August 31, 2021

Ms. Christine Long
Registrar and Board Secretary
Ontario Energy Board
2300 Yonge Street
P.O. Box 2319
Toronto, ON M4P 1E4

Re: Ontario Power Generation 2022 to 2026 Payment Amounts
Final Submissions of AMPCO & CCC
Board File No. EB-2020-0290

In accordance with Procedural Order No. 4 dated July 19, 2021, enclosed please find the submissions of AMPCO and the Consumers Council of Canada (CCC) on the unsettled issues in the above proceeding.

AMPCO worked in collaboration with CCC's counsel, Mr. Michael Buonaguro, and consultant, Ms. Julie Girvan, in the preparation of cross examination for the oral hearing held on August 4-6, 2021, and the preparation of these final submissions.

Please advise if there are any questions with this submission.

Best Regards,

Colin Anderson
President

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**Ontario Energy Board**

**IN THE MATTER OF** the *Ontario Energy Board Act*, 1998,
**AND IN THE MATTER OF** an Application by Ontario Power Generation Inc. for an order or orders approving payment amounts for prescribed generating facilities commencing January 1, 2022.

**Ontario Power Generation Payment Amounts 2022-2026**

# Final Submissions of AMPCO and the Consumers Council of Canada (CCC) on the Unsettled Issues

**August 31, 2021**

## Introduction

In view of the OEB's general direction that parties work together when possible and given the narrowing of the scope of the hearing phase of this proceeding to two distinct issues, AMPCO and CCC have collaborated with respect to drafting and filing of argument. Accordingly, these are the combined submissions of AMPCO and CCC ("AMPCO/CCC") with respect to the outstanding issues of:

a) the recording of Small Modular Nuclear related costs in the Nuclear Development Variance Account, and

b) OPG's request to include a total of $494.7M of capital spending associated with their D2O Storage Facility into rate base.

## A) The Recording of Small Modular Nuclear Related Costs in the Nuclear Development Variance Account.

### Background and Context

Ontario Power Generation Inc. (OPG) filed an application dated December 31, 2020, with the Ontario Energy Board (OEB) under section 78.1 of the Ontario Energy Board Act, 1998. OPG's application seeks approval for changes in payment amounts for the output of its nuclear generating facilities in each of the five years beginning January 1, 2022 and ending on December 31, 2026. OPG also requested approval to maintain, with no change, the base payment amount it charges for the output of its regulated hydroelectric generating facilities at the payment amount in effect December 31, 2021 for the period from January 1, 2022 to December 31, 2026.

On July 16, 2021, a settlement proposal was filed with the OEB. The settlement proposal indicated that parties had reached agreement on most issues in the proceeding, with a small number of issues progressing to oral hearing. The subject of Small Modular Reactors, and that subject's impact on issues 1.2, 13.1 and 14.1 (as set out in the approved Issues List), was one area that progressed to hearing.

The oral hearing was scheduled and took place on August 4, 5 and 6, 2021. In general, two major subject areas were addressed in the hearing - Small Modular Reactors (SMRs) and OPG's Heavy Water Storage Facility.

This section addresses the subject area of SMRs.

**Summary of OPG's Position on SMRs**

In its Argument-in-Chief, filed on August 17, 2021, OPG claims that there is no basis upon which to conclude that the costs of planning and preparing for the development of an SMR nuclear generating facility at the Darlington site are outside the legislative purpose of the Nuclear Development Variance Account (NDVA) as set out in section 5.4(1) of O. Reg. 53/05. According to OPG, the nature of the expenditures included in the NDVA demonstrates that they are consistent with the purpose of the account. Further, they are consistent with the expectations of the Province, as for example set out in the shareholder's concurrence with OPG's 2020-2026 Business Plan, which requests that OPG continue "planning and preparation work for the development of a potential on-grid SMR at the Darlington site including completion of the SMR technology selection process" (Ex. L-A2-02-CCC-014, Attachment 1, p. 2). As such, OPG contends that there is no basis upon which to conclude that the costs of planning and preparing for the development of an SMR nuclear generating facility at the Darlington site are outside the legislative purpose of the NDVA.

OPG also submits that no changes to its customer engagement activities are required, appropriate or practicable in respect of the development of a potential SMR at the Darlington site, since the decision as to the progress and construction of an SMR is a system planning decision that rests with the Minister of Energy – a decision that has not yet been taken.

Finally, in OPG's submission, the existing reporting requirements related to nuclear performance outcomes and measures, the NDVA balance and capital costs for prescribed facilities are appropriate and sufficient, with no additional requirements needed in relation to the potential Darlington SMR.

**Discussion of Cost Eligibility**

Issue 13.1 on the approved Issues List reads as follows:

> *Is the nature or type of costs recorded and the methodologies used to record costs in the deferral and variance accounts related to OPG's nuclear and regulated hydroelectric assets appropriate?*

The evidence filed and the cross examinations that took place at hearing are clear that the only SMR costs being contemplated as part of this proceeding are non-capital costs[1] associated with planning and preparation for an on-grid SMR at Darlington[2]. Those costs are currently being recorded by OPG in the Nuclear Development Variance Account (NDVA), contemplated in Section 5.4 (1) of O. Reg. 53/05, and the current forecast of that balance is $166.1M[3].

While these costs are currently being recorded in the NDVA, it is only OPG's opinion of O.Reg 53/05 that is permitting these costs to be recorded. No OEB Panel has rendered any decision on eligibility of those particular costs.

On June 26, 2021, Torys LLP filed a letter with the OEB on behalf of its client, OPG. That letter contained the following excerpt:

> *Based on O.Reg 53/05, the purpose of the NDVA consists of (i) the recording of non-capital cost incurred and firm financial commitments made for the planning and preparation for development of proposed new nuclear facilities under section 5.4(1) of O.Reg 53/05, and (ii) the OEB's obligation to ensure recovery of those costs, if prudent, under section 6(2)4.1 of O.Reg 53/05. The latter legal obligation was found by the OEB to exist regardless of whether the proposed new nuclear facilities are ultimately prescribed under O.Reg 53/05, section 2.*

This engages several questions in relation to O.Reg 53/05.

First, AMPCO/CCC agrees that the OEB Panel in EB-2007-0905 came to the conclusion as set out above by Torys. However, AMPCO/CCC is also aware that a decision of an OEB Panel does not necessarily bind a subsequent decision by a different OEB Panel, so long as that subsequent decision can be considered "reasonable". Each Panel will have a different set of facts and circumstances that they need to consider in the respective Applications. So, to assume that both Panels arrive at the exact same conclusion, in terms of their interpretation of a specific provision in a Regulation, is not guaranteed. It is very possible that the Panel hearing EB-2020-0290 could view things somewhat differently than the Panel that heard EB-2007-0905.

[1] Transcript Vol. 1, Page 33, lines 25-28
[2] Transcript Vol. 1, Page 81, lines 1-7
[3] Exhibit L, F2-08-Society-013, part c)

Further, the above letter excerpt states that any costs included within the NDVA, contemplated in O.Reg 53/05 Section 5.4(1), would automatically be recovered under section 6(2)4.1 of the same Regulation, assuming those costs were prudently incurred. This requires some further consideration.

Section 6(2)4.1 is worded consistent with section 6(2)4 of the Regulation, which deals with the Capacity Refurbishment Variance Account (CRVA). The CRVA was explicitly established by the Board as part of the Board's Decision in EB-2007-0905[4]. It seems reasonable to AMPCO/CCC that, similar to what was needed in Section 6(2)4, a new account would be required to be established for 6(2)4.1 – a new account which does not exist today. For this reason, AMPCO/CCC disagrees with OPG's position that all costs recorded in the NDVA would automatically be recovered by the provisions of O.Reg 53/05 section 6(2)4.1.

OPG's own witness agreed that both eligibility of costs in the NDVA and their prudence remain to be determined by the Board[5]:

> *MR. SHEPHERD: The one other thing I want to ask about this is, this all talks in theory, but you'll agree that the actual costs that you put in the account, whether you've already done so or you're going to do so, those are still subject to testing against -- at a clearance proceeding, they're still subject to testing by the OEB to determine, A, if they qualify, and B, if they're prudent, correct?*
>
> *MS. MacDONALD: Yes, that is correct.*

All of these considerations support the need for this OEB Panel to turn its collective mind to the question of eligibility of Nuclear Development expenses, as contemplated in both section 5.4(1) and section 6(2)4.1 of the Regulation. AMPCO/CCC believes that an explicit statement with regard to the determination of eligibility from the Panel is required to provide clarity to OPG and to stakeholders.

**Discussion of Prudence**

Based on the language in O.Reg 53/05 in Sections 5.4(1), 6(2)4.1 and 6(2)7.1, AMPCO/CCC does not believe that there is any ambiguity regarding the need for a determination of prudence. Any costs recovered from any accounts established pursuant to these sections of the Regulation would absolutely require a finding of prudence by the OEB.

This was agreed to by OPG's witness in the excerpt shown above in paragraph 16 of this submission[6].

[4] EB-2007-0905 Decision with Reasons, pages 122-123
[5] Transcript Vol. 1, Page 85, lines 16-24
[6] Transcript Vol. 1, Page 85, lines 16-24

**Future Capital Spending**

Notwithstanding that the evidence filed and the cross examinations that took place at hearing are clear that the only SMR costs being contemplated as part of this proceeding are non-capital costs[7] associated with planning and preparation for an on-grid SMR at Darlington[8], the potential for future capital costs exists.

In the cross-examination of OPG's witnesses by the School Energy Coalition, the following excerpts are relevant:

> *MR. SHEPHERD: No, no, I said exactly the opposite. What I said was if you build something, regardless of whether you make a decision to proceed with an SMR, if you build something it's still capital, yes?*
>
> *MS. LADAK: Yeah, if we build an asset that has future benefits, yes, it would be capital.*
> *MR. SHEPHERD: So that can't be put in the NDVA?*
>
> *MS. LADAK: The NDVA is for non-capital costs.*
>
> *MR. SHEPHERD: Awesome…*[9]
>
> *MS. MacDONALD: Currently for any capital we were to spend, no, that would not go into rate base at this point in time.*
>
> *MR. SHEPHERD: Why not?*
>
> *MS. MacDONALD: Because there is not a prescribed -- because an SMR at Darlington is not a prescribed asset.*
>
> *MR. SHEPHERD: Fair enough. What I'm saying is if it's prescribed, then it goes into rate base when it's in service, right? Regardless of what the OEB says, it's in rate base, it's then at a subsequent proceeding the OEB then has to determine whether to add it to rates, right?*
>
> *MS. MacDONALD: Correct. If it were to be a prescribed asset, yes.*[10]

It appears clear that even though no specific request is currently being made by the Applicant as part of EB-2020-0290, the potential exists for capital costs associated with SMRs to be incurred, should the initiative gain the approval of the Province and OPG's Board of Directors.

[7] Transcript Vol. 1, Page 33, lines 25-28
[8] Transcript Vol. 1, Page 81, lines 1-7
[9] Transcript Vol. 1, Page 84, lines 15-23
[10] Transcript Vol. 1, Page 85, lines 3-15

For this reason, AMPCO/CCC believes that the OEB Panel should have some interest in this area, even in the absence of a specific request for approval as part of EB-2020-0290.

Exhibit F2-T8-S1, page 2 of 5, lines 21-24 reads as follows:

> *…OPG is planning to construct an SMR nuclear generating station at the Darlington site with a projected in-service by the end of this decade…*

According to this exhibit, OPG is planning on designing, building, commissioning and starting to operate an SMR before 2030. Based on nuclear facility schedules of the past, AMPCO/CCC feels that this is an ambitious timeline. Further, this Application before this Board currently contains no forecast of capital spending associated with SMRs[11].

The current test period runs from the start of 2022 to the end of 2026. So between the end of the test period (December 31, 2026) and the end of the decade (December 31, 2029), there are 3 years (2027, 2028 and 2029). In AMPCO/CCC's view, designing, building, commissioning and starting to operate an SMR before 2030 was already an ambitious undertaking, even if the activities started today. If you didn't start spending capital until 2027, this task would be even harder to accomplish. Based on that, AMPCO/CCC believes it is a fair assumption that, subject to Provincial and OPG Board approvals, if the SMR initiative is to move forward, OPG will have to start spending capital before 2027 if it is to meet its forecasted in-service date, as set out in F2-T8-S1. Before 2027 places that spending within the current test period.

AMPCO/CCC expects that OPG intends to return to the Board at some future date within the 2022-2026 test period looking for:

- Approval of the establishment of a variance account pursuant to section 6(2)4.1 of O.Reg 53/05
- Approval to post capital and non-capital charges associated with the fully approved SMR initiative to that account
- Ultimately, approval to clear that account to be paid for exclusively by the ratepayers of Ontario

To be clear, AMPCO/CCC is not requesting any specific prohibition from the Board of any of these expected actions, as that would be premature. It is highlighted here only to provide additional areas of reflection when the Board considers the SMR impacts on Issue 14.1 (Are the proposed reporting and record keeping requirements, including performance scorecards proposed by OPG, appropriate?).

**Ongoing Cost Deferrals**

OPG is not requesting to clear the amounts recorded in the NDVA associated with SMRs as part of EB-2020-0290, as set out in Exhibit H1-T1-S1, Page 1, lines 14-16.

[11] Transcript Vol. 1, Page 29, lines 20-25

However, if one looks more broadly at the same evidentiary reference (Exhibit H1-T1-S1, Page 1, lines 10-17), it reads as follows:

> *OPG proposes to clear the audited balances in all deferral and variance accounts as at December 31, 2019, less amortization amounts previously approved by the OEB in EB-2018-0243 and EB-2016-0152, with the exception of the Darlington Refurbishment Project ("DRP") and hydroelectric components of the Capacity Refurbishment Variance Account ("CRVA"), the Fitness for Duty Deferral Account, the portion of the Nuclear Development Variance Account related to preliminary planning and preparation costs incurred for a small nuclear modular reactor ("SMR") generating station at the Darlington site, and the Rate Smoothing Deferral Account.*

Clearly, the SMR component of the NDVA is not the only cost that OPG is choosing not to address as part of this Application.

