**

The main sources of information considered by the DRC in developing the recommendations included:

- reviews conducted primarily by technical staff in the Nuclear business unit;
- information obtained from past DRC reviews; and
- industry experience

**SUMMARY OF RECOMMENDATIONS**

**Nuclear Station Service Lives Review**

*Pickering Station*

A technical assessment has been completed to determine the ability of Pickering units to continue to be fit for service in order to support continued operation to 2024, with fuel channels having been determined to be the life-limiting major component. In the fourth quarter of 2017, the DRC received confirmation that there is high technical confidence that Units 1 & 4 can be safely operated to the end of 2022 and Units 5-8 to the end of 2024, based on the programs and provisions in place to assure fitness-for-service of fuel channel components, up to 286,000 effective full power hours (EFPH) for the lead unit. The work program to support fitness-for-service of fuel channels includes the Fuel Channel Life Assurance project (FCLA) to address the elongation of the fuel channels, which is considered to be the specific life-limiting degradation mechanism that could impact station operation beyond 2020. Based on the results of the FCLA, completed earlier in 2017, OPG has selected a strategy to manage fuel channel elongation and has incorporated it into the life cycle management plans.

The above high technical confidence is consistent with the safety case reflected in OPG’s submission of the Pickering licence application to the Canadian Nuclear Safety Commission (CNSC) in 2017. The licence application spans the operating period to 2024 and the period to prepare the station for safe storage. In support of the licence application, OPG has completed a Periodic Safety Review (PSR) for the station. The final major element of the PSR was submitted to the CNSC in November 2017. The CNSC review of OPG’s PSR submission and licence application is underway, with a decision expected to be rendered by about August 2018, following a public hearing.

## MEMORANDUM

### ***2017 Depreciation Review Committee Recommendations – Nuclear***

The DRC observed that OPG has taken a number of steps to be in a good position to achieve a successful licence renewal, which support high confidence in the continued safe operation of the station to the above noted dates. These include a strong record of operational safety; the highest possible safety rating from the CNSC over the last two years; a program in place to support the provision of safe and reliable service; and completion of the PSR process. The PSR has confirmed that extending station operation to 2024 will continue to pose minimal risk to the health, safety and security of workers, the public and the environment. The PSR also includes component condition assessments to ensure that the major plant components have sufficient life to operate through the end of 2024, as well as an assessment against modern codes and standards.

OPG's 2017-2021 payment amounts application to the OEB reflected the company's plans to continue Pickering commercial operation to 2024 and requested inclusion of the corresponding cost and generation impacts in the determination of the nuclear regulated prices. In its December 2017 decision on the application, the OEB approved the inclusion of cost and generation impacts associated with station operations beyond 2020 in the nuclear payment amounts, providing further certainty to the plans for the continued operation of the station. The DRC also noted that the work program to support continued operation to 2024 is similar in nature and scope to the work program previously completed by 2014 to extend station operation to 2020. That work program was completed successfully within the identified budget, achieving all necessary regulatory approvals.

The DRC noted that the Province of Ontario has consistently endorsed OPG's plans to pursue operation of the Pickering station until 2024, citing the socio-economic benefits of continued operation. Among others, this includes the Government's January 2016 announcement approving OPG's plan to pursue continued operation, the Minister of Energy's May 2017 Letter concurring with OPG's 2017-2019 Business Plan that reflected operation of the station beyond 2020, and, most recently, the inclusion of continued operation of Pickering to 2024 in Ontario's Long-Term Energy Plan, which was published in October 2017. The IESO's independent analysis has confirmed the economic benefits to the electricity system of continued Pickering operation.

The DRC concludes that, taken together, the technical confidence associated with the programs and provisions in place to assure fitness-for-service of fuel channel components, the current status of CNSC and OEB regulatory approvals, and the Province's endorsement of OPG's plans for continued operation of the station provide sufficient high confidence that Pickering Units 1 & 4 are expected to operate to December 31, 2022 and Units 5-8 to December 31, 2024. The DRC recommends adopting these EOL dates for depreciation purposes effective from December 31, 2017.

