ONTARIO POWER GENERATION

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BY RESS

August 17, 2021

Ms. Christine Long
Registrar
Ontario Energy Board
27th Floor - 2300 Yonge Street
Toronto, Ontario
M4P 1E4

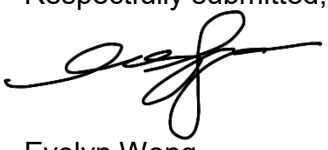
Dear Ms. Long:

Re: EB-2020-0290 Application by Ontario Power Generation Inc.
For 2022-2026 Payment Amounts – OPG Argument-in-Chief

Please find attached OPG's Argument-in-Chief for its payment amount application in EB-2020-0290. OPG has submitted this document through the Regulatory Electronic Submissions System.

If you have any questions regarding this submission, please contact me at 416-592-2181.

Respectfully submitted,



Evelyn Wong

cc: Aimee Collier, OPG
Crawford Smith, Lax O'Sullivan Lisus Gottlieb LLP
Charles Keizer, Torys LLP
Intervenors of Record

EB-2020-0290

OEB Application for
Payment Amounts for OPG's Prescribed Facilities

Argument-in-Chief

Ontario Power Generation Inc.

August 17, 2021

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OVERVIEW

This application covers a pivotal moment for OPG and for the trajectory of electric power in Ontario. As filed, it covered a nuclear revenue requirement of over $16 billion and nuclear in-service additions of over $8.8 billion, encompassing the second half of the Darlington Refurbishment Program ("DRP"), the planned shutdown of the Pickering Nuclear Generating Station, and OPG's transition to a materially smaller workforce and realigned cost-structure.

Through their collaborative efforts, the parties reached a Settlement Proposal at the Settlement Conference, held between June 7th and 14th, 2021, that narrowed the scope of the issues before the OEB in this proceeding considerably. The Settlement Proposal was filed with the OEB on July 16th, 2021 and was approved by the OEB orally at the hearing on August 6th, 2021 as being in the public interest. Set out in the table below are the outstanding issues as per the Settlement Proposal (Ex. O):

"**Complete Settlement**" means an issue for which complete settlement was reached by all Parties and was approved by the OEB.	Issues settled:[1] **1.1, 2.1, 2.2, 3.1, 4.1, 5.1, 6.1, 6.2, 7.1-7.5, 8.1, 9.1, 10.1-10.7, 11.1, 11.2, 12.1, 12.2, 13.3, 13.4, 13.5, 16.1**
"**Partial Settlement**" means an issue for which there is partial settlement, as OPG and the Intervenors who take any position on the issue were able to agree on some, but not all, aspects of the particular issue.	Issues partially settled: **1.2, 13.1, 13.2, 14.1,**

[1] Issues 5.1, 10.6 and 10.7 are subject to any adjustments for the OEB's decision on the D2O Storage Project.

"**No Settlement**" means an issue for which no settlement was reached.	Issues not settled: **7.6, 15.1**

The remaining issues are significant both for OPG and for Ontario's current and future electricity supply. In addition to payment amounts rate smoothing, the unsettled issues relate to two substantive areas of the application: (i) the potential nuclear small modular reactor ("SMR") at the Darlington Nuclear Generating Station ("Darlington") site, and (ii) the proposed in-service additions for the Heavy Water Storage and Drum Handling Facility (the "D2O Storage Project"). OPG has organized its submissions on the partially settled and unsettled issues around these two topics. The OEB has stated that rate smoothing will be considered separately through a subsequent process to be set out in a future procedural order.[2]

The issues related to a potential SMR at the Darlington site – and specifically OPG's ongoing recording of costs to the Nuclear Development Variance Account ("NDVA") established pursuant to Ontario Regulation 53/05 ("O. Reg. 53/05") – are essential to sustaining OPG's ability to effectively advance this innovative, virtually emissions-free generation technology. OPG's ongoing planning and preparation activities for an SMR nuclear generating facility at the Darlington site are consistent with the expectations of the Province of Ontario ("Province"), which is ultimately responsible for system planning and the decision to develop a potential SMR facility.

The D2O Storage Project issues relate to in-service additions for a critical component of the DRP. As fully explored below, this complex and challenging project was more expensive than indicated in the project's initial Business Case Summary ("BCS"), but that BCS was issued before the design of the facility was complete and construction began. It did not reflect the complete scope necessary for the project to deliver its intended functionality or the construction challenges encountered in creating a seismically qualified dike 13 m below ground and integrating the many complex systems required to operate the facility safely. The additional $494.7M that OPG seeks to add to rate base for this project represents the true cost of constructing the project as conclusively established in the expert report provided by Bates White Economic Consulting.

[2] Tr. Vol. 3, p. 124.

1.0 DARLINGTON SMALL MODULAR REACTOR

Under the Settlement Proposal, elements of three issues are unsettled only as related to the potential development of an SMR nuclear generating facility at the Darlington site:

i. the recording of SMR-related costs in the NDVA in the context of the issue identified by the OEB in its Decision on Issues List, dated May 20, 2021 (Issue 13.1),

ii. consideration of SMRs as a component of OPG's customer engagement process (Issue 1.2), and

iii. SMR-related reporting and record keeping requirements (Issue 14.1).[3]

OPG's submissions on these issues are organized around these three unsettled elements.

1.1 Issue 13.1

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?

With respect to Issue 13.1, the OEB has ruled that it will "consider the narrow issue of whether OPG's SMR-related costs are consistent with the purpose of the NDVA and thereby appropriate to be booked in the account" (Decision on Issues List, May 20, 2021, p. 9 (emphasis added)). OPG submits that its SMR-related costs are consistent with the purpose of the NDVA and appropriate to be recorded in the account.

Pursuant to section 5.4(1) of O. Reg. 53/05, OPG is required to establish a variance account in connection with actual non-capital costs incurred and firm financial commitments made for planning and preparation for the development of proposed new nuclear generation facilities. The NDVA was established for this purpose, and was approved by the OEB in the company's first payment amounts proceeding (EB-2007-0905) and in each of the company's subsequent payment amounts proceedings. Consistent with the legislated purpose of the account, OPG is recording in the NDVA variances in the non-capital costs of preliminary planning and preparation activities for a new nuclear generating facility, employing SMR technology, at the Darlington site.

[3] Ex. O, pp. 7-8.

Coincident with OPG's statutory obligation to establish the NDVA, is the statutory obligation of the OEB under section 6(2)(4.1) of O. Reg. 53/05 to ensure that OPG recovers prudent costs incurred in the course of planning and preparation for the development of proposed new nuclear generation facilities.

The SMR-related costs that OPG is recording in the NDVA are consistent with the legislated purpose of the account and with the costs historically recorded therein. There can be no dispute that the NDVA is for the recording of costs for "planning and preparing" to develop a new nuclear generating facility. An SMR generating facility would be, by its nature, a new nuclear generating facility. As described in Ex. F2-8-1, Section 3.0, SMRs are next-generation nuclear reactors designed to have enhanced safety and economic benefits. The non-capital costs that OPG has recorded, and proposes to continue recording, in the NDVA are related to planning and preparation for a new nuclear generating facility, including preparing for a construction license application, conducting technology reviews, vendor selection, and establishing initial project cost estimates (Ex. F2-8-1, p. 3).