AMPCO/CCC has evaluated the various items that OPG is not looking to clear, and has summarized the following impacts:

- SMR component of the NDVA - $166.1M (from Exhibit L, F2-08-Society-013, part c)
- DRP component of the CRVA – $55.6M (from H1-T2-S1, Table 2, line 5)
- Hydro component of the CRVA - $25M (from H1-T2-S1, Table 1, line 6)
- Fitness for Duty Deferral Account – $0.5M (from H1-T2-S1, Table 2, line 21)
- Rate Smoothing Deferral Account - $104.3M (from H1-T2-S1, Table 2, line 23)
- Pickering Closure Costs Deferral Account – there is no forecast for these amounts since it is not yet a Board-approved account. However, if we look at the language in Section 5.6 of O.Reg 53/05, we see the following:
    - "a deferral account in connection with section 78.1 of the Act that records any employment-related costs and non-capital costs related to third party service providers incurred by Ontario Power Generation Inc. that arise from any Pickering closure activities, including,
        (a) costs related to employee termination, layoff, reassignment or retraining; and
        (b) costs related to the hiring of employees or the engagement of third party service providers to perform Pickering closure activities, and their remuneration.

  From Exhibit F4-T3-S1, page 1 of 31, lines 25-28, we see that Pickering closure will result in over 3,000 staff separations. Given that the closure of Pickering is going to impact this many employees, the account balance is likely to be substantial.

Combining the amounts from the previous paragraph, the total forecast amount being deferred to a future period is $351.5M. This does not include anything for the Pickering Closure Costs Deferral Account.

Should there be material additional non-capital amounts included in the NDVA, or if OPG secures its required approvals for the advancement of the SMR initiative and begins to spend capital funds, these amounts will increase.

In AMPCO/CCC's submission, not seeking recovery of all costs in a given Application reduces the overall revenue requirement being sought in that Application. Similarly, pushing costs forward to be dealt with at a later date understates the true consumer impact of OPG's activities as they relate to a given Application.

Again, AMPCO/CCC is not requesting any specific action from the Board in regards to deferral and variance account balances that are not being cleared. It is highlighted here only to provide additional areas of reflection when the Board considers the SMR impacts on Issue 14.1 (Are the proposed reporting and record keeping requirements, including performance scorecards proposed by OPG, appropriate?).

**The Need for SMR Reporting**

Issue 14.1 from the approved Issues List reads as follows:
*Are the proposed reporting and record keeping requirements, including performance scorecards proposed by OPG, appropriate?*

Exhibit F2-T8-S1 contains the following excerpt at page 5 of 5, lines 4-6:

> *The activities described above are key components to developing a Class 5 estimate by November 2021 upon which an investment decision can be made for continued project development work, leading to an application for a LTC.*

When specifically requested whether OPG intended to provide the OEB with a copy of the November 2021 "investment decision" documentation referenced above, OPG's witness stated it was not OPG's intention to provide it[12].

AMPCO/CCC concludes that OPG will be pursuing SMR initiative approvals from both the Province as well as its Board of Directors, possibly as early as November 2021[13].

Appendix A to OPG's Reporting and Record Keeping Requirements forms part of the Settlement Proposal that was agreed to by OPG and Intervenors, filed with the OEB and verbally accepted by the Panel on August 6, 2021.

[12] Transcript Vol. 1, Page 50, line 8
[13] Transcript Vol. 1, Page 50, lines 10-13

In OPG's Argument-in-Chief, filed with the Board on August 17, 2021, OPG suggests that the existing suite of reporting requirements is appropriate and sufficient to cover off any concerns that may exist with respect to SMRs[14] as they may relate to Issue 14.1.

With respect, AMPCO/CCC disagrees with OPG. OPG's "extensive nuclear performance reporting scorecard that contains 27 discrete performance measures for the company's prescribed nuclear facilities[15]" provides information for Pickering GS, Darlington GS and (only in certain cases) OPG Nuclear as a combined entity. Nowhere on the scorecard is information provided specifically for SMR – in any measure. Further, none of the four outcome categories (Safety, Reliability, Cost Effectiveness and Human Resources) lends itself adequately to providing the Board with a snapshot of OPG's spending to date on SMRs.

OPG further goes on to suggest in its AIC that reporting on the NDVA balance will continue as part of its Reporting and Record Keeping Requirements, and that this should again be adequate. While this is helpful, it is a small portion of what is actually required. If SMR is approved by the Province and by OPG's Board of Directors, OPG has already agreed that capital spending will commence[16]. That spending will likely commence well prior to OPG's next Application to the OEB for Payment Amounts, and AMPCO/CCC believes that the Board will have an interest in the capital and non-capital amounts that are being accumulated by OPG pending an eventual disposal request.

Finally, as part of the Reporting and Record Keeping Requirements, OPG will annually report on the prior year's capital in-service additions and construction work in progress balances for prescribed facilities[17]. Again, while helpful, this information will not be specific to OPG's SMR initiative and teasing out what spending belongs against SMRs versus other initiatives will likely be impossible.

Taking all of this into consideration, and considering how potentially significant the SMR initiative could be, AMPCO/CCC requests that the Board amend Appendix A to OPG's Reporting and Record Keeping Requirements to include specific information relating to SMRs.

**AMPCO/CCC Recommendations**

1. AMPCO/CCC is in no way fundamentally opposed to SMR technology or its development. In fact, AMPCO/CCC views SMR technology as a potential path to increased electrification in the province and a positive step against climate change.

2. AMPCO/CCC's primary concern is focused on the quantum of the costs associated with the development of SMR technology and, ultimately, who will be required to bear those costs.

[14] EB-2020-0290 AIC, Page 7, Lines 4-7
[15] EB-2020-0290 AIC, Page 6, Lines 25-27
[16] Transcript Vol. 1, Page 84, lines 7-23
[17] EB-2020-0290 AIC, Page 6, Line 30 and Page 7, Lines 1-2

3. Accordingly, AMPCO/CCC is not requesting the Board to impose any kind of prohibition against OPG pursuing this initiative. That would be beyond the Board's jurisdiction and quite frankly, not necessarily in the public interest.

4. Rather, AMPCO/CCC respectfully suggests that the Board consider the following in its Decision:

   - The Board should confirm that it has in no way opined on: (a) whether any SMR-related costs are eligible to be recorded in the Nuclear Development Variance Account (NDVA, as set out in Section 5.4 of O.Reg. 53/05); and (b) whether the SMR-related costs were prudently incurred. The Board should confirm that OPG is taking the full risk that the OEB may not accept recovery of SMR-related amounts on the basis of NDVA eligibility and/or prudence at the time that OPG seeks disposition of the NDVA balance.

   - Further to this, the Board should also confirm that OPG is taking the risk that the OEB may not accept recovery of SMR-related amounts (capital and/or non-capital) on the basis of eligibility and/or prudence at the time that OPG seeks disposition of any SMR amounts contemplated pursuant to Section 6(2)4.1 of O.Reg. 53/05.

   - Finally, the Board should amend OPG's Reporting and Record Keeping Requirements to require OPG to update the Board annually on all SMR spending (capital and/or non-capital) associated with either the NDVA (as set out in Section 5.4 of O.Reg. 53/05) or Section 6(2)4.1 of O.Reg. 53/05. This reporting will:
     - Be publicly available
     - include all amounts (actual and forecast) for the year 2020 and all years beyond
     - provide a fully itemized breakdown of all amounts (capital and/or non-capital) by cost type

5. These actions will in no way prevent OPG from pursuing its SMR initiative. They will, however, provide public confidence in respect of eligibility and prudence and will increase transparency associated with the spending that is taking place in regards to the initiative – transparency in advance of any request for recovery.

## B) OPG's Request to Include $494.7M of Capital Spending Associated with the D2O Storage Facility into Rate Base

***Overview***

OPG is requesting approval for inclusion of $494.7M in rate base based on a total capital cost of $509.3M in relation to the D2O Storage Facility.[18] As part of that request OPG is requesting that $160M be included in rate base effective 2016 and $320.9M be included in rate base effective 2019, with the remaining $13.8M being added to rate base effective 2020.

In general, AMPCO/CCC respectfully submits that the OEB should:

a) permanently disallow $200M of the requested $509M in spending, with the result that OPG will only be allowed to recover a revenue requirement in payment amounts associated with $294.7M[19] in capital spending over the test period taking into account amounts previously included in rate base;

b) reject OPG's request to treat any of the spending as having been in rate base since 2016, instead treating the allowed costs as all having been added to rate base effective 2020; and

c) require that the issue of the recoverability in payment amounts of the revenue requirement associated with the portion of allowed rate base additions properly allocated to "DRP-related" storage be addressed in the first cost of service application filed by OPG subsequent to the completion of the DRP in order to ensure that that portion of rate base is funded by the appropriate source, i.e. if the storage becomes used in conjunction with the decommissioning of Pickering then the costs of that storage should be recovered from the Decommissioning Fund.

With respect to AMPCO/CCC's proposed $200M disallowance of costs related to the D2O Storage Facility, AMPCO/CCC, under all the circumstances surrounding the development and construction of the D2O Storage Facility, supports the framework utilized by the OEB panel in disallowing a portion of the capital spending for the Auxiliary Heating System and Operations Support Building in its Decision in EB-2016-0152. In that Decision the OEB determined that it was appropriate to account for both legitimate scope increases and imprudent management of those projects by OPG by disallowing 50% of the difference between the Full Execution Release Business Case Summary for each project and the final claimed cost of each project.[20] In the case of the D2O Storage Facility the Full Execution Release Business Case Summary in 2013 was

[18] $14.6M has previously been included in rate bases effective 2014. (D2-2-10 page 12 Chart 1)
[19] $509.3M-$200-$14.6M = $294.7M
[20] EB-2016-0152, Decision and Order dated December 28, 2017, pages 19-22.

based on a total Budget of $110M, such that 50% of the difference between that estimate and the final claimed cost of $509.3M is $200M.[21]

With respect to OPG's submission that $160M of the total spend should be recognized in rate base effective 2016 and $320.9M effective 2019, AMPCO/CCC submits that the elements of rate base associated with the proposed early recognition were not used or useful until the entire facility was commissioned in 2020, such that early recognition in rate base should be rejected.

With respect to AMPCO/CCC's request that the allowed rate base amount properly allocated to DRP-related storage should be addressed in a future cost of service application once the DRP is complete, AMPCO/CCC asserts that through the funding of OPG's Nuclear Liabilities the costs associated with, amongst other things, the storage of D2O associated with decommissioned facilities has already been accounted for in payment amounts, such that it would be inappropriate to allow OPG to continue to collect through rate base a revenue requirement associated with assets that are being used for decommissioning. Any such revenue requirement should instead be recovered by OPG from the Decommissioning Fund.

**The Nature of AMPCO/CCC's Submission on a Proposed $200M Disallowance**

***The difference between Heavy Water Operations Storage Needs and DRP Storage Needs***

AMPCO/CCC's conclusion that it would be appropriate to disallow $200M of the proposed rate base additions associated with the D2O Storage Facility is based on two broad categories of disallowance. The first broad category can be categorized as imprudence on the part of OPG over the course of its management of the project such that the final cost was more expensive that it should reasonably have been. One example of this type of imprudence, which will be discussed in more detail, is the increase in costs of the D2O Storage Facility as a direct result of OPG's acceptance of design changes proposed by their second contractor, CanAtom, in 2015, which led to material cost increases and schedule delays, which design changes OPG eventually determined had been unnecessary. In AMPCO/CCC's respectful submission OPG's handling of the proposed design changes reflected a series of poor management decisions leading to imprudent spending on the project that should be disallowed.

The second broad category relates to the notion that the scope of the project as initially conceived and as ultimately constructed was inappropriate; in essence, AMPCO/CCC submits that the D2O Facility was overbuilt relative to the actual, reasonable needs that the project was required to meet. Under this category of disallowance, which can be properly classified as imprudence specific to the design of the project as opposed to the execution of the project, it is important to understand the two very different needs being met by this single project.

[21] Exhibit L-D2-02-Staff-151. ($509.3M-$110M)*50%=$200M.

***Heavy Water Operations Storage***

The D2O Storage Facility has its origin in studies dating as far back as 2004, within which OPG reviewed the need to increase its storage capacity to improve the efficiency of its Heavy Water Operations activity, largely in connection with the operation of its Tritium Removal Facility (OPG's "TRF"). OPG's review of its Heavy Water Operations related storage needs culminated in 2007 with a Report from Kinectrics that determined that the appropriate level of storage needed to supplement its Heavy Water Operations activities was a total of 400 m3, a conclusion it discussed and verified as reasonable with the Heavy Water Operations stakeholders at OPG.[22] AMPCO/CCC notes that at the time OPG planned on 400 m3 of Class 3 Storage[23] capable of holding D2O drained from its moderators, the heavy water most contaminated with tritium that OPG handles, in order to use the storage interchangeably for reactor grade D2O or downgraded D2O.

It is of note that OPG has, since 2007, consistently maintained that the Heavy Water Operations storage needs, which include maximizing the efficient use of the TRF, remains at 400 m3, with only the addition of 200 m3 associated with the handling of downgraded D2O as a separate concern. This storage, which has ostensibly been needed since 2004 or before, is required to be used on an ongoing basis in conjunction with the TRF, OPG's Heavy Water Management Building ("HWMB"), the Darlington Units, and both the Bruce Power and Pickering units as part of OPG's role in managing the Tritium levels of the D2O used by all of those Units so long as they are operating. Accordingly, such storage can benefit to a large extent from "operational flexibility", which includes a high level of interconnectedness and ability to segregate streams of D2O, all of which is achieved through the combination of siting that storage in proximity to the TRF and HWMB and a complex, expensive array of pipes and valves that interconnect that storage as required, with tie-ins to the TRF and HWMB.

***DRP-related Storage***

By contrast, the storage that is required to meet the needs of the DRP is of a very different character. DRP-related storage needs are temporary; at a high level it is only needed at all during the 10-year duration of the DRP, while on a more granular level it is only needed, in some cases, for months at a time.[24] There is no need for DRP-related storage to have all the "operational flexibility" associated with Heavy Water Management storage; at its most basic level the only requirement is that OPG have a place to store DRP related D2O water for relatively short periods of time, and then return that water to the units as they are put back into service.

In terms of AMPCO/CCC's assertion that the D2O Storage Facility was overbuilt, it is AMPCO/CCC's respectful submission that OPG made two fundamental errors in designing the

[22] Exhibit D2-2-10 Attachment 2k, pages 6-7.
[23] Class 3 refers to nuclear grade of tank
[24] J1.7 Attachment 2 page 1

facility, both related to OPG's incorrect treatment of Heavy Water Management Storage and DRP Storage as equivalent in their required characteristics.