Based on actual asset values as of November 30, 2017, the impact on depreciation expense of the above service life changes is an estimated annual reduction of approximately \$120M for years 2018 to 2020 inclusive. Of this amount, approximately \$33M relates to the existing ARC asset balances and approximately \$87M to the non-ARC balances. In 2021, the estimated annual impact on depreciation expense is an increase of approximately \$125M, of which approximately \$33M relates to the existing ARC balances and approximately \$92M to the non-ARC balances. The impact of the anticipated year-end 2017 adjustment to the ARO / ARC balances and any future capital additions is not included in these figures.

**MEMORANDUM**

**December 2017**

**2017 Depreciation Review Committee Recommendations – Nuclear**

*Darlington and Bruce Nuclear Generating Stations*

There is no recommendation to change the station EOL dates for Darlington, Bruce A and Bruce B Nuclear Generating Stations. The current approved Darlington EOL date reflects the previously approved schedule for the four-unit refurbishment, assuming a 30-year post-refurbishment operating life. The current approved Bruce A and Bruce B EOL dates are based on the Amended and Restated Bruce Power Refurbishment Implementation Agreement between the Independent Electricity System Operator and Bruce Power made public in December 2015. No information has come to the 2017 DRC's attention to justify a change in these dates.

**Asset Class Review (Major Fixed Assets)**

The 2017 DRC review of the average service lives of the nuclear facilities determined that, with the exception of asset class 15411-Nuclear Turbine Blades & Diaphragms-PN, the currently approved average service life estimates for all reviewed asset classes remain appropriate. These recommendations were reviewed with and endorsed by business and technical staff responsible for overseeing the nuclear assets. Below is a summary of conclusions for the reviewed asset classes.

<b>Asset Class</b>	<b>Recommendation</b>
15110 - Site Improvements	Retain the current 75 years average service life.
15361 - Irradiated Fuel Bays - PB&DN	Retain the current 65 years average service life.
15411 - Turbine Blades & Diaphragms - PN	Decrease the current average service life from 40 to 15 years.
15460 - Nuclear Auxiliary Systems - PA&BN	Retain the current 40 years average service life.
15521 - Station Service Main Transformers & Power Distribution Systems	Retain the current 20 years average service life.
15550 - Reactor Building Cabling - PA&BN	Retain the current 40 years average service life.
15560 - AC Standby Power - PA&BN	Retain the current 40 years average service life.
15700 - Nuclear Circulating Water - PA&BN	Retain the current 40 years average service life.
15710 - Water Treatment Plant	Retain the current 20 years average service life.
15711 - Nuclear Circulating Water - PB&DN	Retain the current 55 years average service life.
16210 - Admin & Service Bldgs - Permanent Buildings, Roads, Site Improvements	Retain the current 50 years average service life.
16230 - Admin & Service Bldgs - Buildings - Frame & Metal Clad	Retain the current 25 years average service life.
165601 - Admin & Service Bldgs - Buildings - Admin System Software	Retain the current 5 years average service life.

**Minor Fixed Assets Review**

The DRC recommends that the currently approved average service life estimate of 10 years for the Service Equipment asset class is appropriate.



**MEMORANDUM**

***2017 Depreciation Review Committee Recommendations – Nuclear***

The DRC also recommends retaining the 10-year service life for the Removal Tools for Darlington Refurbishment asset class.

**MEMORANDUM*****2017 Depreciation Review Committee Recommendations – Nuclear*****DRC MEMBERS AND APPROVALS COMMITTEE**

The DRC includes representatives from the operating business units as well as representatives having experience in finance and accounting, investment planning, and rate regulation.