The costs recorded in the NDVA are similar in nature to the types of costs historically recorded in the account (Ex. JT3.13). They appropriately represent the variance relative to the OEB-approved reference amounts against which OPG is required to record amounts in the NDVA consistent with O. Reg. 53/05 (Ex. J1.2). For the current rate period, OPG's approved nuclear revenue requirements include annual reference amounts for non-capital work related to new nuclear generation at the Darlington site of $2.3M in 2017, $1.4M in 2018, $1.7M in 2019, $1.8M in 2020 and $1.8M in 2021 (EB-2016-0152 Payment Amounts Order, App. G, p. 15; Ex. F2-8-1, p. 1).

As indicated in Ex. F2-8-1, OPG is in the initial planning and preparation phase for an SMR nuclear generating facility at the Darlington site. OPG's revenue requirement for the IR Term includes annual non-capital costs of approximately $2.3M to continue planning and preparation activities for new nuclear generation at the site, but it does not include, nor does OPG seek recovery of any amounts related to the planning, preparation for development or development of an SMR nuclear generating facility in this proceeding, including any such amounts recorded in the NDVA to date (Ex. H1-2-1, p. 1; Ex. L-F2-08-Environmental Defence-023, p. 1). OPG would

seek disposition of the SMR-related costs recorded in the NDVA in a subsequent proceeding, in which they would be subject to a prudence review (Ex. L-F2-08-Staff-248).

OPG submits 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. The opposite is true: the nature of these expenditures demonstrates that they are consistent with the purpose of the account. 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).

1.2 Issue 1.2

How could OPG further improve its customer engagement process?

The entirety of Issue 1.2 was settled as part of the Settlement Proposal, with the only exception being the consideration of SMRs as a component of the customer engagement process that OPG undertook to understand customer preferences related to aspects of OPG's payment amounts application. For the reasons discussed below, in OPG's view, a requirement that OPG engage with customers on SMRs as part of the company's business planning underpinning a payment amounts application is neither appropriate nor practicable.

Engagement on planning and preparing for an SMR nuclear generating facility at the Darlington site would not have been appropriate, since the decision as to the progress and construction of an SMR is a system planning decision that rests with the Minister of Energy. As a nuclear facility, an SMR at the Darlington site is necessarily subject to a range of policy decisions and regulatory requirements. While OPG would own the facility, the major policy questions related to such a facility, including the IESO's determination of the system need, will not ultimately be made by OPG. Similarly, decisions around the configuration and construction of an SMR nuclear generating facility at the Darlington site would be subject to regulatory approval by the Canadian Nuclear Safety Commission ("CNSC"). CNSC requirements include mandatory public and

Indigenous community engagement activities.[4] In view of these processes, OPG believes that there would be no practical scope for any additional engagement in connection with the company's business planning.

In addition to the above considerations, customer engagement on SMRs in the context of the current payment amounts application would not have been practicable. At the time OPG was developing its customer engagement process that informed the business planning underpinning this application, the development of such a facility was not being actively explored within OPG (Ex. L-A2-02-CCC-020, part c).

On the basis of the above, OPG 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.

1.3 Issue 14.1

Are the proposed reporting and record keeping requirements, including performance scorecards proposed by OPG, appropriate?

This issue is settled except with respect to SMR-related reporting and record keeping requirements.

The Settlement Proposal includes a range of reporting and record keeping requirements, some of which encompass the NDVA and, should it be legislated as a prescribed facility, a potential SMR nuclear generating facility at the Darlington site (Ex. O, Appendix A). These reporting requirements are to be posted on the OEB and OPG's website, and include an extensive nuclear performance reporting scorecard that contains 27 discrete performance measures for the company's prescribed nuclear facilities spanning the OEB's four outcome categories, with separate annual reporting for the each of the nuclear generating stations on each measure (Ex. A1-3-2, Attachment 1, p. 2). In addition, the balance of the NDVA will continue to be included in quarterly reporting on OPG's deferral and variances accounts. Finally, OPG will annually report

[4] REGDOC-3.2.1 (*Public Information and Disclosure*), and REGDOC-3.2.2 (*Indigenous Engagement*), respectively.

on the prior year's capital in-service additions and construction work in progress balances for prescribed facilities by April 30th.

In OPG's submission, the above 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.

2.0 THE D2O STORAGE PROJECT

2.1 Issue 7.6

Are the proposed test period in-service additions for the D2O Project reasonable?

As no settlement was reached on this issue, it was addressed in an oral hearing held over three days. An OPG witness panel testified on all aspects of the D2O Storage Project ("project"). An expert witness panel from the firm of Bates White Economic Consulting ("Bates White") testified on their independent estimate of the cost to design, engineer, procure materials for, construct, and commission the as-built D2O Storage Project (Ex. D2-2-11, Attachment 3).

As fully explained below, OPG respectfully submits that the remaining $494.7M of capital that OPG seeks to add to rate base was prudently incurred and should be approved.[5] The project was needed for the DRP and for operational improvements at the Tritium Removal Facility ("TRF") and Darlington. OPG undertook the project after substantial investigation and completed it prudently. The amount that OPG seeks to add to rate base is reasonable and represents the true cost of constructing the D2O Storage Project as conclusively established in the expert evidence provided by Bates White (Ex. D2-2-11, Attachment 3).

[5] The total capital expenditure for the D2O Storage Project is $509.3M. Of this amount, the OEB previously approved the addition of $14.6M to rate base, leaving $494.7 at issue in this proceeding. Additionally, $0.7M was incurred for non-capital costs in 2013.

OPG's decision to undertake the D2O Storage Project as part of the DRP was prudent, as was its execution of the project. The D2O Storage Project was one of the prerequisite projects for the DRP and the project's forecasted total cost at the time of the Release Quality Estimate ("RQE"), $381.1M, formed part of the $12.8B overall cost estimate for the DRP.[6]

Section 2.0 contains the following sections:

- The Applicable Prudence Standard – discusses the standard of review that the OEB has articulated and applied when reviewing the prudence of completed capital projects.
- OPG's Request – covers the capital amounts OPG seeks to place in service and the related ratemaking treatment.
- A Description of the Project – describes the first-of-a-kind D2O Storage Project.
- The Need for the Project – discusses the DRP and operational improvement storage needs that required OPG to construct the project.
- Contracting Under the ESMSA and the Selection of Black & McDonald ("B&M") – addresses OPG's decision to contract under the Extended Master Service Agreement ("ESMSA") and the process used to select B&M as the contractor for the project.
- OPG's Management of the B&M Contract – discusses how OPG prudently managed B&M despite some early challenges.
- Cost Changes Due to Scope, Design Complexity and Construction Conditions – covers some of the main aspects of the project that let to higher than originally estimated costs.
- Termination of B&M – explains why OPG's decision to terminate B&M was necessary and prudent.
- OPG Becoming the Interim General Contractor – explains why it was necessary for OPG to become the general contractor and continue work on the project as it proceeded to select a new contractor.
- Selection and Management of CanAtom – discusses the process used to select CanAtom and how OPG prudently managed the contract with CanAtom, including negotiating a maximum price contract to complete the project.
- Project Completion and Commissioning – describes the completion and commissioning of the project.
- Conclusion – summarizes the evidence that supports OPG's request to add the remaining $494.7M to rate base as part of the reasonable cost of the D2O Storage Project.

2.1.1 The Prudence Standard

The issue before the OEB is whether the $494.7M remaining cost for the D2O Storage Project is reasonable. For completed capital projects, the OEB has traditionally employed a prudence review to determine the reasonableness of the costs expended.