First, OPG did not properly recognize that DRP Storage was only needed temporarily such that there were several opportunities to reduce the DRP-related storage capacity included in the project. As an example, OPG, having failed to finish the D2O Storage Facility in time to use it during the refurbishment of Unit 2, was able to undertake the refurbishment of that unit from start to finish without access to any incremental storage. This was possible because, based on the temporary needs for the DRP as they related to Unit 2, OPG was able to leverage existing storage at its HWMB, Bruce and Pickering to move D2O out of the Unit 2 PHT and Moderator without lengthening the Unit 2 outage requirements.[25] In AMPCO/CCC's respectful submission OPG's handling of the Unit 2 storage requirements during refurbishment is an indication of the ability to leverage existing storage and use the HWMB as a clearing house to avoid incremental generation loss while moving D2O from Units, to the HWMB, and then to offsite storage that should have been leveraged when planning DRP-related storage.

Second, OPG did not properly recognize that DRP-related storage, even if it intended to be later used as storage in relation to decommissioning needs, does not need all the operational flexibility associated with Heavy Water Operations storage. As a result, in AMPCO/CCC's respectful submission, OPG did not build a D2O Storage Facility with an appropriate amount of Heavy Water Operations storage and an appropriate amount of DRP Storage; instead, OPG built a D2O Storage Facility comprised of 2100 m3 of Heavy Water Operations storage, namely 2100 m3 of storage that has the maximum operational flexibility that one would want in support of ongoing Heavy Water Management operations, even though at least 1500 m3 of that storage is not actually needed for Heavy Water Management operations, will only be used temporarily for the DRP, and may only possibly be used for decommissioning activities which, again, do not require maximum operational flexibility through complex interconnected piping.

With the distinction between Heavy Water Operations Storage and DRP Storage in mind, AMPCO/CCC's submissions are structured as follows:

1) Cost Background
2) Indications that the D2O Storage Facility is Overbuilt
    a. Inappropriate Scope of Refurbishment Storage
    b. Uncontrolled Scope to achieve operational flexibility drove cost increases
    c. OPG did not optimize tank volumes
    d. No economic evaluation of increased scope
3) Inexperienced Project Management Staff
4) OPG Selected the Wrong Contractor
5) Viable Alternatives not Adequately Considered
    a. Critical Alternative outside the Protected Area dismissed

[25] Transcript Volume 2 pages 2 line 25 – page 3 line 7

   b. Evaluation of Alternatives was Incomplete and Cursory
   c. Construction of a Building on Grade was not Adequately Considered
   d. Feasibility of Raising the Elevation of the Building to Mitigate Construction Issues Considered After the Fact
6) The Relative Cost of DRP-related Storage
7) Refurbishment storage capacity not appropriately sized
8) Execution Issues with Black & McDonald ("B&M"), OPG, And OPG's Failure to Establish a Proper Baseline Cost Estimate
9) Escalation of Costs Between the 2015 Business Case Summary of $381.1M and the Final Claimed Costs of $509.3M
10) The Bates White Report
11) More Value in Comprehensive Post Implementation Review (PIR)
12) The recognition of Rate Base Additions prior to 2020
13) Allocation of DRP Storage Costs Post-DRP
14) Conclusions

## 1) Cost Background

The D2O Storage Project consists primarily of tanks, pipes and valves constructed in a seismically qualified reinforced concrete dike 13 m deep (at elevation 87.0 m) anchored to bedrock using 221 rock anchors[26]; drum handling, testing and cleaning equipment on the ground floor of the facility (at elevation 100.0 m) and the electrical and mechanical systems to safely operate the building located on the second floor (elevation 107.8 m).[27]

The total cost of the D2O Storage Project is $510M, consisting of $509.3M in capital costs and $0.7M in OM&A for removal costs incurred in 2013.[28] The "full" cost of the project is claimed by OPG to be approximately $587M[29] as the $510M excludes the approximately $77M that CanAtom had incurred as of year-end 2019 that OPG did not pay for.[30]

Throughout this argument AMPCO/CCC will be focusing on the $509.3M capital cost and $494.7M amount that OPG seeks to add to rate base. In AMPCO/CCC's respectful submission CanAtom's $77M of unrecovered costs is not relevant to OPG's claim from ratepayers' perspective; the fact that OPG was able to contract with CanAtom in a fashion that left CanAtom with $77M in unrecovered costs only means that OPG was able to mitigate the impact of its imprudence by having CanAtom absorb some of the impact of that imprudence. Had OPG paid CanAtom that additional $77M and sought to recover it from ratepayers that would, under

[26] Exhibit D2-2-10 page 7
[27] Exhibit D2-2-10 page 15
[28] Exhibit D2-2-10 page 1
[29] Transcript Volume 2 page 125 lines 4-5
[30] Exhibit D2-2-10 page 102

the circumstances and in AMPCO/CCC's submission, increase the appropriate level of disallowance by an offsetting amount.

The evolution of the six Business Case Summary (BCS) documents for the D2O Storage Project is provided in Table 1 below:[31]

**Table 1: Evolution of Business Case Summary Documents for D2O Storage Project**

| | Date | Total Cost with Contingency ($k) |
|---|---|---|
| **Developmental Release** | November 2006 | 36,863 |
| **Full Definition Release** | June 2012 | 108,148 |
| **Partial Execution Release** | August 2012 | 108,051 |
| **Full Execution Release** | May 2013 | 110,015 |
| **Superseding Full Execution Release** | March 2015 | 381,100 |
| **Superseding Full Execution Release** | January 2018 | 498,500 |

After years of planning and numerous studies prepared by external consultants on the topic of heavy water storage,[32] OPG released the Full Execution BCS in May 2013 that set the cost and schedule baseline for the approved D2O Storage Project of $110M and an available for service date of October 2015.

Two Superseding BCSs for the project were subsequently approved in March 2015 and January 2018 in the amounts of $381.1M and $498.5M, respectively. The 2018 BCS excluded an $11.5M management reserve which was ultimately spent, which, when included, provides for the total cost of $509.3M that is claimed by OPG.[33] Table 2 below sets out the business case details compared to the final costs.

The final cost of $510M represents a $400M increase (364%) compared to the $110M Full Execution Release Business Case Summary (BCS) in May 2013.[34] The D2O facility was available for service in March 2020, almost 4 ½ years beyond the initial forecast date of October 2015.

**Table 2: Baseline Business Case Details & Final Project Costs ($ M)**

[31] Exhibit L D2-02-Staff-151

[32] Exhibit L D2-02-AMPCO-087 Attachment 1; Exhibit L D2-02-AMPCO-131 Attachments 5&6

[33] Exhibit L D2-02-Staff-150

[34] EB-2015-0162 Decision P 22 The OEB directs OPG to file, at a minimum, the costs for each major capital project based on the first execution business case and the final proposed amount for which OPG is seeking approval.

| | Full Definition BCS | Full Execution BCS | Superceding BCS | Superceding BCS | Final Costs | | | |
|---|---|---|---|---|---|---|---|---|
| | Jun 2012 | May 2013 | Mar 2015 | Jan 2018 | Dec 2020 | | Var $ | Var % |
| **Cost Category** | | **A** | **B** | **C** | **D** | | **D-A** | **D/A** |
| OPG Project Management | 4.0 | 4.2 | 6.7 | 12.4 | 21.9 | | 17.7 | 424% |
| OPG Engineering (incl. design) | 6.2 | 4.6 | 7.4 | 16.3 | 13.3 | | 8.7 | 189% |
| OPG Procured Materials | 14.1 | 19.1 | 1.4 | 10.3 | 20.4 | | 1.4 | 7% |
| OPG Other | | | 18.7 | 22.6 | | | | |
| OPG TRF | | | | 3.0 | | | | |
| OPG Subtotal | | 27.8 | 34.2 | 64.6 | 55.6 | | 27.8 | 200% |
| Design Contracts | | | 7.1 | 14.3 | | | | |
| Construction Contracts | 52.5 | 58.8 | 40.8 | 44.4 | | | | |
| EPC Contracts (B&M/CanAtom) | | | 244.9 | 331.6 | 336.1 | | | |
| Consultants | | | 0.1 | 0.2 | | | | |
| Other Contracts/costs | 0.2 | 0.7 | 0.1 | 0.1 | 72.1 | | | |
| Interest | 7.5 | 7.5 | 20.0 | 43.3 | 45.5 | | 38.0 | 608% |
| Subtotal | 84.4 | 94.8 | 347.2 | 498.5 | | | | |
| General Contingency | 23.9 | 15.2 | 33.9 | 0 | | | | |
| Management Reserve | | | | 11.5 | | | | |
| **Project Costs (w/ contingency)** | **108.3** | **110.0** | **381.1** | **510.0** | **510.0** | * | **400.0** | **364%** |
| *Variance to previous BCS* | | | *271.1* | *128.9* | | | | |
| **Available for Service** | **April 2015** | **Oct 2015** | **May 2017** | **May 2019** | **Mar 2020** | | | |
| *Includes $11.5 M Management Reserve & $0.7 M in 2013 OM&A removal costs | | | | | | | | |
| Reference D2-2-10 | Appendix 2m | Appendix 2o | Appendix 2p | Appendix 2q | P12 | | | |

The cost estimate for the D2O project increased by $271M between 2013 and 2015 and an additional $129M between 2015 and 2018.

Included in the $400M cost overrun is $17.7M in additional OPG management costs, $8.7M in additional OPG engineering costs, $38M in interest costs, and close to $10M in incremental overtime costs in 2016 for accelerated work,[35] all costs that AMPCO/CCC respectfully submits could have been materially reduced if not eliminated entirely had OPG properly managed the project from the outset, including completing the project on time.

## 2) Indications that the D2O Storage Facility is Overbuilt

For the reasons discussed below, AMPCO/CCC's view is that OPG undertook a merged project with the wrong overall scope and in doing so overlooked viable, less costly alternatives for refurbishment storage and significantly overbuilt the D2O facility in terms of size and operational flexibility, thereby wasting time and money.

In 2005, OPG initially planned for an operational improvement project at Darlington to address the lack of operational flexibility at the TRF, the lack of adequate bulk storage for reactor grade

[35] JT1.6

and downgraded heavy water and the inability to empty out, clean and dispose of surplus drums.[36] OPG finalized its estimate of the storage needed for operational improvement, ultimately concluding that it required 400 m3 of additional D2O storage and a facility to handle, store and pressure-test drums at Darlington.[37] Kinectrics recommended that OPG build an extension to the HWMB to achieve the additional capacity.[38]

The initiation phase of the DRP commenced in late 2007 and a decision was made in 2008 to defer the operational improvement project pending a decision on Darlington refurbishment. OPG determined that without the extended Darlington station life from the refurbishment, the operational improvement project would no longer be justified.[39]

In 2010, OPG decided to merge the operational improvement needs with the refurbishment storage needs into one project. The first project charter for the merged project was issued in August 2010.[40] With that decision came a preference early on by OPG to build the DRP-related storage at the same location as the Heavy Water Management storage, close to the HWMB, which is the current site, with piping interconnection to that facility.[41] The design of the facility was to be similar to the existing system in the HWMB to take advantage of previous design work including the use of an underground seismically qualified dike.[42]

### *a. Inappropriate Scope of Refurbishment Storage*

There never was a stand-alone project charter or business case for the DRP-related storage.[43] In AMPCO/CCC's view this was a critical mistake on OPG's part because the two sets of needs, DRP-related Storage and Heavy Water Operations storage, had distinctly different requirements; by combining them OPG significantly overbuilt the DRP-related storage component of the project by applying the same drivers underpinning the Heavy Water Operations storage component, which was never approved to move forward on its own. As a consequence, OPG added full "operational flexibility" to the fifteen 100 m3 DRP-related storage tanks, even though that flexibility was only required for the four 100 m3 tanks and 6 smaller tanks that were built in support of ongoing Heavy Water Operations.

While the Heavy Water Operations storage benefitted from being adjacent to the TRF/HWMB to improve the TRF/HWMB utilization, the DRP-related Storage did not need to be tied to the

[36] Exhibit D2-2-10 Attachment 2a
[37] Exhibit D2-2-10 page 36
[38] Exhibit L-D2-02-AMPCO-131 Attachment 6 page 10
[39] Exhibit D2-2-10 page 37
[40] Exhibit D2-2-10 Attachment 2b
[41] D2-2-10 Attachment 2b page 9
[42] D2-2-10 Attachment 2b page 10
[43] Transcript Volume 1 page 132 lines 20-21

TRF/HWMB; The need for the DRP-related storage was limited to temporary storage of D2O while the Station units were undergoing refurbishment. Accordingly, in combining the two sets of needs and treating both DRP-related and Heavy Water Operations storage identically in the final design of the D2O Storage Facility OPG failed to seriously consider less costly alternatives for DRP-related storage that did not necessarily have to be underground, in close proximity to the TRF and HWMB, or provided with the full suite of "operational flexibility" that was provided to Heavy Water Operations storage. Options like the one OPG ultimately used to store heavy water from Unit 2, when the D2O storage facility was not ready for use, were not evaluated and costed against what was built. For Unit 2, OPG utilized existing storage flexibility within the HWMB, Bruce and Pickering facilities at a cost of only $30,000 related to the cost of shipping D2O between the HWMB and Bruce/Pickering.[44]

OPG routinely trucks large volumes of heavy water between Darlington, Pickering, and Bruce, and could have implemented a solution for DRP-related storage that relied on moving D2O from each unit to the HWMB and then to DRP-related storage options using trucks in a manner similar to what was utilized during the Unit 2 refurbishment, all without suffering any additional lost generation as a result of extended unit outages.[45]

### *b. Uncontrolled Scope to Achieve Operational Flexibility Drove Cost Increases*

By the end of the project, OPG had installed 25 heavy water tanks with a capacity of 2,100 m3, three additional tanks not routinely used to store heavy water, close to 10,000 meters of piping[46] and 1,040 valves.[47]

The total length of piping contained within the new facility was originally estimated to be approximately 3 km.[48] The final design required almost 10 km of piping[49], over three times the original estimate, with an associated increase in supporting equipment (i.e. valves, controls, hangers).

The 2015 Superseding BCS reflected incremental costs of $271M, due in part to increased materials quantities for piping, valves and equipment due to design changes and the need to install stand-alone systems rather than tying into existing systems at the TRF.[50] The large increase in the amount of piping was "to allow for the independent filling and emptying of each

[44] Exhibit L D2-02-AMPCO-126 (c)
[45] Exhibit D2-2-10 Attachment #5
[46] Exhibit D2-2-10 page 85
[47] Exhibit D2-2-10 page 34
[48] Exhibit D2-2-10 Attachment 2p page 3
[49] Exhibit D2-2-10 page 85
[50] Exhibit D2 Tab 2 Schedule 10 page 110

tank, which provides operational benefits and flexibility."[51] As previously indicated, it's AMPCO/CCC's view this flexibility was not required for DRP-related storage.