The Approvals Committee is responsible for approving the DRC recommendations and, as it relates to the nuclear business, is comprised of the following individuals:

- Glenn Jager, Nuclear President and Chief Nuclear Officer
- Ken Hartwick, Chief Financial Officer and Senior Vice President, Finance
- Chris Ginther, Chief Administrative Officer

The 2017 DRC for the nuclear business is comprised of the following members:

- Michael Gore, Director, External Reporting & Accounting Policy (DRC Chair)
- John Blazanin, Vice President, Nuclear Finance
- Cynthia Domjancic, Director, Controllership, Business Support, Central Nuclear
- Randy Pugh, Director, Ontario Regulatory Affairs
- John Mauti, Vice President, Chief Controller & Accounting Officer
- Louisa Kwan, Senior Manager, Corporate Accounting & Reporting

**2016**

**DEPRECIATION REVIEW COMMITTEE**

**RECOMMENDATIONS**

**FOR**

**NUCLEAR**

***DECEMBER 2016***

## MEMORANDUM

December 2016

### 2016 Depreciation Review Committee Recommendations – Nuclear

#### PURPOSE AND SUMMARY

This memorandum is intended to obtain approval for the recommendations resulting from the 2016 Depreciation Review Committee (DRC) review of the average service lives of the selected asset classes and the station service lives for OPG's nuclear facilities. The prescribed nuclear facilities are the Pickering Nuclear Generating Station and Darlington Nuclear Generating Station.

The 2016 DRC review recommends the following for depreciation purposes, effective January 1, 2017, for the selected nuclear asset classes reviewed.

- 15120 – Yard Facilities: **Retain the current 50 year average service life and establish a new asset class with a 20 year average service life to separate nuclear fencing from yard facilities**
- 15511 – Station Service Main Transformers and AC Power Distribution Systems - Pickering Units 5-8 and Darlington: **Decrease average service life from 55 to 40 years**
- 15500 – Main Power Output System: **No change to average service life**
- 15510 – Station Service Main Transformers and AC Power Distribution Systems - Pickering Units 1 and 4 and Bruce: **No change to average service life**
- 16310 – Administration and Service Buildings – Nuclear Training Simulators: **No change to average service life**
- 153411 – Moderator Heat Exchangers-Pickering: **No change to average service life**

These recommendations will result in an annual nuclear depreciation expense increase of approximately \$1.5M.

There is no recommendation for a change in service life of the operating nuclear stations. The following average nuclear station end of life (EOL) dates which were effective December 31, 2015, continue to be used:

Darlington	December 31, 2052
Pickering Units 1 and 4	December 31, 2020
Pickering Units 5-8	December 31, 2020
Bruce A	December 31, 2052
Bruce B	December 31, 2061

#### BACKGROUND

The DRC is convened annually to review the service lives for depreciation purposes of OPG's major facilities and/or a selection of asset classes in those facilities with the general objective of reviewing all significant asset classes over a five year period. OPG's practice of reviewing asset classes over an approximate five-year cycle to re-evaluate the average service life estimates was considered appropriate by Gannet Fleming ULC (GF), an external consultant. In the recommendation section of the report, dated November 29, 2013, that was accepted by the Ontario Energy Board in the application for 2014/15 payment amounts, GF noted "Continued surveillance and periodic revisions are required to maintain use of appropriate average service lives and depreciation rates. Each [asset class] account should be

## MEMORANDUM

December 2016

### **2016 Depreciation Review Committee Recommendations – Nuclear**

subjected to a complete depreciation study to re-evaluate its average service life estimates periodically. Gannet Fleming notes that the practice of OPG to review its various asset accounts and depreciation service lives over an approximate five-year cycle meets this common depreciation practice.” The current five year review period started in 2013.

The 2013 independent depreciation study performed by GF reviewed the estimated average asset class lives and station service lives for the property, plant and equipment, including intangible assets, of the nuclear and hydroelectric prescribed facilities, including the newly regulated hydroelectric facilities, based on in-service balances as at December 31, 2012, as well as the Niagara Tunnel. GF provided their findings in their report dated November 29, 2013 that was accepted by the OEB in the application for 2014/15 payment amounts.

#### **SCOPE OF 2016 DRC REVIEW FOR NUCLEAR**

The focus of the of the DRC was to review a selection of nuclear asset class service lives as well as confirm OPG’s nuclear station service lives. The review focused on the following main areas:

- **Asset class review** – six nuclear asset classes were selected for the 2016 DRC review. The asset classes to be reviewed were determined by selecting the higher value asset classes that had not been previously reviewed by the DRC as part of the current review cycle. The business unit/site contacts did not identify any additional asset classes for review.
- **Nuclear station service lives review** – to assess whether there is any new information pertaining to nuclear station lives that would warrant changes based on the principle of high confidence

The main sources of information considered by the DRC in developing the recommendations included:

- reviews conducted primarily by technical staff in the nuclear business unit;
- information obtained from past DRC reviews; and
- industry experience.