[6] The $381.1M total cost comprised $14.6M that was approved for rate base addition, $0.7M in non-capital costs and $365.9M in forecasted in-service additions in EB-2016-0152 that OPG subsequently removed from the proposed revenue requirements in the N2 Impact Statement (Ex. J3.3).

In practical terms, "prudence" and "reasonableness" are essentially synonymous unless otherwise prescribed by statute. As Justice Rothstein wrote for the Supreme Court of Canada in *ATCO Gas Pipelines Ltd. v. Alberta Utilities Commission*:

> In the context of utilities regulation, I do not find any difference between the ordinary meaning of a 'prudent' cost and a cost that could be said to be reasonable. It would not be imprudent to incur a reasonable cost, nor would it be prudent to incur an unreasonable cost.[7]

The standard that the OEB has used in reviewing the prudence of expenditures on completed capital projects is set out in RP-2001-0032. There the OEB defined the standard at paragraph 3.12.2 in the following way:[8]

> - To be prudent, a decision must have been reasonable under the circumstances that were known or ought to have been known to the utility at the time the decision was made.
> - Hindsight should not be used in determining prudence.
> - Prudence must be determined in a retrospective factual inquiry, in that the evidence must be concerned with the time the decision was made and must be based on facts about the elements that could or did enter into the decision at the time.

This approach to prudence reviews was affirmed by the Ontario Divisional Court and the Court of Appeal in *Enbridge Gas Distribution Inc. v. Ontario Energy Board* (2005), 75 O.R. (3d) 72 (Div. Ct.); rev'd on other grounds, (2006), 41 Admin L.R. (4th) 69; leave to appeal to SCC refused, [2006] SCCA No 208 (SCC). This approach to prudence was also employed in the OEB's review of OPG's capital expenditures for the completed Niagara Tunnel in EB-2013-0321 (EB-2013-0321, Decision with Reasons, November 20, 2014, p. 30).

While the Supreme Court held that the OEB is not required to continue using this standard in prudence reviews (*Ontario Energy Board v. Ontario Power Generation Inc* (2015), 2015 SCC 44 at para. 103), its decision does not suggest that the OEB should abandon its previously

[7] [2015] 3 SCR 219, at para. 35.

[8] In *Ontario Energy Board v. Ontario Power Generation Inc* (2015), 2015 SCC 44 at para. 79, the Supreme Court held that applying a presumption of prudence would conflict with the burden of proof in the *Ontario Energy Board Act*, 1998. OPG's submissions do not rely on a presumption of prudence; it has presented extensive evidence that fully supports a finding of prudence. The formulation of the OEB's approach to determining prudence shown here removes any reference to a presumption of prudence.

articulated prudence standard or that the *Enbridge* formulation is disfavoured. Rather, the opposite is true:

> The prudent investment test, or prudence review, is a valid and widely accepted tool that regulators may use when assessing whether payments to a utility would be just and reasonable. While there exist different articulations of prudence review, *Enbridge* presents one express statement of how a regulatory board might structure its review to assess the prudence of utility expenditures at the time they were incurred or committed. (*Ontario Energy Board v. Ontario Power Generation Inc* (2015), 2015 SCC 44 at para. 102).

On the continued use of the prudence test, the decision goes on to state:

> The question of whether it was reasonable to assess a particular cost using hindsight should turn instead on the circumstances of that cost. I emphasize, however, that this decision should not be read to give regulators carte blanche to disallow a utility's committed costs at will. Prudence review of committed costs may in many cases be a sound way of ensuring that utilities are treated fairly and remain able to secure required levels of investment capital. As will be explained, particularly with regard to committed capital costs, prudence review will often provide a reasonable means of striking the balance of fairness between consumers and utilities. (*Ontario Energy Board v. Ontario Power Generation Inc.* (2015), 2015 SCC 44 at para. 104).

OPG respectfully submits that the continued application of the OEB's historical approach to prudence review is appropriate in this proceeding. The capital costs for the completed D2O Storage Project are unquestionably committed. In determining the reasonableness of its costs, OPG's decisions over the course of completing this complex, first-of-a-kind project should be evaluated based on what was known or reasonably should have been known at the time of the project. This is particularly true in light of O. Reg. 53/05 section 6.(2)4.ii, which requires that the OEB ensure recovery of the DRP and other costs eligible for Capacity Refurbishment Variance Account ("CRVA") treatment "if the Board is satisfied that the costs were prudently incurred."

OPG further submits, with respect, that applying this standard leads to one conclusion – the costs OPG seeks to recover to design and construct the D2O Storage Project were prudently incurred. The costs above the original budget arose for two reasons. First, the original budget estimate was prepared before the full scope of the project was understood as the design was not completed and engineering had not begun. Second, the site-specific challenges associated

with constructing the project adjacent to the Heavy Water Management Building ("HWMB") and within the protected area of Darlington while the station was undergoing refurbishment were not, and could not reasonably have been, fully appreciated prior to construction. This led to the project's costs being under-estimated prior to the final BCS.[9]

In OPG's respectful submission, the fact that the project cost substantially more than its early estimates does not make the additional cost *per* se imprudent. The costs OPG seeks to recover for the project reflect the true costs to design, engineer, procure materials for, construct, and commission the D2O Storage Project to meet the needs that gave rise to its construction. The project's increasing scope and complexity along with its actual cost of construction caused its cost to be higher than originally estimated, not imprudent management by OPG. That the amount OPG seeks to recover is a realistic estimate of the true project cost is shown by the expert analysis contained in the Bates White report (Ex. D2-2-11, Attachment 3).

2.1.2 OPG's Request

OPG seeks a determination that the D2O Storage Project's remaining capital cost of $494.7 million is reasonable and should be added to rate base. The result of this determination would be the inclusion of this amount in the rate base approved in this proceeding as of the dates various portions of the project were placed into service (Ex. D2-2-10, p. 13). The OEB's determination of the amount to be included in rate base will also effectively resolve the unsettled portion of Issue 13.2 because the D2O Storage Project costs to be recovered through the CRVA in this application will flow directly from the approved rate base additions.[10]

2.1.3 Description of the D2O Storage Project

The D2O Storage Project is a first-of-a-kind facility necessary to safely store tritiated heavy water from Darlington units undergoing refurbishment and to support the operations of the TRF and

[9] See Ex. D2-2-10, Attachment 2q.
[10] In this application, OPG has sought to recover year-end 2019 audited balance of the CRVA related to the D2O Storage Project, as further discussed under Issue 13.2.

Darlington.[11] To enable the project to safely store various streams of heavy water[12] and limit emissions, the project includes 25 stainless steel nuclear grade storage tanks[13] contained in a seismic dike and a number of process and support systems necessary for safe operation (Ex. D2-2-10, Figure 1, reproduced below). The project also includes a drum handling facility, which enables the cleaning, weighing and storage of heavy water drums.