While AMPCO/CCC does not believe, as will be discussed later, that the OEB should rely on the Bates White Report as evidence that the claimed costs of $509.3M for the D2O Storage Facility was prudently incurred, the Bates White Report, to the extent it reflects the actual material costs and relative costs between different components of the project is useful for illustrative purposes.

The cost of materials underpinning the approximate 10 km of piping is $7.42M[52] and the cost estimate for "getting the tanks, purchasing the tanks, putting them on site, and having them ready to connect without connecting to everything else" is $7.2M;[53] in other words, the installed cost of all the tanks and the material costs of the piping infrastructure, together, made up less than 3% of the total claimed project costs of $510M.

As shown in Table 3 below prepared by AMPCO/CCC using actual data from the Bates White perfect knowledge cost estimate[54], it was the cost of the labour to install the complex piping systems within the D2O Storage Facility that drove the project costs up, not the material cost of the piping or the material and labour costs of purchasing and installing tanks.

The total cost of the labour to install the Piping Process Systems (C+D+E) was estimated at approximately $170M which accounts for almost 50% of the Bates White $371.6M overnight construction cost estimate.[55] In comparison, the cost of labour is almost two times the cost to construct the D2O facility building structure[56] ($88.65M) including the seismic dike and dewatering costs.

**Table 3: Summary of Bates Whites Costs: D2O EPC Overnight Costs**[57]

| | Bill Of Quantities (BOQ) | Page # | Material $ | % | Labour $ | % | Equipment $ | % | Total $ | % |
|---|---|---|---|---|---|---|---|---|---|---|
| B | Architectural/Structural (Civil) | 67 | $33,293,012 | 32% | $55,022,454 | 21% | $332,480 | 94% | $88,647,945 | 24% |
| C | Process Systems Tie-in | 114 | $843,946 | 1% | $3,543,501 | 1% | $20,933 | 6% | $4,408,380 | 1% |
| D | Process Systems | 124 | $24,457,439 | 24% | $151,095,187 | 57% | $0 | 0% | $175,552,625 | 47% |
| E | Process Support Systems | 214 | $6,977,371 | 7% | $15,253,565 | 6% | $765 | 0% | $22,231,701 | 6% |
| F | Building Support System Tie-Ins | 231 | $35,115 | 0% | $130,793 | 0% | $0 | 0% | $165,908 | 0% |
| G | Building Support Systems | 238 | $3,457,387 | 3% | $7,272,326 | 3% | $0 | 0% | $10,729,713 | 3% |
| H | Electrical | 262 | $34,893,971 | 34% | $34,981,082 | 13% | $229 | 0% | $69,875,282 | 19% |
| | **Total $** | | **$103,958,241** | **100%** | **$267,298,908** | **100%** | **$354,407** | **100%** | **$371,611,554** | **100%** |
| | Total % | | 28% | | 72% | | 0% | | 100% | |
| | **Process System Piping C+D+E** | | **$32,278,756** | **31%** | **$169,892,253** | **64%** | **$21,698** | **6%** | **202,192,706** | **54%** |

Ref J3.4 Attachment 1

[51] D2-2-10, Attachment 2p page 3
[52] J3.6
[53] J3.5, Exhibit D2-2-11 Attachment 3 page 125
[54] J3.4 Attachment 1 Appendix D pages 67,114,124,214,231,238,262
[55] J3.4 Attachment 1 Page 19
[56] Materials + Labour + Equipment
[57] K.13 Tab 51 Updated as per J3.4 Attachment #1

OPG's main evidence explains that the heavy water tanks are connected to the HWMB, and each other, through a complex array of pipes, valves and pumps. Each tank has a header which allows for multiple connections.[58] OPG describes the piping work as complex and exacting involving detailed engineering, precise placement of piping, thousands of individual welds and connections to tanks, valves and pumps and hundreds of racks and hangers. At the heart of the difficulties in keeping the project on schedule was the fabrication of the piping spools and installation of almost 10,000 meters of piping.[59] In AMPCO/CCC's submission these project cost and schedule increases related to piping were imprudently incurred and could have been largely remedied had OPG decoupled the DRP-related storage requirements from the Heavy Water Operations storage requirements of the project and limited the piping interconnectedness to the latter.

In AMPCO/CCC's view the delay in completing detailed engineering on the project from July 2013[60] to the spring of 2015[61], almost 2 years later, left the door open and contributed to the scope increases related to piping. The first EPC contractor, Black & McDonald (B&M), was terminated by OPG in October 2014 responded to OPG's termination letter stating the increases in cost of the D2O Purchase Order and related schedule extensions are largely attributable to a list of factors including "Scope increase introduced by Tritium Recovery Facility stakeholders during the acceptance review of the design which multiplied the piping and valve complexity and increased scope of office facilities.[62]

MODUS,[63] OPG's internal auditor, reported that "P&M employed a disengaged, "hands-off" model which caused P&M to" (in part) "not lock down scope and allow Operations & Maintenance and other OPG stakeholders to initiate scope changes to these projects long after the conceptual design period ended".[64] MODUS also pointed out that a "Cost reimbursable contract required OPG to engage in active project management which means providing very specific instructions to lock down scope at the project's conceptual design phase and holding contractors accountable on a daily basis to meet expected cost and schedule.[65] MODUS also concluded that OPG incorrectly applied an "oversight" project management approach for its EPC contracting strategy leading to a series of cascading management failures and contractor performance issues, including misunderstandings of scope and uncontrolled scope creep.[66]

With respect to recommendations MODUS stated "Operations & Maintenance's and other OPG stakeholders' ability to change project scope must be contained – As noted, the processes in

[58] Exhibit D2-2-10 page 22
[59] Exhibit D2-2-10 page 85
[60] Board Staff 105 Attachment 2 page 183
[61] Transcript Volume 2 page 49 lines 6-9
[62] Exhibit L D2-02-SEC-096 Attachment 2 page 2
[63] Burns McDonnell / Modus Strategic Solutions
[64] Board Staff 105 Attachment 2 pages 180-181
[65] Board Staff 105 Attachment 2 page 180
[66] Board Staff 105 Attachment 2 page 176

place for the Campus Plan Projects allowed Operations & Maintenance and various other OPG stakeholders to make scope and resultant design changes that caused significant increases to the Campus Plan Projects after the conclusion of the conceptual design phase. These changes have crept into cost estimates over time. The appropriate time to add scope to projects is the conceptual design phase, subject to the approval of the authorized stakeholders, not after the project has been approved and passed through multiple gates including approval at the Board of Directors level. The process needs change to eliminate the consideration of major post-award design changes that increase project costs or extend project schedules.[67]

AMPCO/CCC respectfully submits that OPG's inadequate project management allowed stakeholders to, essentially and inappropriately, expand the D2O Heavy Water Operations scope of the project from the modest 400 m3 that underpinned the original Heavy Water Operations project to the full 2100 m3 of the D2O Storage Facility as built. In AMPCO/CCC's respectful submission this inappropriate increase in scope justifies a material reduction in the allowed costs associated with the project to protect ratepayers from imprudent spending on the project.

### *c. OPG Did Not Optimize Tank Volumes*

With respect to tanks sizes, the 2011 Conceptual Design Report provided two viable options for tank sizes: large tanks and small tanks. "Large tanks" included options including one 700 m3 tank for Moderator D2O and one 800 m3 tank for PHT D2O, whereas small tanks refer to seven 100 m3 tanks for Moderator D2O and eight 100 m3 tanks for PHT D2O.[68]

The Conceptual Design Report recommended that during detailed design, vendor manufacturing and shipping capability for large tank sizes should be confirmed and the choice of exact tank volumes optimized accordingly.[69] Large tanks would result in savings of roughly 20% compared to small tanks; the increased costs of smaller tanks is driven by the additional equipment required to support more tanks such as valves, gauges, and piping. In addition, tank fabrication of large tanks would likely provide some value based on less material, fewer welds, etc.

OPG admitted that it did not evaluate tanks larger than 100 m3 for the D2O Storage Facility as recommended in the Conceptual Design Report.[70] By not optimizing tank volumes the opportunity for potential savings was missed. Two large tanks for DRP-related storage would have required a fraction of the piping and associated equipment. Based on the current design,

[67] Board Staff 105 Attachment 2 page 188
[68] Exhibit L D2-02-AMPCO-106 Attachment 1 page 67
[69] Exhibit L D2-02-AMPCO-106 Attachment 1 page 72
[70] J2.6

AMPCO/CCC calculates savings of approximately $24.8M for large tanks compared to small tanks based on OPG's allocation of system piping costs as per its NPV calculation allocations of 62% DRP-related storage and 28% Heavy Water Operations storage.[71]

OPG indicates large tanks would have required assembly within the seismic dike, which would have required on-site welding thereby significantly increasing construction complexity and quality assurance when compared to using fully assembled prefabricated tanks supplied by a tank manufacturer.[72] AMPCO/CCC respectfully submits on-site welding is commonplace for this project given all the complex piping and valve installations that require welding; in any event, there is no evidence that the option was properly assessed.

#### *d. No Economic Evaluation of Increased Scope*

The Net Present Value calculations (NPV) in the Business Cases are connected to the 400 m3 Heavy Water Operations storage and Drum Handling facility scopes of work.[73] OPG has not quantified any supporting incremental economic benefits by increasing the "operational flexibility" for the full 2100 m3 of storage in the D2O Storage Facility. Without this evaluation, AMPCO/CCC respectfully submits that OPG has not justified the extra cost, schedule delay, and the value for money for ratepayers.

In conjunction with the rest of AMPCO/CCC's submissions on the appropriate measure of disallowance, AMPCO/CCC does not believe it is possible for the OEB to confidently disentangle the cost of legitimate scope changes and the cost of imprudently incurred costs whether stemming from poor execution or poor planning, such that it would be appropriate to account for both by disallowing only 50% of the increase in total costs between the original Full Execution Release BCS estimate of $110M and the final claimed cost of $510M, a disallowance of $200M.

### 3) Inexperienced Project Management

The Auditor General found that significant cost and delays on the prerequisite projects were due in part to assigning prerequisite work to staff with limited relevant experience with complex project work.[74] In its reply letter to OPG's termination letter, one of B&M"s indirect factors influencing cost increases and schedule extensions was "OPG project management on

[71] $200M *0.62*.20 = $24.8M
[72] J2.6
[73] Exhibit D2-2-10 Attachment #2p page
[74] EXHIBIT K1.9: 2018 Auditor General's Report page 150

the project had never managed a construction project of this magnitude and it became apparent that they had little to no influence with the other OPG stakeholders to remove obstacles, secure access or obtain approvals to facilitate the B&M project team to proceed on time and within budget."[75] In AMPCO/CCC's view it was incumbent on OPG to ensure experienced staff were in place to manage this first-of-a-kind, multifaceted facility within the protected area of Darlington, which was on the critical path of Darlington refurbishment.

### 4) OPG Selected the Wrong Contractor

The Auditor General found that underweighting technical criteria contributed to cost overruns and delays on the D2O project.[76]

OPG selected B&M even though B&M received a substantially lower score on technical criteria compared to ES Fox, the competing contractor, 32/50 compared to 49/50; more specifically, B&M's claimed experience with this type of project was limited, whereas ES Fox had some experience with parts of a nuclear generating station's Heavy Water Facility.[77]

OPG agreed at the oral hearing they might have adjusted the weightings had they known everything about the complexity of the project:

> *MR. BUONAGURO: Thank you. So in hindsight you would have changed the weighting of the technical versus cost factors in selecting the contractor, and you did in fact do that?*
>
> *MR. REINER: We selected it for selection of CanAtom, and it's somewhat a hypothetical question would we change it if we knew everything about the complexity. It's possible that we might have adjusted the weightings for the project had we known everything we knew at the initial election that we knew when we selected CanAtom, yes.*[78]

AMPCO/CCC respectfully submits that by using a 50/50 weighting on the D2O Storage Project, for price and technical expertise, OPG selected the wrong contractor that ultimately led to significant cost and schedule delays. Given the first-of-a-kind nature of this project, the technical criteria deserved a higher weighing particularly given that for half of the 18 prerequisite projects, OPG had assigned a score of 40% to bid price and 60% to technical ability.[79]

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[75] Exhibit L D2-02-SEC-096 Attachment 2 page 3
[76] Exhibit K1.9: 2018 Auditor General's Report page 154
[77] Exhibit K1.9: 2018 Auditor General's Report page 155
[78] Transcript Volume 1 page 117 lines 19-28
[79] Exhibit K1.9 2018 Auditor General's Report page 154

## 5) Viable alternatives not adequately considered.

### *a. Critical Alternative Outside the Protected Area Dismissed*

In April 2011 OPG conducted a Value Engineering Workshop, ostensibly to review options for the proposed merged storage project. At the workshop OPG engineers were given the 2010 Project Charter as a baseline for their review; within the Charter OPG had already combined the projects and outlined OPG's preference for the current design.[80] This led to the evaluation of alternatives that looked at various locations of the current design (using an underground seismic dike) as well as alternatives that separated the location of DRP-related storage from the Heavy Water Operations storage.

It was noted at the Workshop that OPG had abandoned consideration of a potential Site D location outside the Protected Area, an option that would have materially reduced construction costs, given the time constraints of the project and OPG's opinion that it would likely not be able to obtain the necessary approvals for construction outside the Protected Area to permit implementation prior to April 2015.[81]

In AMPCO/CCC's respectful submission, consideration of an option sited outside the Protected Area and therefore less expensive to construct, would have been feasible had OPG acted in a timely fashion to plan and execute DRP-related storage options. The July 2011 Draft Environmental Assessment ("EA") Scoping Information document prepared by OPG for the DRP included consideration of the construction of the D20 Storage Facility inside the Protected Area. It also considered construction of the Retube Waste Storage Building(s) that was outside the Protected Area.[82] The Canadian Nuclear Safety Commission ("CNSC") released its decision regarding the EA on March 14, 2013.[83]

In late 2006, the Province instructed OPG to begin assessing the decision to continue the operation of both Pickering and Darlington. In late 2007, OPG started assessing the Darlington decision. In 2008-2009, OPG was into the initial planning, scoping of what it was going to take to refurbish the first unit as early as October 2015.[84]

In AMCPO/CCC's respectful submission OPG had ample time, had it begun to plan DRP-related storage at the same time it started planning the DRP itself, to consider the possibility of establishing DRP-related storage outside the congested Protected Area, including assessing the

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[80] Exhibit L D2-02-AMPCO-097 Attachment 2
[81] Exhibit L D2-02-AMPCO-097 Attachment 2 P25
[82] Environment Canada Website https://www.ceaa-acee.gc.ca/050/evaluations/document/87565?culture=en-CA
Proposal by Ontario Power Generation for the Refurbishment and Continued Operation of the
Darlington Nuclear Generating Station in the Municipality of Clarington, Ontario
Draft Scoping Information Document P4
[83] Exhibit D2-2-10 page 48
[84] Transcript Volume 1 page 131 lines 21-28

required CNSC and EA approvals, and should have done so given the potential, material cost advantage. Not doing so is a shortcoming on OPG's part as building outside the Protected Area means that the cost advantage of higher labour productivity rates akin to commercial constructions sites was not evaluated. To account for building inside the Protected Area and radioactive work practices, Bates White used a productivity rate of 39% as an input in its cost model for labour costs. The point estimate of 39% represented the mean rate derived from two contractor productivity "wrench time" studies commissioned by OPG.[85] This illustrates the significant extra costs incurred by OPG to work inside the Protected Area.