Excluding asset retirement costs, more than 85% of the in-service net book value of the major fixed asset classes as at December 31, 2015 of the nuclear business, have been covered by the 2013 to 2016 DRC reviews.

#### **SUMMARY OF RECOMMENDATIONS**

##### **Asset Class Review**

The DRC review of the average service lives of the nuclear facilities determined that, except for asset class 15120, Yard Facilities, and asset class 15511, Station Service Main Transformers and AC Power Distribution Systems, the currently approved average service life estimates for all reviewed asset classes are appropriate. These recommendations were reviewed with and endorsed by business and technical staff responsible for overseeing the nuclear assets. Below is a summary of conclusions for the reviewed asset classes.

## MEMORANDUM

December 2016

### **2016 Depreciation Review Committee Recommendations – Nuclear**

- 15120 – Yard Facilities: Security fencing makes up the majority of the net book value of this asset class and has a design life of 20 years. *It is recommended to establish a new asset class with a 20 year average service life to separate fencing from other assets within this asset class. This will result in an annual increase in depreciation of approximately \$1.5M. The current 50 year average service life for the assets remaining in the Yard Facilities asset class will be retained.*
- 15511 – Station Service Main Transformers and AC Power Distribution System - Pickering Units 5-8 and Darlington: Plant condition assessments and engineering assessments indicate that the asset class life should be 40 years rather than the current 55 years. *It is recommended that the service life of this asset class be decreased from 55 to 40 years. There is no impact on depreciation, as the EOL dates of Darlington (2052) and Pickering (2020) are the life limiting factors for these assets.*
- 15500 – Main Power Output System: *Retain current 35 year average service life*
- 15510 – Station Service Main Transformers And AC Power Distribution Systems - Pickering Units 1 and 4 and Bruce: *Retain current 40 year average service life*
- 16310 – Administration and Service Buildings – Nuclear Training Simulators: *Retain current 45 year average service life*
- 153411 – Moderator Heat Exchangers-Pickering: *Retain current 25 year average service life*

### **Nuclear Station Service Lives Review**

#### *Pickering Station*

The 2016 DRC is recommending that the average station end of life dates for depreciation purposes for Pickering Units 1 and 4 and Pickering Units 5-8 continue to remain unchanged at December 31, 2020. The 2015 extension of the Pickering Units 5-8 EOL to 2020 was based on the technical confirmation of high confidence, that all four Pickering Units 5-8 were expected to be fit to safely operate until at least December 31, 2020, received in 2015 based on the results of the fuel channel work. The 2016 DRC considered the potential to extend the Pickering station EOL date beyond 2020 and concluded that OPG currently does not have the necessary high confidence, for accounting purposes, of the units' fitness-for-service beyond that date.

In January 2016, OPG announced that it plans to pursue continued safe and reliable operation of the Pickering station beyond 2020. Under OPG's plan, all six operating units at the station would operate until 2022, at which point two units would be shut down and the remaining four units would continue to operate until 2024. Although OPG has increasing confidence that the Pickering fuel channels can safely operate to 2024 through work being completed as part of the fuel channel work program, OPG continues to undertake further technical and regulatory work to confirm that the Pickering pressure tubes will achieve the additional life predicted. The end of life for accounting purposes will be reassessed when this work confirms that the longer fuel channel life necessary to extend Pickering operations will be achieved.

#### *Darlington Station*

The average station end of life date for Darlington was previously established at December 31, 2052 in the 2015 DRC. This EOL was based on the November 2015 OPG Board of Directors' approval of the

**MEMORANDUM**

**December 2016**

***2016 Depreciation Review Committee Recommendations – Nuclear***

budget and schedule for the four unit Darlington refurbishment, continuing to assume a 30-year post-refurbishment operating life. This EOL date remains unchanged.