The project provides a total of 2,100 m^3 of heavy water storage. Of this total, 1,500 m^3 is to accommodate the heavy water from the moderator and primary heat transport ("PHT") systems of two Darlington units undergoing refurbishment simultaneously and 200 m^3 is to facilitate flushing and other support operations associated with refurbishment. This 200 m^3 of storage is designated for use by Darlington when not needed for refurbishment. The project also includes 400 m^3 of storage to improve ongoing heavy water operations at Darlington and at the TRF. The TRF provides detritiation services to all the operating nuclear generating stations in Ontario. The drum handling, storage, testing and cleaning facility (drum handling facility) supports the regular transportation of heavy water to and from the Pickering and Bruce stations for detritiation.[14]

The facility's tanks are connected to each other, the drum handling facility, the HWMB, the TRF and the Darlington generating units through a series of pipes, valves, pumps and headers. These connections are essential in providing the project's intended functionality and operational flexibility (Ex. L-D2-02-AMPCO-137, Attachment 46, pp. 5, 11). As with the tanks, the pipes and valves that handle heavy water are made of nuclear grade stainless steel to preserve the chemical properties of the heavy water and avoid corrosion.

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[11] Tritium, a low-energy, radioactive molecule, is a by-product of a heavy water deuterium atom being irradiated from nuclear fission. The TRF functions to remove the tritium from heavy water so that the heavy water can be safely used in primary heat transport and moderator systems of the Darlington generating units. This process is known as detritiation and is essential for the safe operation of all Ontario CANDU nuclear reactors, including those at Pickering and Bruce. See Ex. D2-2-10, Attachment 1 for additional explanation.

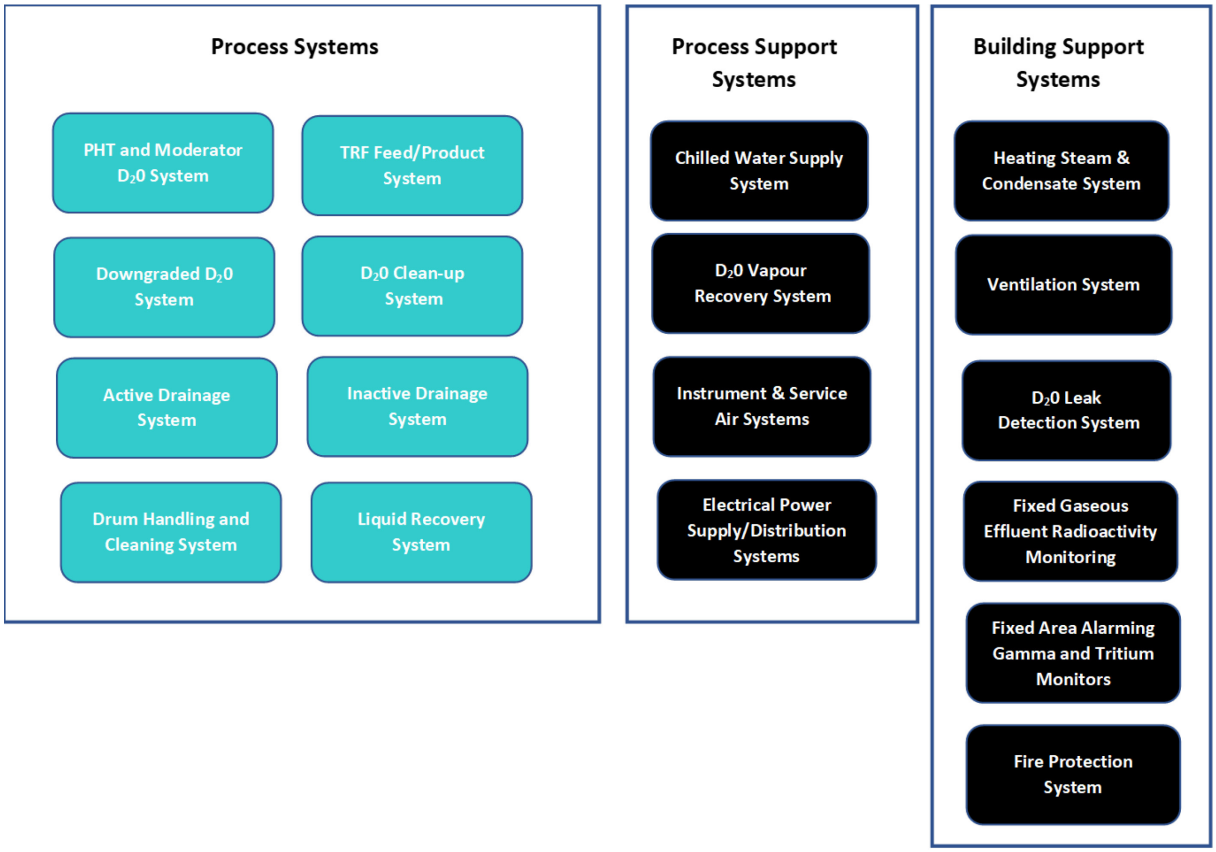
[12] Streams of heavy water refer to heavy water from different sources that can have different levels of tritium concentration, isotopic properties and contamination and therefore must be handled and stored separately (Ex. D2-2-10, p. 15, ft. nt. 13 and Attachment 1; Ex. L-D2-02-AMPCO-103, Attachment 2, p. 8).

[13] The project also includes three smaller tanks that are not routinely used to store heavy water for a total of 28 tanks (Ex. D2-2-10, p. 18).

[14] The drum handling facility also could potentially support heavy water sales, but none are forecasted over the term of this application (Ex. G2-1-1, p. 4).

The D2O Storage Project facility's systems are an integral part of its safe operation, and are independently provided in the facility (Ex. D2-2-10, Attachment 2p, p. 20). These systems are shown in Figure 1 below. The number of required systems and the interactions among them necessitated design work, precise engineering and challenging construction logistics during installation. The instrumentation and control for these systems is also complex, requiring that each system be connected to the new control panel in the HWMB control room to allow the integrated operation of the entire heavy water management system at Darlington. As well, displays and backup controls for each system are provided within the facility (Ex. D2-2-10, p. 7).

Figure 1 – D2O Storage Project Systems



2.1.4 Need for the D2O Storage Project

The D2O Storage Project was conceived and executed to meet two distinct needs – support the DRP, and achieve operational improvement in the handling of heavy water at the TRF and Darlington (Ex. D2-2-10, pp. 35-38). The need for operational improvement arose first and gave

rise to an early operational improvement storage project. When OPG began to consider Darlington refurbishment, the operational improvement storage project was deferred pending a decision on refurbishment (Ex. D2-2-10, p. 36).

Once OPG determined it would proceed with the DRP, it merged the operational improvement and refurbishment heavy water projects into the current D2O Storage Project after an analysis showed that doing so was forecasted to produce overall cost savings of 12% (Ex. J1.6, p. 19). Upon approval of the project charter for the merged project (Ex. D2-2-10, Attachment 2b), the project was designed and executed to address both the identified needs holistically.

OPG fully investigated available approaches for addressing the need for additional heavy water storage. Prior to commencing the project, it engaged an external expert, Kinectrics, initially to develop the options for addressing the operational improvement storage needs (Ex. L-D2-02-AMPCO-087, Attachment 1). OPG subsequently retained Kinectrics to refine and test these options (Ex. L-D2-02-AMPCO-131, Attachment 6).[15] OPG conducted a further evaluation of heavy water storage options as part of the DRP (Ex. J1.6, Attachment 1). All of these studies identified a storage facility employing below ground heavy water storage with associated process support and building support systems as the preferred option and explained why such a facility was the appropriate choice to safely store heavy water (Ex. L-D2-02-AMPCO-087, Attachment 1, p. 26; Ex. L-D2-02-AMPCO-131, Attachment 6, pp. 59-60).