### *b. Evaluation of Alternatives was Incomplete and Cursory*

The Value Engineering Workshop did not develop forecast costs for the alternatives inside the Protected Area. Instead, an order-of-magnitude cost estimate based on the then current state of knowledge about the project (in April 2011) was assumed. The order-of-magnitude cost estimate assumed was $200M consisting of $150M in construction and other direct project costs and $50M in overhead costs. OPG used a baseline capital cost of $150M to build adjacent to the HWMB to evaluate the cost of the other alternatives. The direct project cost assumption was based on construction occurring at the current site of the D2O Storage Project facility. The costs of alternatives were evaluated based on assumed differences to the $150M, and costs related to system tie-ins, equipment redundancy, site remediation (due to the 2009 tritium spill), flood plain, building envelope and building foundations were accounted for as positive or negative cost implications depending on the site location.[86] The cost of the split solution alternative (DRP-related storage at an alternative site and the remaining storage and operations at the site of the current facility) was assumed to have order-of-magnitude direct project cost differences of between $2M and $14M for an assumed total direct project costs of between $152 M and $163M.[87]

The results of the Workshop were that participants preferred a split solution alternative with the TRF operational components at the current site (Site A) and the refurbishment storage located immediately east of the Powerhouse (Site C). Their second choice was to locate the refurbishment storage at Site A as well. The final report from the workshop notes this preference is primarily driven by constructability advantages at Site C, with the trade-off being a slightly higher capital cost. The report specified that the scores will need to be revisited once more reliable information regarding the extent of site remediation work and overall project construction costs become available.[88]

[85] J3.7
[86] Exhibit L D2-02-CME-020
[87] Exhibit L D2-02-AMPCO-097 Attachment 2 page 28
[88] Exhibit L D2-02-AMPCO-097 Attachment 2 page 29

The cost evaluation from the second Value Engineering Meeting held on June 28, 2011 includes the same analysis and information as the April 2011 workshop which puts the split solution alternative (Site A/Site C) as the best value alternative. However, after concluding that soil remediation at Site A was not as bad as assumed, Site A became the preferred solution (the current project) for both the TRF operational components and the refurbishment storage.[89] In AMPCO/CCC's submission this was a poor assumption on OPG's part; the soil remediation work was worse than anticipated and resulted in incremental costs of $14M due to the impacts from a 2009 spill at the Injection Water Storage Tank which was known at the time of the workshops. Interestingly, in advance of the second Value Engineering Meeting, OPG had already penned its final Project Charter on June 20, 2011[90], which had already specified refurbishment storage at Site A, west of the HWMB with piping interconnection to the facility.

The Value Engineering Meeting specified that the path forward required OPG to confirm geotechnical information and cost data, confirm the preferred alternative and develop the RFP.[91] It appears to AMCP/CCC that OPG did not confirm the geotechnical information and cost data and revisit the alternatives. In fact, OPG adjusted its estimate down to $108M in 2012 at the time B&M and ES Fox, the two contractors who responded to the request for proposal, were preparing bid estimates for the project. This unjustifiably low-cost estimate made the alternatives considered at the Value Engineering workshop appear far worse than they were, and the opportunity was lost early on for OPG to pursue less costly options for achieving the same outcome, all at the expense of the ratepayer. As will be examined later in these submissions, OPG's auditor MODUS expressed its opinion that the driving down of the initial estimate was intentional on the part of the P&M group that managed the D2O Storage Facility Project, with the effect that proper consideration of less expensive alternatives in a timely fashion was obviated.

Based on its review of the documentation of OPG's planning for the D2O Storage Facility, it appears to AMPCO/CCC that OPG's Value Engineering exercise was inappropriately skewed towards the current design. At that critical time, prior to the conceptual design phase, OPG did not seriously consider other plausible, less expensive options for DRP-related storage including utilizing the flexibility of the HWMB, Pickering and Bruce; it was only when OPG had failed to meet the construction schedule for the D20 Storage Facility that it was forced to take advantage of more efficient, less costly alternatives to avoid negatively impacting the DRP schedule for Unit 2, but did so only in the context of refurbishing Unit 2.

### *c. Construction of a Building on Grade was not Adequately Considered*

[89] Exhibit L D2-02-AMPCO-097 Attachment 3 Page 26
[90] Exhibit D2-2-10 Attachment 2c
[91] Exhibit L D2-02-AMPCO-097 Attachment 3 Page 30

In AMPCO/CC's view, OPG did not adequately consider the cost of building the facility on grade for just refurbishment storage or operational improvements or both. It was not an option evaluated at the two Value Engineering Workshops where split designs were considered. The October 2011 Conceptual Design Report used by B&M to bid on the project did not include an option to build the structure on grade even though the 2007 Trow Geotechnical Investigation for the site identified that slab-on-grade construction was feasible[92] and that, provided the excavations did not extend below the observed groundwater level (i.e. 2.5 m below existing grade), no major groundwater dewatering was anticipated.[93] On grade construction appears feasible if seismic requirements are met through either seismically qualified micropiles within a non-seismically qualified concrete dike (Option B) or double walled tanks and piping (Option C).[94] OPG did not undertake a cost-benefit analysis of seismically qualified tanks and piping[95] and presumably micropiles, thus these potentially viable alternatives to building a seismic concrete dike 13 m deep at the current site were not properly evaluated.

OPG ultimately confirmed "Option B[96]might make sense for other applications."[97] OPG has previously utilized this design option. Tanks were installed on a micro-pile foundation with a reinforced concrete dike between 2005 and 2009 for the D2O Storage Tank Project at Pickering.[98]

The 2011 Conceptual Design Report indicates the expected cost of a double walled tank option (Option C) is roughly twice the cost of a single walled pressure boundary system (i.e. two times the cost of the tanks). Bates White indicates the material cost of the 28 tanks is $4.74M, so presumably, it appears to AMPCO/CCC, the incremental cost for double walled tanks would be $4.74M, a relatively minor cost increase compared to the overall cost of the project under any scenario. As discussed later, the labour to install the complex piping network is what drove the construction costs up, not the cost of the materials.

The double walled tank option would have eliminated the need for a concrete containment dike, and consequently, the required excavation depth,[99] thereby eliminating or reducing the constructability issues at Site A related to soil contamination, dewatering and buried service relocations. OPG's witness clarified that the "project charter said don't reinvent the design; use what's already been done."[100] This approach was short sighted on OPG's part as an above ground alternative, particularly for DRP-related storage without the need for all of the elaborate piping, had the potential for significant cost advantages.

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[92] Exhibit L D2-02-AMPCO-094 Attachment 1, P12
[93] Exhibit L D2-02-AMPCO-094 Attachment 1, Page 11
[94] Exhibit L-D2-02-AMPCO-106 Attachment 1 P 34-37
[95] Transcript Volume 2 P61 Lines 24-27
[96] Tanks supported by micropiles
[97] Transcript Volume 2 page 66 line 25-26
[98] Exhibit L-D2-02-AMPCO-106 Attachment 1 page 9
[99] Exhibit L-D2-02-AMPCO-106 Attachment 1 page 37
[100] Transcript Volume 2 page 67 lines 7-8

By constructing a seismic dike 13 m deep at the current site, OPG incurred costs of $42M in concrete costs[101], $24.55M for dewatering[102], $14M for soil management[103]and $10M to relocate a 30-inch buried service[104]; all constructability challenges at the current site that OPG was aware of in advance:

- ***Dewatering***

Trow's 2007 Geotechnical Investigation Report for the Proposed Heavy Water Management Building and EXP's 2012 Geotechnical Investigation Report indicate free groundwater was encountered in all the boreholes upon completion of drilling and the water level was observed at depths of about 2.08 m to 2.54 m below existing grade,[105] and 2.13 m to 2.74 m below existing grade,[106] respectively.

Bates White's perfect knowledge cost estimate included $24.55M for dewatering costs.[107] Bates White confirmed this amount is actually information they got directly from OPG.[108] This amount is significantly more than the total cost of dewatering on the D2O Storage Project of $8.9 M subsequently provided by OPG.[109] OPG should clarify this discrepancy in its reply submission.

- ***Soil Management***

Following a 2009 spill at the Injection Water Storage Tank, additional soil testing revealed low levels of tritium in the soil above the free release limits of the Darlington license which required ongoing testing, and that the excavated soil be placed in a laydown area (F1) so any remaining tritium could dissipate prior to permanent soil disposal. The cost associated with the development, construction, monitoring and restoration of the F1 area were approximately $14M.

- ***Buried Services***

A list of buried services to be removed or relocated at the site was included as Appendix F to the 2011 Conceptual Design Report[110] and provided to B&M when bidding on the work.

[101] J3.4 Attachment 1 page 67
[102] D2-2-11 Attachment #3 P113
[103] Exhibit L D2-02-AMPCO-107
[104] Exhibit L-D2-02-AMPCO-115
[105] Exhibit L D2-02-AMPCO-094 Attachment 1 P6
[106] Exhibit L D2-02-AMPCO-099 Attachment 1 P7
[107] Exhibit D2-2-11 Attachment 3 P113
[108] Transcript Volume 3 P81 lines 6-15
[109] J2.5
[110] Exhibit L D2-02-AMPCO-106 Appendix F

However, the full scope required to relocate a 30-inch Low Pressure Service Water (LPSW) pipe was missed which resulted in a two-month delay in the TRF outage and delayed the start of installing the D2O Storage Project's caisson wall and excavating the seismic dike.[111]

In October 2013, OPG conducted an internal review of the LPSW pipe relocate to investigate the reasons why it was delayed.[112] A key finding was that OPG failed to anticipate and mitigate risk prior to affecting external milestones which led to a schedule delay and imprudently incurred costs.[113] The predominant failures identified were inadequate planning, inadequate project management, insufficient staffing (persons specified not able to perform task), inadequate communication among organizations and inadequate teamwork.[114]

OPG estimates the cost to relocate the LPSW, including any costs associated with the delay, at approximately $10M.[115]

Further, OPG's internal review also concluded that Bruce Lessons Learned were actually not fully utilized to avoid similar pitfalls during the D2O Storage and Drum Handling Project and sustainable corrective actions from the original self-assessment and subsequent SCR's[116] were not implemented.[117]

In AMPCO/CCC's respectful submission OPG's poor project management performance led to this schedule delay and imprudently incurred costs of $10M.

### *d. Feasibility of Raising the Elevation of the Building to Mitigate Construction Issues Considered After the Fact.*

In 2014, OPG requested that RCM Technologies Canada Corporation ("RCMT") (B&M's subcontractor for engineering) examine the technical viability of raising the D2O Storage Project building's foundation from the original design elevation of 87 m, which was selected to match the elevation of the HWMB/TRF, to a higher elevation of 94.8 m. OPG sought to examine this approach as a possible mitigation of ongoing water ingress issues and the need to design and construct the buried pipe chase.[118]

RCMT's preliminary analysis considered the feasibility of elevating the building as currently designed within the building's footprint and concluded that it could not endorse a decision to

[111] Exhibit D2-2-10 page 59
[112] Exhibit L D2-02-AMPCO-115 Attachment 1 SCR No. D-2013-19100
[113] Exhibit L D2-02-AMPCO-115 Attachment 1 page 4
[114] Exhibit L D2-02-AMPCO-115 Attachment 1 page 41 Appendix E
[115] Exhibit L D2-02-AMPCO-115 P2 part (c)
[116] SCR: Station Condition Report
[117] Exhibit L D2-02-AMPCO-115 Attachment 1 page 13
[118] Exhibit D2-2-10 page 68

elevate the building's foundation because of concerns about the resulting structure's stability and OPG accepted this conclusion. RCMT only considered the existing design in its analysis and was not asked by OPG to opine on the feasibility of raising the D2O Storage Project building's foundation from the original design elevation based on an alternate design. In AMPCO/CCC's submission this this underscores OPG's refusal to properly address feasible and less costly alternatives to their preferred design to the detriment of ratepayers.

In its September 16, 2014 letter to OPG on this issue, RCMT pointed out that designing the building founding on soil could have been a viable option if it had been considered in the conceptual design phase.[119]

Had on grade construction been an option considered at the conceptual design phase, many of the constructability issues at the site related to dewatering, soil contamination and buried services could have been substantially reduced if not eliminated.

### 6) The Relative Cost of DRP-related Storage

In 2011, as part of the decommissioning plans for OPG's nuclear facilities, Kinectrics prepared cost estimates for storing all heavy water used in the primary heat transport and moderator systems at both Darlington and Pickering.[120] Kinectrics assumed dedicated stand-alone storage facilities utilizing 100 and 150 Mg stainless steel tanks that are not required to interface with other systems or structures at the site such that extensive piping was not a cost driver. The location within the site was undefined but the estimates applied to construction outside the Protected Area and therefore excluded working in a protected area with its associated radioactive work practices and decontamination. Kinectrics provided costs for different scenarios that utilized either all Class 3 tanks or a combination of Class 3 tanks (50%) and Class 6 tanks (50%) and the storage tanks were required to be seismically qualified (i.e. double walled tanks). The soil at each site was assumed to be ready for construction.