*Bruce Nuclear Generating Stations*

Bruce A and Bruce B average end of life dates were previously established as December 31, 2052 and December 31, 2061, respectively in the 2015 DRC. These dates were based on the Amended and Restated Bruce Power Refurbishment Implementation Agreement between the Independent Electricity System Operator and Bruce Power made public December 2015. These EOL dates remain unchanged.

**MEMORANDUM*****2016 Depreciation Review Committee Recommendations – Nuclear*****DRC MEMBERS AND APPROVALS COMMITTEE**

The DRC includes representatives from the operating business units as well as representatives having experience in finance and accounting, investment planning, and rate regulation.

The Approvals Committee is responsible for approving the DRC recommendations and is comprised of:

- Glenn Jager, President, OPG Nuclear and Chief Nuclear Officer
- Mike Martelli, President, Renewable Generation & Power Marketing
- Ken Hartwick, Senior Vice President, Finance, Strategy, Risk and Chief Financial Officer
- Chris Ginther, Senior Vice President, Legal, Ethics & Compliance

The DRC is comprised of the following members:

- Glenn Inouye, Vice President, Shared Financial Services (DRC Chair)
- John Blazanin, Vice President, Nuclear Finance
- Lubna Ladak, Vice President, Renewable Generation & Power Marketing Finance\*
- Jeffrey Hansen, Vice President, Strategic Operations, Renewable Generation & Power Marketing\*
- Randy Pugh, Director, Ontario Regulatory Affairs
- Alec Cheng, Director, External Reporting and Accounting Policy
- Vassa Chase, Director, Accounting
- Dwight Zerkee, Senior Manager, Investment Management, Nuclear Finance

\*Did not participate in the development of the nuclear report.



Numbers may not add due to rounding.

Filed: 2020-12-31  
EB-2020-0290  
Exhibit F4  
Tab 1  
Schedule 1  
Table 1

Table 1  
Depreciation and Amortization - Hydroelectric (\$M)

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Numbers may not add due to rounding.

Filed: 2020-12-31  
 EB-2020-0290  
 Exhibit F4  
 Tab 1  
 Schedule 1  
 Table 2

Table 2  
 Depreciation and Amortization - Nuclear (\$M)

Line No.	Cost Item	2016 Actual	2017 Actual	2018 Actual	2019 Actual	2020 Budget	2021 Budget	2022 Plan	2023 Plan	2024 Plan	2025 Plan	2026 Plan
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
1	<b>Darlington NGS</b>	34.2	37.3	44.6	52.9	72.3	83.9	101.2	122.0	142.5	160.7	173.2
2	<b>Darlington Refurbishment Project - Excluding D2O<sup>1</sup></b>	16.1	27.5	33.9	34.4	122.8	186.1	164.9	164.9	251.3	300.4	336.1
3	<b>Heavy Water Storage Facility (D2O)</b>	0.4	4.8	4.8	5.6	14.8	15.0	15.0	15.0	15.0	15.0	15.0
4	<b>Pickering NGS</b>	150.4	182.8	119.9	119.3	129.3	143.5	151.7	78.1	76.5	0.4	0.0
5	<b>Operations and Project Support</b>	29.7	34.0	37.7	37.2	30.8	34.7	38.1	41.2	42.9	41.7	40.8
6	<b>Asset Retirement Costs</b>	50.3	74.1	82.2	82.2	82.2	82.2	82.2	50.5	50.5	3.6	3.6
7	<b>Other<sup>2</sup></b>	0.5	5.5	0.9	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	<b>Total</b>	281.6	366.1	324.1	333.0	452.1	545.2	553.0	471.5	578.7	521.6	568.6

- Notes:
- 1 As discussed in Ex. D2-2-2 and Ex. B1-1-1, for the purposes of this application, OPG proposes to limit DRP-related net plant in rate base for projects completed prior to 2022 (other than the D2O Storage Project) to the values approved in EB-2016-0152 as of December 31, 2021. Depreciation expense for the IR term has been adjusted accordingly.
  - 2 Includes losses on retirements, gains on disposal and other related charges.