Both the second Kinectrics study and the DRP study explicitly recommended that the new storage be built on the site where the D2O Storage Project is located (Ex. L-D2-02-AMPCO-131, Attachment 6, pp. 59-60; Ex. J1.6, Attachment 1, p. 4). After these earlier studies identified the current location as preferred, OPG conducted a value engineering workshop that examined alternative locations and confirmed that the current site remained the preferred location (Ex. L-D2-02-AMPCO-97, Attachment 6, p. 27).[16]

[15] OPG also engaged another external expert to review and report on operating experience with the HWMB so as to use this experience to improve the design of the D2O Storage Project (Ex. L-D2-02-AMPCO-096, Attachment 1).

[16] OPG also had external experts study the cost of the facility. These studies were conducted both for the early operation improvement project and for the merged D2O Storage Project (Exhibit D2-2-10, Attachment 2k, p. 15; Ex. L-D2-02-AMPCO-131, Attachment 6, pp. 76-81; Ex. L-D2-02-AMPCO-137, Attachment 128).

Refurbishment Needs

Given the significant overlap among units being refurbished, as envisioned in the refurbishment schedule in place at the time the D2O Storage Project commenced (Ex. J1.7, p. 1 and Attachment 1, p. 19), the D2O Storage Project was designed to accommodate the heavy water needs of two units undergoing refurbishment (Ex. D2-2-10, Attachment 2b, p. 5). This required the ability to store 800 m^3 of PHT heavy water, 700 m^3 of moderator water and 200 m^3 of storage for downgraded heavy water generated during decontamination, for a total of 1,700 m^3 of refurbishment-related storage (Ex. D2-2-10, Attachment 2c, p. 6).[17]

The fact that OPG was able to develop and implement a temporary solution for storing the heavy water from a single unit, Unit 2, in no ways impacts the need for the D2O Storage Project for the ongoing DRP (Ex. D2-2-10, p. 87; Ex. D2-2-10, Attachment 5). The approach used for Unit 2 cannot be replicated for multiple units undergoing simultaneous refurbishment outages and therefore cannot be used to meet the heavy water needs of the DRP through to its completion. Even the temporary use of this approach for Unit 2 involved managing ongoing risk. In particular, once all available storage in the HWMB was filled, the station would have faced great challenges in the event of an emergency situation that required a moderator drain because there was no ready place to store additional heavy water (*Ibid.)*.

Operational Improvement Needs

The project provides 400 m^3 of storage necessary to improve the operation of the TRF and Darlington. The need for this additional storage was identified in the early 2000s and in 2004, OPG commissioned a study to determine how best to address it (Ex. L-D2-02-AMPCO-087, Attachment 1). That study identified that additional storage was required both to increase the operational flexibility of the TRF and to improve the management of heavy water during generating unit outages at Darlington. As part of the definition phase work for the early operational improvement project, OPG commissioned a follow-up study in 2007 to review the

[17] Ex. J1.6 is OPG's study of various refurbishment heavy water drain scenarios and the resulting amounts of heavy water storage required for refurbishment. OPG selected the middle (medium risk) scenario (see Ex. J1.6, pp. 8-9), which required 845 m^3 of refurbishment storage for each unit undergoing refurbishment. Multiplying this per unit figure by two to account for the simultaneous refurbishment of two units produces, after rounding, the 1,700 m^3 of refurbishment-related storage included in the D2O Storage Project.

options for improving heavy water management in greater detail and begin developing the costs of these options (Ex. L-D2-02-AMPCO-131, Attachment 6).

Tritium is constantly being produced at CANDU plants and must be removed on a regular basis through the operation of the TRF (Ex. L-D2-02-AMPCO-131, Attachment 6, p. 12). The additional capacity created by the D2O Storage Project will improve TRF operations by: (1) allowing greater storage of TRF feed and product to address any gaps between TRF availability and the demand for tritium removal, (2) enabling the storage of additional heavy water to address periods when the TRF is undergoing an outage, including outages related to the planned TRF life extension, (3) facilitating a more flexible schedule for heavy water shipments to and from the Pickering and Bruce stations, and (4) potentially assisting with heavy water management once Pickering commercial operations end.

OPG also had identified the need to increase heavy water storage at Darlington to meet station needs. Inadequate heavy water storage space at Darlington constrained OPG's ability to address competing storage demands for outages and process needs. For example, during a station containment outage, the moderator heavy water must be drained and stored, which occupies a large portion of the storage used by the TRF (Ex. L-D2-02-AMPCO-087, Attachment 1, p. 16).

2.1.5 Contracting under the ESMSA

Selection of ESMSA Contractors

The D2O Storage Project was the first major engineer, procure, and construct ("EPC") project undertaken using the Extended Services Master Services Agreement. The operation of the ESMSA is fully explained in OPG's DRP evidence (Ex. D2-2-4, pp. 23-25 and Attachment 20). The ESMSA approach offers many advantages, in terms of resource optimization, fee for performance and value for money (Ex. D2-2-10, p. 45). OPG continues to complete many areas of the DRP under the ESMSA and to employ EPC contracts for major work bundles (Ex. D2-2-4, pp. 5, 23).

Through the competitive bid process to select ESMSA contractors, OPG evaluated the technical abilities of the responding experienced and nuclear qualified contractors as well as their pricing

proposals. Based on this evaluation, OPG selected two experienced and qualified ESMSA contractors: ES Fox and Black & McDonald (Ex. D2-2-10, p. 45).

OPG respectfully submits that conducting the D2O Storage Project under the ESMSA was a reasonable and prudent action. The purpose of the ESMSA was to establish standard contract terms and requirements with one or more contractors who were selected through a competitive process and whose technical qualifications, including safety and quality assurance programs, were pre-established through a vetting process. The ESMSA contract created a structure that linked a portion of the contractors' target price and corresponding fee to their performance in key areas such as safety, job performance, cost and schedule (Ex. L-D2-02-SEC-095, Attachment 1). Employing the ESMSA structure on a large EPC project in advance of commencing the unit refurbishments was a necessary and prudent first step to deploying this contract structure in other areas of the DRP (Ex. D2-2-10, p. 46).

Selection of B&M for the D2O Storage Project

OPG began the competitive solicitation for the D2O Storage Project by issuing a work request to each of the two qualified ESMSA contractors, B&M and ES Fox, in March 2012 (Ex. D2-2-10, p. 46).[18] The work request included a scope of work ("SOW") that outlined OPG's required schedule, deliverables and procedures. The work request also included OPG's Preliminary Design Requirements and a Conceptual Design Report, both of which provided proponents with additional information on the project's scope and design objectives.

The work request also included the criteria used in scoring and the weighting assigned to each criterion. Evaluation of key project personnel and the team's experience were weighted 25%. Risk management and contingency plans were weighted 15%. Overall quality of the proposal was weighted 10%. The performance fee for engineering was weighted 30% and the overall project cost estimate was weighted 20%. This weighting resulted in OPG placing equal emphasis on the proposals' technical factors and cost, as each of these two categories represented 50% of the scoring.

[18] CanAtom was added as a third ESMSA contractor in December 2014 (Ex. D2-2-10, p. 44).