Based on these assumptions, and a layout of 4 tanks to 31 tanks at Darlington, the estimated costs ranged from $22.2 M (Darlington, 4 tanks) to $60.4 M (Darlington, 31 tanks) including design, procurement, construction, equipment installation and commissioning activities[121] and excluding taxes, interest on borrowed funds, site preparation and the cost of OPG site supervision.[122]

In AMPCO/CCC's respectful submission the 2011 Kinectrics report provides a useful illustration of the lower costs associated with not only decommissioning storage, but also DRP-related

[119] Exhibit L-D2-02-AMPCO-137 Attachment 120, P1
[120] Exhibit L-D2-02-AMPCO-131 Attachment 5
[121] Exhibit L-D2-02-AMPCO-131 Attachment 5 page 4
[122] Exhibit L-D2-02-AMPCO-131 Attachment 5 page 10

storage, both examples where the storage tanks are not required to interface with other systems or structures and the construction of a stand-alone facility can be outside the Protected Area. In AMPCO/CCC's view, OPG did not adequately assess other options that reflected the actual DRP-related needs, including constructing a simple stand-alone building outside the Protected Area utilizing larger tanks and no extraneous piping. Such an option, it appears to AMPCO/CCC, was feasible, particularly given the demonstrated viability of using trucks to transport heavy water from and to the Darlington site using the HWMB as a clearing house exactly as it was used for the purposes of the refurbishment of Unit 2 to avoid incremental generation losses.[123]

**7) Refurbishment Storage Capacity not Appropriately Sized**

The 2010 Project Charter for the merged project specifies that the new Heavy Water Storage Facility must have a storage capability of 1700 m3 for DRP-related storage. This storage is for two units Moderator drain (700 m3), two units Primary Heat Transfer ("PHT") drain (800 m3), and downgraded D20 generated during PHT Decontamination (200 m3). OPG committed to 1700 m3 of refurbishment storage early on and the D2O storage facility was sized based on 1700m3 of refurbishment storage and 400 m3 of operational improvement storage (200 m3 for Moderator operations support, 200 m3 for PHT operations support) for a total of 2,100 m3.[124]

OPG did not undertaken a thorough economic evaluation of different capacity options for refurbishment storage under different planning scenarios even though OPG was never planning to hold 100% of the heavy water of two units at the same time for any significant period. In fact, under the current schedule, OPG never plans on having two moderators drain at the same time,[125] and only plans on having two PHTs worth of water drained at the same time for a total of 17 months out of the total 10 years of the DRP timeline from 2016 to 2026.[126] AMPCO/CCC acknowledges that OPG provided a 2012 schedule that shows a different preliminary overlap schedule for the DRP; to that AMPCO/CCC notes that even under that preliminary schedule OPG was only planning to hold 2 moderator's worth of D2O at the same time for 10 months out of the then 8 year schedule for the DRP, with, again, only 17 months of PHT overlap.[127] AMPCO/CCC further notes that, obviously, the schedule for the DRP changed over time as OPG prepared to file its EB-2016-0152 Application, and that there is no indication that OPG could not have accounted for reduced overlap in the schedule in the scope of the D2O Storage Facility as

[123] Exhibit D2 Tab 2 Schedule 10 Attachment 5
[124] The Heavy Water storage tanks were designed with a safety margin of 10% (i.e., each tank is sized 10% greater than its rated capacity). As a result, the D2O project includes 2,310 m³ of total storage space, with only 2,100 m³ used to store heavy water under normal circumstances.
[125] Transcript Volume 2 page 5 lines 19-20
[126] Exhibit K1.6.
[127] Exhibit J1.7 Attachment 2

the details for the DRP became more certain. Indeed, AMPCO/CCC notes that it was not until December 2015[128] before OPG had even begun to install tanks, let alone the supporting piping that turned out to be the costliest aspect of the facility.

Additionally, OPG did not factor in the potential use of the 400 m3 of Heavy Water Operations storage at the D2O facility for Moderator or PHT refurbishment drains, particularly when the overlapping drains were of short duration or, as is the case under the current schedule, not planned at all. The first two 100 m3 tanks were always designed as class 3 tanks capable of holding moderator D2O but OPG did not consider the relatively modest incremental cost of making the other two operational storage tanks (200 m3) Class 3 so that they too could be used as part of refurbishment storage for Moderator drains in addition to PHT drains.

Using the Heavy Water Operations storage could require OPG to limit, for a short period of time, deliveries of heavy water from Bruce and Pickering; however, in addition to the small impact such a limitation would have on net generated TRF related revenue, it is more likely that OPG could have timed the draining of, for example, moderators from units undergoing refurbishment directly to the new Heavy Water Operations storage for immediate de-titration. OPG noted, for example, that on draining the Unit 3 moderator that D2O was planned for de-titration[129], such that OPG could have planned to send that water directly to the new Heavy Water Operations storage in combination with the pre-existing storage at the HWMB in the normal course to be run through the TRF.

AMPCO/CCC further notes that:

a) the actual volumes of D2O in OPG's units, particularly the PHTs, are materially below the theoretical maximums that OPG used for planning purposes[130], and
b) the draining of the units are split into two phases, a bulk drain and a vacuum dry phase, with the effect that the immediate bulk drain needs for each drain, particularly the PHTs, are less than the total drain, and the time to fully drain each unit, particularly the PHTs, is spread over weeks as opposed to days, such that[131]
c) part a) and b) above contribute to the conclusion that that there is flexibility in the drain and fill schedules that OPG did not account for in its planning for DRP-related storage.

Lastly, AMPCO/CCC notes that at the end of 2025, the TRF will be supporting only 10 reactors (7 units at Bruce Power, and 3 units at Darlington), significantly less that the 16 reactors the TRF was supporting at its in-service date of 1989 (8 units at Pickering and 8 units at Bruce Power).[132] Post refurbishment OPG will have a storage volume of 2,100 m3.

[128] Exhibit D2-2-10 page 83
[129] Exhibit J2.1.
[130] Exhibit J1.7; AMPCO/CCC notes that the drain amounts are measured in this exhibit in mgs; converting to m3 reduces the amounts by 10%.
[131] Exhibit J1.7
[132] Exhibit L D2-02-AMPCO-084 (c) & (a)

This is in addition to the existing heavy water storage capability at the TRF (HWMB) of 943Mgs (850 m3) and approximately 1500 drums.[133] Given the declining TRF requirements for storage AMPCO/CCC submits the as-built storage is excessive for the TRF.

The 2018 Superceding BCS states "An Operational Improvement project-for the existing TRF was launched in 2006 and was subsequently merged with the DRP heavy water storage project in order to align strategies and achieve efficiencies. This operational enhancement scope minimizes the risk of incurring capital costs to refurbish the existing TRF or build a new TRF facility in 2035."[134] Currently OPG is reviewing the strategy for life extension of the TRF.[135] AMPCO/CCC respectfully submits until the strategy and economic evaluation of this work is complete it's premature to assess the operational benefits in this way.

**Summary**

In AMPCO/CCC's respectful submission it is clear that OPG only considered one size for the D2O Storage Facility; the largest and most expensive version possible, based on the assumption that all of the DRP-related storage needs had to be met with new storage specifically built for that purpose, and that that new storage had to be built to the same, expensive and complex specifications that were being imposed on Heavy Water Operations storage. In AMPCO/CCC's respectful submissions this was imprudent on the part of the OPG and should be addressed through a reduction in the capital costs approved for the D2O Storage Facility.

AMPCO/CCC notes that it has, within its submission on the overbuilt nature of the D2O Storage Facility, referred to several examples of imprudently incurred costs resulting from OPG's execution of the project; what follows are detailed submissions related to two of the more distinct areas of where OPG's management of the project contributed to material cost increases.

## 8) Execution Issues with both B&M and OPG, and OPG Failure To Establish A Proper Baseline Cost Estimate

In its evidence OPG asserts that B&M's failure to meet the schedule for delivery of design documents and the delay in completing the LPSW relocation increased the costs of the project; through the interrogatory process OPG was asked to quantify the claimed increase, but OPG did not answer the question[136]. During the Technical Conference the issue was pursued again, with

[133] Exhibit L D2-02-AMPCO-084 P2
[134] Exhibit D2-2-10 Appendix 2q page 2
[135] Exhibit L-D2-01-SEC-053 Attachment 2 page 1
[136] Exhibit L D2-02-CCC-035

OPG providing a more fulsome answer to the question of the impact of B&M's performance on the costs of the project:

> *MR. BUONAGURO: No. I think the sentence, at least to me, it speaks for itself. It says "the failure to meet the schedule for delivery of design documents", so that's a failure on B&M's part, "and the delay in completing the LPSW relocation", so presumably another failure on behalf of B&M, "has increased costs." I am trying to know what those costs were.*
>
> *MR. REINER: So we have to -- one of the issues related to B&M's early work on this project is in relation to a baseline cost estimate which we had extreme difficulty getting to with Black & McDonald, and you will see in the evidence and in the interrogatory answers that that theme comes through.*
>
> *So in order to answer that question, it means -- to answer it precisely with a quantification, you need good baseline estimates to compare to.*
>
> *Intuitively, we know it increased cost because it added time and time means more effort, more cost. So I don't know that we are able to give you -- because I don't believe it exists -- that we are able to give you a quantification of that relative to a cost estimate, because that was a big part of the problem with Black & McDonald which ultimately resulted in changing course with contractors. We couldn't get a baseline cost estimate or schedule that they would commit to.*
>
> *MR. BUONAGURO: Okay.*
>
> *MR. REINER: On the basis of that, it would be impossible to quantify this.*

Accordingly, while OPG clearly asserts that there were cost and schedule consequences associated with B&M's performance, OPG claims that it is impossible to quantify those impacts because of the lack of a proper baseline cost estimate. In making these assertions, however, OPG appears blind to the fact that, as between OPG and ratepayers, it was OPG's responsibility to establish a proper baseline estimate as part of its obligation to establish the prudence of its claimed costs. Most disturbingly, in AMPCO/CCC's view, is OPG's silence on the findings of MODUS, its own auditor, to the effect that OPG staff intentionally minimized the baseline estimate underpinning the original 2012 BCS and obscured the increasing costs of the project over time:

> *P&M's management failures can be seen throughout the planning and execution phase of the project. Notable from OPG's initial negotiation and acceptance of bids for this work is P&M's mischaracterization of the vendors' estimates in the*

*approved Business Case Summaries ("BCS"). In August 2011, OPG produced a BCS for D2O Storage that estimated its cost at $210.6M, including $165.8M in project cost and $44.7M in contingency. At the project's next gate in June 2012, the estimated cost had dropped from $210M to $108M. However, BMcD/Modus could not find any attempt by P&M to rationalize or otherwise explain how the cost estimate for this building was cut virtually in half from one approval gate to the next. Moreover, the estimate for design and construction was $52.2M, which P&M characterized as a "Class 2 Estimate" despite the fact that at the time of the estimate, Black & McDonald had little experience with this type of construction and had performed no engineering or scope definition. Thus, this estimate was more likely a Class 5 Estimate. In retrospect, it is likely that the initial $210M estimate was more accurate; however, it is certainly clear that the approved $108M estimate should not have had any greater accuracy attributed to it, since it was not based on a significantly greater level of project maturity. Likewise, the AHS BCS was termed a "Class 3" Estimate, though it was similarly immature.*

*This estimate classification drove P&M to vastly underestimate the amount of contingency associated with each package. There is no evidence that P&M engaged in the type of vetting of the estimates that we would expect on projects of these size and importance. From interviews with the current P&M staff and the contractors, it appears that these initial BCS estimates were poorly characterized as part of a deliberate management strategy directed by the former VP of P&M. P&M's managers told us that the contractors were challenged to reduce their bid prices and remove all contingencies for unknowns, despite the extreme immaturity of project definition underlying their respective bids. As an example, for the D20 Storage project, Black & McDonald was told to remove from its contract price any contingency for unforeseen soil conditions, even though there was a high likelihood that there would be contaminated soil issues.*

*Moreover, P&M clearly overvalued price as a consideration in the contractor selection process, especially in light of the fact that the work was going to be performed on a cost-reimbursable basis and the bid prices were not binding.*

*P&M gave only token consideration to determining which contractor had a better approach for executing the work. P&M chose the "low bidder" even though the other contractor's qualifications and project approach were viewed more favorably. Thus, P&M created the conditions for a perfect storm of cost and schedule overruns. Because the work is largely based on a cost-reimbursable target price with no caps on size, P&M's artificial beating down the contractors' prices in the bid phase was a Pyrrhic victory: P&M's actions did not reduce cost and only served to deprive senior management of realistic cost projections for this work. The budgets for these and other F&I projects were nothing more than paper barriers*

*that were easily surmounted as the design work continued to generate more complex (and expensive) work.*

*. . .*

*Moreover, throughout 2011-13, P&M did not require Black & McDonald to timely update costs and provide visibility to the cost of these design changes as they were occurring; thus, as with AHS, P&M's management allowed the contractors to run up the tab and incorporate a flood of OPG stakeholder generated late design changes without adequate checks and balances or understanding of the magnitude of these changes.*

*As a direct consequence of P&M's failure to report these cost and schedule variances, senior management was deprived of the ability to:*

- *Stop the design changes that led to these increases;*
- *Stop the project entirely and resort to one of the other evaluated options;*
- *Identify and characterize the cost increases that are not related to Refurbishment and subject these changes to the same value-enhancing criteria as the remainder of the DR Project's work; and*
- *Mitigate the impact of the schedule delays and overruns.*

*Thus, the consequences to OPG are two projects that may cause external stakeholders to question OPG's management prudence.* [137]

AMPCO/CCC recognizes that, at the request of OPG, MODUS provided a supplementary report to, ostensibly, provide the "proper perspective" to its original 2014 Q2 Report criticizing OPG's performance on the D2O Facility while reiterating the primary failures of OPG in managing the project:

*BMcD/Modus was requested by NOC to provide a Supplemental Report that summarizes our role, the oversight activities we are performing on the Project and major findings to date, while at the same time providing the broader context for these findings in light of the influx of new members to OPG's Board of Directors ("BOD") and NOC. In this regard, it is important that the comments and recommendations that BMcD/Modus made with respect to the Campus Plan Projects in our 2Q 2014 Report dated May 13, 2014 are viewed with the proper perspective.*

*. . .*

[137] Exhibit L-D2-02-Staff-105, Attachment 2, pages 181, 182, 184, 185.

*In particular, the P&M organization made several mistakes with respect to determining the projects' budgets, including:*

*"Negotiation" of bid prices which gave a false sense of security regarding the accuracy of the cost estimates— too much emphasis was given to pricing during the bid evaluation phase rather than understanding the scope, execution plan and qualifications of the contractors;*

*Assuming, without the proper vetting and review, that estimates provided by the contractors had a certain level of accuracy even though no design was complete and scope was still in flux – this resulted in significantly lower contingency than should have been applied to these estimates; and*

*P&M's and the contractors' failure to regularly update the Estimate at Completion (EAC) once changes were known resulted in the budget shock occurring all at once with the presentation of revised Business Case Summaries ("BCSs").*[138]

In AMPCO/CCC's view, whether through MODUS' original report or through the "supplemental" report requested by OPG, the conclusion remains essentially the same; poor management of the project from the outset by OPG is the root cause of the poor baseline estimate for the project; coupled with the failure to report the escalating costs, OPG's management was largely deprived of the opportunity to:

- Stop the design changes that led to cost increases;
- Stop the project entirely and resort to one of the other evaluated options;
- Identify and characterize the cost increases that are not related to Refurbishment and subject those changes to the same value-enhancing criteria as the remainder of the DR Project's work; and
- Mitigate the impact of the schedule delays and overruns.