Both B&M and ES Fox responded to the work request by assembling a team to undertake the project. OPG first assessed each team's proposal on the technical criteria before evaluating price (Ex. D2-2-10, p. 47). It is important to emphasize that while ES Fox scored higher on the technical criteria, both teams were viewed by OPG as fully qualified to execute the project. EllisDon, B&M's first-tier excavation and concrete subcontractor, was seen as a key component of the B&M team, given the extent and importance of the underground and concrete work necessary to complete the seismic dike. The other first tier subcontractor on the team, RCM Technologies Canada Corporation ("RCMT") for engineering, was led by an engineer who had worked in various senior engineering capacities at OPG/Ontario Hydro for 30 years, most of which was spent undertaking projects at Darlington (Ex. L-D2-02-AMPCO-104, Attachment 1, p. 1).

With OPG having found that both teams satisfied the technical criteria, the evaluation moved to price where the B&M team's proposal led. OPG then negotiated with both teams to bring their price proposals into better alignment, with the result being that the B&M team continued to offer a significant price advantage. (Ex. D2-2-10, p. 47). At the conclusion of the negotiations, the significant price advantage of the B&M team's proposal resulted in it receiving a higher overall score and, on that basis, winning the contract (Ex. D2-2-10, p. 47).

OPG respectfully submits that the RFP process that selected B&M was fair, appropriately weighted bid price and technical factors, and aligned with the processes that OPG used for other RFPs under the ESMSA for DRP prerequisite projects. Moreover, as OPG's witness Mr. Reiner testified, had the weight given to technical factors in selection criteria been higher, the proponents' proposals would have changed, which makes it impossible to determine which team would have been selected under a different weighting (Tr. Vol. 3, p. 13).

2.1.6 OPG's Management of B&M

The early effort on the project was dedicated to verifying, revising and, where possible, improving the preliminary project design as explained in the SOW (Ex. L-D2-02-AMPCO-103, Attachment 1, p. 20). In other words, the first step of the project was to further define the project by testing and challenging the preliminarily solutions reflected in the Conceptual Design Report (Ex. L-D2-02-AMPCO-106, Attachment 1 (emphasis added)). Not only is the D2O Storage Project a First of a Kind facility, it is also part of the system used for heavy water management at Darlington.

As such, the project needed to seamlessly integrate with the other major components of that system, namely the HWMB, and the TRF (Ex. L-D2-02-AMPCO-103, Attachment 2, p. 8).[19] This could not have been accomplished without the in-depth involvement of experts in Darlington's heavy water system and TRF operations (Ex. J1.5, Attachment 1, p. 7; Ex. D2-2-10, p. 50).

Integrating the external designers from RCMT and the various internal stakeholders was a challenging process and not without friction. Rather than this process being an example of imprudence however, OPG respectfully submits that the opposite is true – to have done otherwise would have been imprudent. Part of executing a project whose complexity was, at the time, not fully understood was learning how best to bring OPG expertise and contractor resources together to completely define and ultimately deliver the project with the required functionality.

OPG's early project management was premised on the fact that the project was constructed under an EPC contract whereby the contractor is responsible for the engineering, procurement and construction of the project according to the owner's specifications. Initially, OPG took the approach that the contract provision that gives the contractor sole responsibility for the means and methods of completing the work (Ex. D2-2-10, Attachment 2d, pp. 25-26) limited not only OPG's ability to direct means and methods but also to require that the contractor demonstrate how it intended to perform the work (Ex. J1.5, Attachment 1, p. 11).

Early in 2013, OPG recognized that this oversight approach was limiting its ability to lend expertise to B&M in areas that could improve overall project performance and consequently began employing a much more collaborative management style where contractor and OPG personnel worked together to identify and solve problems (Ex. L-D2-02-Staff-105, Attachment 2, p. 21). OPG continued to apply this collaborative approach throughout the remainder of the project and continues to apply it to the benefit of the DRP as a whole (Ex. D2-2-4, pp. 2-4).

[19] The official title of the project is the "Heavy Water Management Building West Annex". This title emphasizes the interconnection between and common operation of the two facilities. OPG has used the "D2O Storage Project" in this evidence for consistency with prior filings and to better distinguish this project from the HWMB (Ex. D2-2-10, p. 1, ft. nt. 2).

2.1.7 Project Cost Increased Due to Necessary Changes to Scope, Design Complexity and Construction Conditions

Throughout the early stages of the D2O Storage Project, its scope evolved. These changes were as a result of a growing understanding of what was required for the project to fulfill its intended purpose and for OPG to meet its commitments under the DRP. This sometimes meant adding scope, and at other times removing it. At all times, OPG prudently evaluated the project's scope and ensured that it was necessary to address the needs that the project was created to meet, considering cost and schedule impacts.

Among the earliest changes in scope was the decision to convert the facility to a stand-alone building. This was necessary when early design work determined that the D2O Storage Project facility's footings would interfere with the existing footings of the HWMB. While the project had considered that a stand-alone building might be required, an attached building was initially chosen because of its operational benefits (Ex. L-D2-02-AMPCO-106, Attachment 1, p. 34).

The move to a stand-alone building had other consequential impacts on scope. Moving to a stand-alone building, along with water hammer issues, necessitated the construction of the buried pipe chase to connect the project piping to the HWMB (Ex. D2-2-10, p. 110). The move also necessitated an extension of the covered causeway between the two buildings (Ex. D2-2-10, p. 90). Undertaking the project as a stand-alone building also caused one scope reduction, which was to eliminate the requirement to first demolish the existing loading dock on the west side of the HWMB and then rebuild it in a new location.

Design complexity also increased as the specifics of the connections necessary to achieve the project's full intended functionality were better understood. In addition, investigation into the capacity of existing systems in the HWMB confirmed that the D2O Storage Project would require independent systems for functions like instrument and service air (compare Ex. L-D2-02-AMPCO-137, Attachment 40, pp. 6, 8 with Ex. L-D2-02-AMPCO-137, Attachment 13, p. 5).

Ultimately, the major process support and building support systems shown in Figure 1 above were required to be independently provided in the D2O Storage Project.[20]

OPG also looked for ways to reduce scope. In April 2014, OPG, RCMT and B&M initiated an exercise to review the scope of the project (Ex. D2-2-10, pp. 67-68). Among the results of this exercise was the elimination of the office space from the project, which also removed the need for a separate air handing system for occupied portion of the facility and for washrooms. The exercise also simplified the piping connections in the project primarily by increasing the use of bi-directional pipes, which reduced the amount of piping by approximately 900 m and eliminated numerous valves and other components (Ex. D2-2-10, p. 68).

Low Pressure Service Water Line

Relocation or removal of all buried services that intersected the project site was part of the initial SOW (Ex. L-D2-02-AMPCO-103, Attachment 1, p. 23). The issue with the Low Pressure Service Water Line ("LPSW") arose because OPG's early design documents did not sufficiently distinguish the relocation of this very large pipe from other buried service relocation work and the contractor's bid did not include sufficient scope and schedule to execute this complex task (Ex. D2-2-10, p. 58). The relocation of the LPSW required construction and shoring of a trench 6 m deep, dewatering, the positioning, welding and coating of a 30-inch pipe, filling and restoration (Ex. D2-2-10, pp. 56-57). Inclusion of the effort required to relocate the LPSW increased both cost and schedule, but this activity was always a necessary part of the project and the resulting costs were prudently incurred.

Soil Management

OPG had done sampling following a 2009 spill at the Injection Water Storage Tank to investigate tritium levels in the soil and groundwater in the area north of the project site (Ex. D2-2-10, p. 44). Sampling indicated that the water plume was migrating toward the project site (Ex. D2-2-10, p. 44). What was unknown at the time OPG issued the work request for the project was the extent of the tritium that would be found in the wet soil at the site during excavation.