Accordingly, when OPG asserts that B&M's poor performance increased the costs of the project but that a poor baseline estimate makes it impossible for OPG to quantify the cost impact, OPG is in fact highlighting its own role in failing to manage the project properly from the outset. This places the OEB, in reviewing the prudence of the costs incurred, in the same position the OEB panel that decided the EB-2016-0152 application was in with respect to arriving at a reasonable reduction to the claimed costs of a project that had experienced imprudent spending comingled with scope increases (which increases, AMPCO/CCC has respectfully submitted, are unjustified to a large extent). Not only is it almost impossible for the OEB to specify the imprudently incurred costs specific to B&M's performance; OPG's role in developing the baseline estimate

[138] Exhibit L-D2-02-Staff-105, Attachment 2, pages 2, 18.

makes it almost impossible for the OEB to specify the imprudently incurred costs in relation to OPG's poor execution of the project.

In AMPCO/CCC's view OPG's behaviour in establishing the original 2013 BCS estimate of $110M, obscuring the escalation of the estimated costs until 2014, and then ultimately terminating B&M and requiring a transition to a new contractor, particularly in conjunction with all the other issues identified by AMPCO/CCC in this submission, support a material disallowance based on the OEB's previous utilized model of disallowing 50% of the cost increase between the original BCS estimate of $110M and the final claimed cost of $510M, a disallowance of $200M.

## 9) Escalation of Costs Between the 2015 BCS of $381.1M and the Final Claimed Costs of $509.3M

In EB-2016-0152, with a filing date of May 27, 2016, OPG made the following series of assertions in support of its request for an approved capital cost for the D2O Facility of $381.1M:

> *The Cost*
>
> *At its forecast total project cost of $381.1M (full in-service in May 2017), the Heavy Water Facility provides substantial value to the DRP and Darlington operations. Initial scope identification for the Heavy Water Facility was limited. The initial project budget was based on a conceptual design and very preliminary design requirements. The initial full release of $110.0M (updated to $287M in EB-2013-0321) was based on an EPC contractor's conceptual design and associated cost estimates that did not match the complex requirements of the project needs. <u>While cited as a Class 2 estimate, this was not the case.</u>*
>
> *For example, the conceptual design did not include the amount of piping, shielding requirements and vapour recovery systems required to meet operational and environmental requirements in the final design. The current project budget of $381.1M as set out in the superseding BCS dated March 2015 reflects required project scope and costs as the design now properly incorporates the engineering, design and safety requirements to address the need and complexity of the project. Therefore, the superseding BCS (see Attachment 1, Tab 1) provides the relevant and appropriate basis for evaluating the costs associated with the scope of work that is required for the Heavy Water Facility project.*
>
> *The changes in the forecasted project costs are primarily associated with progressing from conceptual design requirements to detailed design requirements*

*to ensure the proper design and functionality of the project. Design concerns were raised by OPG and independent oversight at the initial stage of the project, with work not having progressed beyond site preparation. OPG took definitive steps to become more actively involved in the facility's detailed design to ensure the proper scope. This included co-locating OPG engineering staff with the contractor's design team.*

*Ultimately, OPG determined that the contractor's performance on this project was unsatisfactory and in October 2014, terminated the Heavy Water Facility purchase order for default. OPG assumed the role of general contractor for an interim period while it secured a new contractor. The SNC/AECON JV has now been awarded the contract to complete the project.*

*The changes in project cost are design related to ensure a scope that matches the need and do not reflect any significant reworking or reconstruction of facilities. The increased project budget reflects true project costs as the design was further developed.*[139] *(emphasis added)*

AMPCO/CCC has made submissions to the effect that:

a) the D2O Facility was overbuilt,
b) OPG's management of the project led to imprudent costs associated with the project's execution,
c) OPG's own auditors (MODUS) determined that the initial planning for the D2O Facility by OPG was flawed,
d) MODUS found that OPG's P&M group intentionally minimized the original costs of the project and allowed the cost and scope of the project to escalate, essentially without restraint, until the project had progressed beyond the point of allowing viable, more cost-efficient alternatives to be re-assessed by management,
e) OPG incurred cost increases because of its assessment that its original contractor, B&M, had performed poorly, resulting in the termination of B&M by OPG when B&M refused to cap the target price for completion of the project,
f) OPG has asserted that it is unable to provide an estimate of the cost increases caused by B&M's poor performance because of the failure to establish a proper baseline cost estimate for the project, a failure that AMPCO/CCC has submitted is primarily the fault of OPG, and
g) OPG's own poor management of the project is also almost impossible to quantify as a result of OPG's failure to establish a proper baseline cost estimate for the project.

Accordingly, AMPCO/CCC does not agree with OPG's 2016 assertion that the $381.1M proposed project costs as detailed in the 2015 BCS should be taken as reflecting the "true costs" of the

[139] EB-2016-0152, Exhibit D2, Tab 2, Schedule 10, pages 16-17, filed May 27, 2016.

project and accepted by the OEB on that basis; in AMPCO/CCC's view, included within the $381.1M estimate are material amounts of imprudently incurred costs that should contribute to an overall disallowance.

However, AMPCO/CCC does believe that the assertions with respect to the proposed $381.1M estimate of the project is useful in evaluating OPG's project performance after the termination of B&M and the subsequent retainer of CanAtom as the replacement contractor.

Between the March, 2015 BCS and the final January 2018 BCS OPG's estimated total cost for the D2O Facility escalated, again, from $381.1M to a final claimed amount of $510M, an escalation of $128.9M[140]; this despite all of the various assertions by OPG to the effect that it had brought the "true" project costs under control as of May, 27, 2016.

The cause for the cost increase from $381.1M to $510M was set out in the 2018 BCS:

> *The key reasons for the increase in costs since the last BCS are changes to civil design brought forward by the vendor of record which resulted in cost increases and schedule delays. OPG agreed to the changes based on that vendor's assurances that the changes would have no net cost impact and would improve the construction schedule. In fact, the changes resulted in significant cost increases and schedule delays.*[141]

further on in the 2018 BCS OPG provided further details about the key reasons for the increase in costs:

> *Following the approval of that [2015] business case, OPG engaged a new vendor. The new vendor recommended changes to the existing design based on what it said were code deficiencies in the original design. It assured OPG that the changes would have no cost or schedule impact. OPG approved the changes on that basis.*
>
> *In fact, the changes resulted in significant cost and schedule impacts. After OPG refused to pay for the cost increases, it negotiated revisions to the agreement with the vendor to convert it to a guaranteed maximum price agreement.*

In 2018 the Ontario Auditor General specifically highlighted this cost increase in its review of the escalating costs associated with various DRP related projects:

> *In 2015, OPG approved the request of the newly selected contractor (a joint venture between SNC- Lavalin Nuclear Inc. and AECON Construction Group Inc.) to change the design of the Heavy Water Facility. In a project business case for the Heavy Water Facility, OPG identified that this was based on the contractor's view*

[140] Exhibit L, D2-02-SEC-094 provides a synopsis of the escalating costs of the project from BCS to BCS; AMPCO/CCC notes that the 2018 BCS is based on an estimate of $498.5M, with the remaining $11.5M being attributed to the use of a "management contingency" to arrive at the total claimed cost of $510M.
[141] Exhibit D2, Tab 2, Schedule 10, Attachment 2q, page 2.

*at that time that design changes would not increase the cost to perform the project work; however, these actually resulted in further cost increases (about $130 million, primarily related to design changes suggested by the new contractor in addition to changes to the project's scope and other factors) and delays to the Heavy Water Facility.*

*At the time of our audit, the Heavy Water Facility was expected to cost about $510 million—about $400 million or over 4.5 times more than originally estimated, and not to be completed until May 2019—three-and-a-half years later than originally estimated. This includes approximately $130 million primarily related to allowing the newly selected contractor to make design changes (in addition to other factors, as mentioned above) and about $14 million related to selecting the new contractor and transferring the work to it from Black & McDonald.*[142]

The Auditor General noted OPG spent almost $32M to complete prerequisite project work faster such as having staff work overtime, that could have been avoided or reduced if OPG had planned its prerequisite work better. OPG spent significantly more in contractor overtime on the D2O project in 2016, $10.47M compared to an average of $626,000 for other years[143], yet the facility wasn't available for service until March 2020.

In response to the Auditor General's criticisms about the escalating costs of various projects OPG's only response, in general, was to cite the complexity of the various projects and assert that the initial estimates for the projects, while presented as Class 3 estimates, were in fact more like Class 5 estimates, and that the current estimates were now proper Class 3 estimates.[144] This explanation does not, however, apply at all to the escalation of the D2O Facility costs from $381.1M to $510M from the 2015 BCS to the 2018 BCS. OPG had already blamed the escalation of costs between the original 2012 BCS estimate of $108M and the 2015 BCS estimate of $381.1M on a mischaracterization of the original estimates; the 2015 BCS estimate of $381.1M was already a properly characterized Class 2 estimate.

The design changes proposed by CanAtom were formally accepted by OPG in writing on July 31, 2015; while OPG communicated to CanAtom OPG's understanding that the proposed design changes would not materially impact the costing or schedule for the D2O Facility, OPG did not, it appears to AMPCO/CCC, take any steps to contractually bind CanAtom to the impacts of the proposed design changes.[145] This, despite OPG's assertion that one of the main drivers for

[142] Exhibit K1.9, 2018 Auditor General's Report, Chapter 3, pages 155-156.
[143] JT1.6
[144] Exhibit K1.9, 2018 Auditor General's Report, Chapter 3, pages 157-158.
[145] Exhibit L D2-02-SEC-099, Attachment 1.

terminating the previous contractor, B&M, was related to B&M's refusal to accept any financial risk associated with a target price.[146]

On October 5, 2016, over 1 full year after OPG accepted the proposed design changes, CanAtom submitted Project Change Notice #67 seeking to amend the project cost and schedule, largely in relation to the design changes accepted by OPG in July 2015.[147]

On February 17, 2017, over 4 months after PCN#67 was submitted, OPG responded to CanAtom by denying that the design changes requested by CanAtom were necessary, and rejected the notion that OPG should be responsible for the impacts of the re-design:

> *OPG does not accept SNC-Aecon JV's request to approve the additional $37.4M claimed for the Work. SNC-Aecon JV claims arise out of its perceived need to redesign the seismic dike slab of the D20 building. Based on the information currently available, OPG does not agree that any such redesign was necessary. OPG disputes that it is responsible for the $37.4M in increased costs arising from SNC-Aecon JV's design decision, and therefore is not prepared to issue a Project Change Authorization or a Consent to Proceed for those costs at this time.*
>
> *I can, however, advise you that OPG has retained a third party expert to evaluate the need for the redesign and will reassess its position once it has the expert's opinion.*[148]

OPG did obtain a 3rd party review of the proposed design changes in April, 2017, approximately 21 months after it approved the design changes.[149] OPG confirmed that the report supported its view that the design changes proposed by CanAtom and accepted by OPG had not been necessary.[150]

AMPCO/CCC respectfully submits that, as between OPG and ratepayers, the facts underpinning the escalation of costs between the 2015 BCS estimate of $381.1M and the final claimed cost of $510M lead inexorably to the conclusion that those costs were unnecessarily and imprudently incurred such that OPG should not be allowed to recovery those costs in rate base. In AMPCO/CCC's view, the evidence clearly indicates that despite the massive escalation of costs between the 2012 BCS and the 2015 BCS, the termination of B&M in large part, according to

[146] Exhibit L D2-02-CCC-036; OPG explains that while B&M was willing to take the risk on its performance fee, B&M was unwilling to take any additional financial risk if the actual costs of the project exceeded a target price.
[147] Exhibit L D2-02-AMPCO-127, Attachment 1.
[148] Exhibit L-D2-02-AMPCO-127 Attachment 1b.
[149] Exhibit L-D2-02-SEC-101 Attachment 1.
[150] Transcript, OPG Oral Hearing, Volume 1, August 4, 2021, pages 118-119. AMPCO/CCC notes that had the design changes actually been necessary then the consequential cost increases and schedule delay, even if necessary, would have been attributable to OPG's earlier failures to properly management the project prior to CanAtom's retainer. The fact that the design changes were not necessary simply emphasizes the fact that the related cost increases between the 2015 BCS and final claimed cost of $510M and schedule delay of almost 4.5 years were, at the time CanAtom proposed the changes, still avoidable had OPG acted appropriately.

OPG, on the basis that B&M would not provide a cap on the final costs of the project, and OPG's assertion that it had increased its role in managing its contractor in the execution of the project, OPG took an unacceptably laissez-faire approach to proposed design changes that underpinned yet another massive increase in the cost of the project, coupled with a material delay in its completion.

It seems clear, AMPCO/CCC respectfully submits, that had OPG acted prudently at the time the design changes were proposed, particularly given its experience in working with and ultimately terminating B&M and given the already $273.1M increase in costs, OPG would have:

a) taken the appropriate steps to confirm the need for and consequences of the proposed design change at the time it was proposed, not 21 months after, and

b) committed CanAtom to a total project cost at the time of the proposed re-design, not more than two years after the re-design was proposed and accepted, particularly since OPG claims to have terminated the predecessor contractor in large part because it would not commit to a target price.

It is particularly of concern that, after having asserted to the OEB in 2016 that it was co-locating its own engineering staff with the contractor's design team, OPG appears to have been taken by surprise in October 2016 that the design changes that CanAtom had been working on since July, 2015 were going to impact the cost and schedule of the project.[151] In AMPCO/CCC's respectful submission, it appears that despite OPG's assertions with respect to the complexity of the D2O Facility and to the effect that the proposed build was a "first of a kind" project, OPG repeatedly failed to take measures when planning the project and overseeing its contractors commensurate with the project's asserted nature, particularly when engaging a new contractor in 2015 and having been admonished by MODUS in 2014 with respect to the behaviour of its P&M group in governing the project since its inception.