[20] Only the breathing air system is shared between the HWMB and the D2O Storage Project facility (Ex. L-D2-02-AMPCO-106, Attachment 1, pp. 122-125) The TRF also supplies water for fire protection and provides steam which is used to heat water for the heating system in the D2O Storage Project (*Ibid*., pp. 120, 135).

About the same time that OPG issued the work request for the project (March 2012), it engaged a contractor to test boreholes and establish monitoring wells on the project site so that the successful proponent would have up to date information on the extent of tritium when work began (Ex. D2-2-10, p. 44; Ex. L-D2-02-Staff-152). As the concentrations of tritium, and thus the type and cost of treatment that ultimately would be required, were unknown at the time the work request was issued, OPG instructed both proponents to assume in their proposals that the soil could be disposed of in a non-hazardous landfill site (Ex. L-D2-02-Staff-155). This was both a conscious and correct decision to improve comparability between the contractors' price proposals. The alternative would have been to allow inconsistent assumptions about the cost of addressing tritium in the soil to it skew the cost comparison between the proponents.

When testing revealed the low levels of tritium in the soil at the site, OPG determined that the most efficient way to proceed was to construct a facility to hold and dewater the wet soil while the low levels of tritium present dissipated (Ex. D2-2-10, pp. 53-54). The amount of storage required, the total of which increased due to the excavation of the LPSW and the pipe chase, and the cost of constructing the F1 soil laydown area to address the low levels of tritium required additional funding. The risk that additional funding would be needed for this purpose was identified in the project's first BCS (Ex. D2-2-10, Attachment 2m, p. 9).

Dewatering

As with soil management, OPG was aware of the need to dewater the excavation due to the high water table (Ex. L-D2-02-AMPCO-137, Attachment 126, p. 11). What caused the cost to increase above initial estimates were the volume of water, the need to sample and, as necessary, treat the water before release, and the dewatering requirements of the LPSW and pipe chase. These factors increased dewatering costs, not imprudence on OPG's part.

The volume of water is a product of the specific geology and hydrology of the site as encountered during excavation. These subsurface conditions cannot be fully known in advance. The clearest example of this is the destruction of the northern (40%) portion of the sub-slab by water upwelling through the bedrock (Ex. D2-2-10, p. 72). Despite the fact that OPG had fully dewatered the excavation for months before pouring the sub-slab and that the southern section of the sub-slab (60%) was poured without incident, upon pouring the northern section, hydraulic pressure led to

significant uplift (between 2 and 8 inches). The force of the water was sufficient to break the sub-slab into pieces, some with bedrock attached to their undersides. As a result, the site had to be drained, dried and the sub-slab repoured.

Dewatering cost also increased due to the low levels of tritium at the site, which required that the water be tested and, in some cases, held for additional processing before disposal (Ex. D2-2-10, p. 54). Finally, as with soil management, dewatering costs increased due to the need to dewater the LPSW and the pipe chase excavations.

2.1.8 Termination of B&M from the Project

OPG did not decide to terminate B&M's purchase order for the D2O Storage Project lightly. B&M was, and remains, a qualified ESMSA contractor engaged in the DRP (Ex. D2-2-4, p. 25). As fully documented in OPG's evidence (Ex. D2-2-10, pp. 64-65, 67-70), OPG made numerous attempts to develop an acceptable path forward for completing the project. After months of being presented with ever increasing cost estimates (see Ex. D2-2-10, pp. 64-65, Chart 3), OPG determined that unless B&M assumed increased risk for the cost, B&M could not continue on the project. B&M was unwilling to assume additional risk. Faced with this impasse, OPG terminated the contract.

OPG respectfully submits that this was a prudent decision. OPG had instituted changes to its approach in an effort to work collaboratively with B&M to improve the project's schedule and cost performance, but these efforts did not yield the requisite cost or schedule certainty. While this was not the only issue related to B&M's performance, it was the dominant reason for B&M's termination.[21]

The $14M mentioned in the Auditor General's Report (Ex. K1.9, p. 156) was based on an estimate of OPG's maximum claim for the potential cost of transitioning between contractors (Ex. L-D2-02-SEC-096, Attachment 3, p. 12, Item 20). As Mr. Reiner explained, these costs were spent on necessary work for the project; they were not wasted (Tr. Vol. 3, pp. 14-15).

[21] OPG's termination letter also mentions B&M's ongoing difficulty in working with EllisDon (Ex. D2-2-10, p. 68; Ex. L-D2-02-SEC-096, Attachment 1) and there were issues with safety performance (Ex. D2-2-10, pp. 66-67).

As OPG's evidence notes, B&M cooperated in the transition to OPG as general contractor, including working with OPG on the assumption of B&M's contracts with its Tier 1 subcontractors, EllisDon and RCMT (Ex. D2-2-10, p. 70). After a period of negotiation, OPG and B&M reached a settlement on a number of outstanding commercial issues, including all issues related to the D2O Storage Project. The settlement, which OPG's evidence discusses in detail (Ex. D2-2-10, pp. 69-70), included claims by EllisDon and RCMT for work completed prior to their becoming direct sub-contractors to OPG. While these settlements involved the setoff of numerous claims, in the end, OPG paid only the agreed cost of completed work, in some instances at a discount, and did not pay any additional performance fees as part of the settlement (*Ibid.)*.

2.1.9 OPG as General Contractor

Upon termination of the B&M contract, OPG became the general contractor, assumed the B&M contracts with EllisDon and RCMT, and awarded 14 purchase orders ("POs") to B&M's Tier 2 subcontractors. These contracts and POs were used to ensure continued progress on the project while OPG undertook to engage a new general contractor (Ex. D2-2-10, p. 71).

To replace the work B&M previously performed and to meet emerging project needs, OPG executed two SOWs under its existing ESMSA contract with ES Fox. The first was to support ongoing excavation by EllisDon, which included hoisting and rigging and other construction support. The second SOW related to the temporary trailers acquired to house contractor staff, tie-in work to be undertaken in the HWMB/TRF and work on items to be embedded in the seismic dike concrete, such as drainage, grounding and conduits. ES Fox also took charge of the unused materials that B&M had procured for the project (Ex. D2-2-10, p. 72).

OPG's actions to continue construction on the project were reasonable and necessary. At the time of the B&M's termination, EllisDon was actively engaged in excavating and shoring the seismic dike and RCMT was continuing to complete engineering packages and procure materials (Ex. D2-2-10, p. 72). These activities, along with those of ES Fox and the other subcontractors, were all required to complete the project. Had OPG paused the project while awaiting selection of a new contractor, it would have incurred substantial costs to make the site safe and demobilize/remobilize the subcontractors, delayed the acquisition of long lead materials and ultimately delayed the project's completion.

2.1.10 Selection and Management of CanAtom

Selection of CanAtom

In late December 2014, OPG issued a work request under the ESMSA contract to select a new EPC contractor to complete the D2O Storage Project. The work request was sent to the two remaining ESMSA contractors, ES Fox and CanAtom. In recognition of the project's technical complexity, which was understood by this time, the work request scoring was weighted 75% technical factors and 25% price (Ex. D2-2-10, pp. 78-79).

Both contractors responded to the work request, but neither proposal was deemed compliant with the pricing terms. After negotiations with both contractors to improve their proposals, OPG received revised proposals from both contractors. CanAtom's revised proposal scored higher on both technical and price factors. As a result, CanAtom was selected as the new EPC contractor and discussions began on the terms of a PO.