Accordingly, in AMPCO/CCC's respectful submission, OPG's behaviour in allowing the costs to escalate, again, from $381.1M to $510M between the 2015 BCS and the final claimed costs of the project supports a material overall disallowance, particularly in conjunction with all the other issues raised by AMPCO/CCC in these submissions. As previously noted, AMPCO/CCC respectfully suggests that in view of OPG's failures in properly managing the project from its inception in 2010 through to the original 2013 Full Execution Release BCS cost estimate of $110M through to the final claimed cost of $510M, and recognizing that OPG's behaviour has effectively frustrated any reasonable attempt that the OEB may make in trying to disentangle not only the cost impacts caused by imprudence as opposed to scope changes, but also disentangle scope changes that were necessary as opposed to scope changes that could have

[151] AMPCO/CCC notes that it is not clear whether OPG co-located its own engineering staff with CanAtom, B&M, or both. If it is the case that OPG did not co-locate its own engineering staff with CanAtom, then AMPCO/CCC submits that not doing so after having **done** so with B&M in order to try and mitigate the cost escalation and schedule delay was an additional imprudent decision on the part of OPG under the circumstance**s.**

been avoided or more efficiently implemented, the OEB's approach in EB-2016-0152 of disallowing 50% of the difference between the original 2013 BCS estimate of $110M and the final claimed cost of $510M would be appropriate, resulting in a disallowance of $200M.

In making its submission as to the appropriateness of an overall reduction AMPCO/CCC notes that the of the various causes of cost escalation the escalation between the 2015 BCS estimate of $381.1M and the final claimed cost of $510M is, arguably, the least complicated to assess in terms of splitting the increase between imprudent costs and legitimate scope increases; in AMPCO/CCC's view it would be appropriate, in isolation, to specifically deny the entire cost escalation of $128.9M as a specific disallowance in view of OPG's assertions to the OEB concerning its claimed control over the project in EB-2016-0152, its failure to act prudently in reaction to the proposed design changes, and the fact that the design changes were the primary cause of the entire cost increase and schedule delay relative to the 2015 BCS. Having said that, AMPCO/CCC stands by its submission that, taking into consideration OPG's performance from the inception of the project, the appropriate response from the OEB would be to disallow 50% of the increase between the 2013 BCS estimate of $110M and the final claimed cost of $510M, rather than, for example, disallowing 50% of the escalation from the 2013 BCS and the 2015 BCS, a disallowance of $136M, and then disallowing the entire escalation from the 2015 BCS to the final cost claim of $509.3M, an additional disallowance of $128.9M for a total disallowance of $265M.

**10) The Bates White Report**

In the respectful submission of AMPCO/CCC the Bates White Report, insofar as it purports to establish a reasonable cost estimate for the D2O Storage Facility, is of limited value with respect to the issues before the OEB in this proceeding under all the circumstances. In the view of AMPCO/CCC the scope of the Bates White report is so narrow as to provide no insight whatsoever with respect to the two main issues in the proceeding as they relate to the D2O Storage Facility. In addition, the way Bates White Report was retained by OPG raises serious questions with respect to reasonable apprehension of bias.

In AMPCO/CCC's respectful submission the primary two issues before the OEB in this proceeding as they relate to the D2O Storage Facility are:

a) did OPG select an alternative that reasonably reflects the actual needs that were the drivers of the project, namely a need to construct a limited amount of incremental storage for the purposes of supporting OPG's Heavy Water Operations and the need to construct a limited amount of storage for the purpose of enabling the DRP; and

b) during construction of the D2O Storage Facility, apart from the issue of the choice of alternative, were there any costs imprudently incurred by OPG, with the effect that those costs should not be recovered from ratepayers?

OPG was very careful not to obtain Bates White's expert opinion on either of these two primary issues; as Bates White confirmed at the hearing, it was not engaged to and did not purport to offer any assistance to the OEB through its report or its testimony with respect to whether the design of the D2O Storage Facility was the appropriate alternative to pursue under all the circumstances, nor was it engaged to provide any assistance to the OEB, through either its report or its testimony, with respect to whether OPG had acted prudently over the course of the almost decade long period during which OPG was managing the construction of the D2O Storage Facility.[152] This, despite:

a) the fact that OPG failed to meet the construction timeline necessary for the project to be fully available for use during the DRP, one of the main drivers of the project in the first instance;

b) the massive increases in cost and material increases in scope related to the project from the initial Full Execution Release BCS in 2013 to the final completion of the project; and

c) the obvious points of increased cost related to poor management of the project, including but not limited to the retainer of the initial contractor, B&M, despite the vast difference in technical expertise between B&M and the other bidding contractor at the time based on OPG's own criteria, the dismissal of B&M on the basis of poor performance, the need to transition to a second contractor, CanAtom, and the complete redesign of material components of the project at the suggestion of that new contractor, a redesign that not only materially increased the costs of the project and delayed its completion, but was determined to have been entirely unnecessary by OPG, albeit over 2 years after the redesign was proposed.

Instead, Bates White was retained to provide a "perfect knowledge" estimate for the project based directly on the exact design specifications selected by OPG, an estimate that is being put forward by OPG in attempt to obviate any discussion, findings, or responsibility on the part of OPG for how OPG actually planned and executed the construction of the project. The implication, it appears to AMPCO/CCC, is clear; OPG does not want the OEB to review the reasonableness of the scope of the facility it built as against alternatives that would have met the properly characterized needs of the project, nor does OPG want the OEB to scrutinize OPG's management of the project despite the already publicized criticism levied by OPG's own auditor (MODUS) and the government of Ontario (through the Auditor General).

Additionally, AMPCO/CCC notes that in retaining Bates White OPG provided Bates White with the full details of OPG's actual costs for the project, including the final claimed cost of $509.3M

[152] Transcript Volume 3, pages 77-78.

in capital costs.[153] In AMPCO/CCC's this puts the independence of the estimate in question, as it provided a target for Bates White to hit on behalf of OPG. OPG recognized the importance of maintaining the independence of a third party's estimate of costs during constructing the D2O Storage Facility itself; when faced with concern about CanAtom's performance on the project, OPG retained High Bridge Associates Inc. to provide an independent cost estimate. As OPG noted in its evidence:

> *At the end of March 2017, High Bridge produced its detailed estimate of the work remaining on the project, which was based primarily on the remaining quantities of major commodities as ascertained from project documents and validated through discussions with CanAtom project personnel. To ensure independence, High Bridge avoided reviewing CanAtom's estimate of the cost to complete the project.*[154]

In other words, when seeking out an independent cost estimate for use in evaluating a contractor's estimate, OPG recognized the need to avoid providing the impugned estimate to the 3rd party; however, when seeking to defend its own costs before the OEB, OPG instead provided full details of all its costs to the 3rd party, with the unfortunate effect of impugning the independence of the estimate.

In addition to its own submissions with respect to the Bates White Report AMCPO/CCC has had the opportunity to review an early draft of SEC's more detailed critique of the Bates White Report; to that end AMPCO/CCC specifically repeats and relies on SEC's submissions with respect to the shortcomings of the Bates White Report in the context of this proceeding.

For all these reasons AMPCO/CCC respectfully submits that the Bates White Report should not be used by the OEB to obviate a review of OPG's actual performance in designing and executing the D2O Storage Facility Project.

**11) More Value in Comprehensive Post Implementation Review (PIR)**

In lieu of the Bates White perfect knowledge cost estimate for the project, it's AMPCO/CCC's view that it would have been more helpful to the OEB if OPG had put its resources and effort towards the completion of the Comprehensive PIR for the project which involves an independent and broad review of the project: to verify whether the benefits explicitly quantified in the each project business case were realized; to capture the lessons learned; and assess the value for money for ratepayers.[155] The D2O facility was declared capable of

[153] Transcipt Volume 3, page 119.
[154] Exhibit D2 Tab 2 Schedule 10 Page 93.
[155] Exhibit L D2-01-AMPCO-016 Attachment 1 PROJECT PHASE-GATE MANAGEMENT OPG-MAN-00120-0019 P7

accepting heavy water in March 2020[156] leaving ample time for a comprehensive PIR to be part of this proceeding had it been undertaken purposefully to be ready in time. OPG expects to have it done before the end of this year.[157]

**12) The recognition of Rate Base Additions prior to 2020**

Of the $509.3M in capital cost, $14.6M in 2014 has already been approved for inclusion in rate base. OPG seeks to incorporate the remaining $494.7M of capital costs for the D2O Storage Project in rate base based on the schedule shown in Table below.[158]

Table 4: D2O Capital Costs by Year & In-Service Additions (ISA) ($ M)

| | Capital Spend | Cum. Spend | ISA | OPG ISA Request |
|---|---|---|---|---|
| **2010** | 1.9 | | | |
| **2011** | 1.2 | 3.1 | | |
| **2012** | 9.6 | 12.7 | | |
| **2013** | 32.8 | 45.5 | | |
| **2014** | 76.7 | 122.2 | 14.6 | |
| **2015** | 71.2 | 193.4 | | |
| **2016** | 146.9 | 340.3 | 160.0 | 160.0 |
| **2017** | 58.3 | 398.6 | | |
| **2018** | 60.5 | 459.1 | | |
| **2019** | 43.0 | 502.1 | 320.9 | 320.9 |
| **2020** | 7.2 | 509.3 | 13.8 | 13.8 * |
| | **509.3** | | **509.3** | **494.7** |

Ref: AMPCO-80; D2-2-10 P12

* less than $0.1M expected to come in service in 2021

OPG's proposal is to place $160M and $320.9M in rate base in 2016 and 2019, respectively. The $160M ISA amount in 2016 reflects completion of the seismic dike and installation of piping to connect five PHT tanks. However, the D2O facility was not used to store heavy water for Unit 2 in 2016. Instead, the existing HWMB facility was used to temporarily store Unit 2 heavy water. To make the necessary storage space available, D2O was transferred to Pickering and Bruce.[159] The D2O facility was not used as it would have required installation of several temporary safety systems, such as leak detection and radiation monitoring, to safely store radioactive heavy water in the building, which would have added to the project's cost.

[156] Exhibit D-2-10 Attachment 4 page
[157] Transcript Volume 2 P57 lines 15-16
[158] D2-2-10 P1

[159] Exhibit D2-2-10 Attachment 5

Furthermore, the presence of heavy water in the building would have adversely affected ongoing construction progress to complete the facility.[160]

OPG's timeline of major project milestones indicates the D2O facility was declared capable of accepting heavy water in March 2020, and in November 2020 the D2O facility accepted heavy water for the first time when PHT heavy water was drained from Unit 3.[161]

AMPCO/CCC submits the appropriate year to include in-service capital amounts in rate base is 2020, when the D2O facility was declared capable of accepting heavy water. Prior to 2020, the facility was neither used nor useful.

**13) Allocation of DRP Storage Costs Post-DRP**

At various points in the evidence OPG notes that, once the DRP is complete, the 1500 m3 of storage within the D2O Storage Facility that was ostensibly built-in support of the DRP may be used in support of the decommissioning of the remaining Pickering Units. Specifically, that storage may be used to meet some of the long-term storage requirements for the Pickering Units' D2O.[162] While this change in use should not happen until the completion of the DRP, such that issues related to the change of use for that storage can likely be addressed at the time the use changes, AMPCO/CCC respectfully submits that it is important to flag the possible change of use and related change in accounting for the costs of storage at the time the OEB determines the rate base impact for the D2O Storage Project over the 5 year period governed by this application.

In AMPCO/CCC's respectful submission it is important that, upon completion of the DRP, the exact use of the 1500 m3 of storage originally built to support the DRP going forward be specified and appropriately accounted for in payment amounts. Given the declining number of nuclear generators requiring D2O in the province, combined with the shutdown of the Pickering Units in the 2024-2025 period, AMPCO/CCC expects and generally supports the use of that storage to support decommissioning activities at Pickering; in using the storage in that way, however, AMPCO/CCC believes it is important to note that the decommissioning activities related to Pickering, including the long term storage of D2O post shutdown, are costs that are contemplated and funded by the Nuclear Liabilities funding that OPG's ratepayers already pay in payment amounts. More specifically, funding for the long-term storage costs associated with D2O from decommissioned units is a cost that is included in the scope of the Ontario Nuclear Funds Agreement as a decommissioning cost that is funded through the Decommissioning Fund.[163] Accordingly, at the time that any part of the storage in the D2O Storage Facility is used for decommissioning, the cost of that storage in payment amounts should either be recovered

[160] Exhibit D2-2-10 page 88
[161] Exhibit D2-2-10 Attachment 4 page 8
[162] See, for example, Exhibit D2 Tab 2 Schedule 10 Page 11.
[163] Exhibit C2 Tab 1 Schedule 1 Page 4

directly from the Decommissioning Fund as other revenue, or the costs of the storage removed from rate base and separately tracked as a cost to OPG that it can then recover from the Decommissioning Fund in the normal course.

AMPCO/CCC respectfully submits that it is necessary to carefully account for the use of assets for decommissioning in this way because the terms of the ONFA are such that on termination, the Province, not OPG or ratepayers, is entitled to any surplus.[164] Accordingly, as the Decommissioning Fund is currently fully funded and has been funded on the assumption that it will bear the costs of decommissioning costs including the long-term safe storage of D2O from decommissioned units, it is important to properly account for costs when associated with decommissioning, as intentionally under-recovering from the Decommissioning Fund by using OPG's base payment amounts to recover decommissioning costs will likely result in over-recovery from ratepayers given the nature of the ONFA.

**14) Conclusion**

For all of the reasons set out in these submissions, AMPCO/CCC respectfully submit that, in relation to the claimed costs of the D2O Storage Facility, the OEB should:

a) permanently disallow $200M of the requested $509M in spending, with the result that OPG will only be allowed to recover a revenue requirement in payment amounts associated with $294.7M in capital spending over the test period taking into account amounts previously included in rate base. In AMPCO/CCC's respectful submission, in recognition of all of the circumstances surrounding the D2O Storage Facility from the Full Release Business Case Summary in 2012 approving the construction of the facility at a cost of $110M to the final claimed capital cost of $509.3M, it is appropriate for the OEB to impose a disallowance of $200M based on 50% of the difference between the Full Release Business case estimate and the final claimed cost as a way to account for both acceptable scope increases and unacceptable, imprudently incurred costs, both of which contributed to the overall cost increase;

b) reject OPG's request to treat any of the spending as having been in rate base since 2016, instead treating the allowed costs as all having been added to rate base effective 2020, the year the facility was commissioned and went into service; and

c) require that the issue of the recoverability in payment amounts of the revenue requirement associated with the portion of allowed rate base additions properly allocated to "DRP-related" storage be addressed in the first cost of service application filed by OPG

[164] Exhibit C2 Tab 1 Schedule 1 Page 13

subsequent to the completion of the DRP in order to ensure that that portion of rate base is funded by the appropriate source.

**ALL OF WHICH IS RESPECTFULLY SUBMITTED THIS 31st DAY OF AUGUST 2021**