Management of the CanAtom Contract

In April 2015, CanAtom began its work on the project under an interim agreement put in place while the PO terms were being negotiated (Ex. D2-2-10, p. 80). During this time, CanAtom was engaged in finalizing project documents, procuring long-lead materials, prefabricating welded piping assemblies (pipe spools) and installing piping in the HWMB. In August 2015, CanAtom was issued a PO for $160M. This amount was within the $381.1M total project estimate in the 2015 Superseding BCS (Ex. D2-2-10, Attachment 2p).

CanAtom began work on the project by reviewing the engineering packages that RCMT was finalizing. In May 2015, CanAtom began to question the design of the seismic dike top slab and the superstructure proposed for the project building. They asserted that the building design had not been shown to meet applicable codes and would be unstable during construction. RCMT disagreed, maintaining that the current design met applicable codes, incorporated standard construction techniques and that maintaining lateral stability during construction was a typical responsibility for a construction contractor (Ex. D2-2-10, p. 81).

By July 2015, CanAtom proposed modifying the RCMT design for the seismic dike top slab and building superstructure. CanAtom asserted that the RCMT design was not based on the

appropriate nuclear-related building standard and the top slab was not properly connected to the building's structure. They also claimed that the building superstructure required redesign because it failed to meet the applicable code for wind loading and would be difficult and costly to construct. In support of these changes, CanAtom stated: "The engineering cost to redesign the building can be reconciled with the savings in the construction costs; therefore will not change our performance fee submitted July 3rd 2015." (Ex. D2-2-10, p. 82).

As an initial assessment of these claims, OPG had an external engineer look over the RCMT design in light of the issues raised by CanAtom (*Ibid*.). Based on a high-level review, the engineer concluded that the RCMT design was atypical because the building superstructure would require significant temporary support during construction until the precast panels were attached. The reviewing engineer also indicated the RCMT design lacked documentation showing compliance with applicable standards for structural integrity under wind loading. The reviewing engineer concluded that adopting a design where the steel superstructure was used to meet all loads and the precast panels were solely used for architectural, rather than structural, purposes would minimize construction delays and engineering effort.

Based on CanAtom's explicit confirmation that the proposed design changes would neither increase the project's cost nor delay it, OPG accepted CanAtom's redesign proposal (Ex. L-D2-02-SEC-099, Attachment 1). This was a reasonable decision given the external engineer's confirmation that the CanAtom design was superior from a constructability perspective, CanAtom was responsible for safe construction, and CanAtom was asserting that the change would not result in additional cost.

The work under CanAtom experienced delays in its first year (2016) due to the effort required to ramp up piping fabrication and the overall complexity of revising the design while managing piping and tank installation (Ex. D2-2-10, pp. 83-84). However, the erection of the building's superstructure in the fall of that year did proceed smoothly and on schedule, demonstrating the construction benefits of the redesign (Ex. D2-2-10, pp. 85-86).

Contract Dispute and Settlement

In October 2016, CanAtom issued Project Change Notice ("PCN") 67. This PCN sought a cost increase of $37.4M for engineering redesign and delays to procurement and construction arising primarily from the changes to the building's steel superstructure and the ground level slab atop the seismic dike. By December 2016, CanAtom had issued several additional smaller PCNs, which together totaled about $7.5M. Thus, by the end of 2016, CanAtom was claiming some $45M in additional costs.

Through commercial discussions between the parties, OPG accepted about $7.5M in claims related to approved scope changes or estimation issues that OPG agreed represented legitimate costs of the project. The remaining $37.4M, primarily related to the PCN 67 redesign issue, continued to be in dispute. OPG's position was it had agreed to the redesign based solely on CanAtom's representation that the design change would not adversely impact the project's cost and schedule, and in any event, that the claimed engineering and project management costs were excessive.

At the end of January 2017, CanAtom informed OPG senior management that the project was running out of funding, which would require CanAtom to stop working. CanAtom further indicated that failing a favourable resolution of PCN 67, it would be required to begin demobilization by mid-February 2017 to avoid over-spending the approved PO (Ex. D2-2-10, p. 92).

In response, OPG issued a formal rejection of PCN 67 and advised CanAtom that the ESMSA contract prohibited any work stoppage or delay based on commercial disputes. OPG disputed CanAtom's cost claim and rejected responsibility for any of the $37.4M in increased costs. To independently assess whether RCMT's original design met applicable standards and was constructible, OPG's counsel retained an external engineering firm. This was a prudent step, done to gauge the strength of CanAtom's claim should the matter proceed to arbitration or litigation (Ex. L-D2-02-AMPCO-127, Attachment 1b).[22] In the interim, OPG provided short-term funding to the project to allow work to continue while the dispute was being resolved.

[22] Ares Corporation reviewed the codes and standards compliance and constructability of the RCMT design for the D2O Storage Project (Ex. L-D2-02-SEC-101, Attachment 1). This review concluded that the design met applicable standards and was constructible, but identified three discrete issues that the authors indicated could be resolved through the provision of additional information.

Through continuing discussions, OPG and CanAtom agreed to a Recovery Plan that provided for a six-week slowdown in project work between March 6 and April 17, 2017. During the slowdown, CanAtom was required to retain High Bridge Associates, Inc. ("High Bridge") to perform an independent estimate of the cost, schedule and remaining scope to complete the project. CanAtom was also required to significantly reduce its project management team, complete the remaining work packages and procurement, and perform ongoing construction to complete the building (Ex. D2-2-10, pp. 92-93).

At the end of March 2017, High Bridge produced its detailed estimate of the work remaining on the project and the cost to complete it over approximately 18 months. OPG and CanAtom reviewed the High Bridge initial estimate, which was then refined and finalized to show a cost to complete of $99.5M plus $9M in contingency (Ex. D2-2-10, p. 93).

OPG was dissatisfied with the CanAtom's progress on the tasks scheduled for completion during the slowdown period and with its increasing estimates of the cost to complete the project. On April 21, 2017, OPG notified CanAtom that it was prepared to terminate the PO for cause and instructed CanAtom to halt work on the project (Ex. L-D2-02-SEC-104, Attachment 1). OPG and CanAtom began planning the transition of the project back to OPG while continuing to negotiate a resolution of the outstanding commercial issues.

While OPG assessed alternatives to completing the project with CanAtom, including attempting to engage a new contractor, all were viewed as inferior to completing the project with CanAtom if a fixed price contract for completion could be negotiated (Ex. D2-2-10, pp. 93-95). On June 27, 2017, OPG and CanAtom signed a comprehensive settlement agreement that created a framework to resolve all outstanding disputes and established the path forward to compete the project. The settlement contains three major sections outlined in Chart 1 below (Ex. D2-2-10, pp. 95-97).

Chart 1 – Outline of the Settlement with CanAtom

Settlement Section	Period Covered	Settlement	Amount Paid
1	Through April 21, 2017	OPG to pay all of CanAtom's verified costs including overheads, but excluding performance fee (about $10M) with the maximum payment not to exceed $175.7M.	$171.9M
2	April 22, 2017- June 26, 2017	Lump sum payment without overhead or performance fee for cost of reduced work during this period.	$1.8M
3	June 27, 2017 - Completion	Target price/maximum price including reduced target price with a deadband and sharing and a $20M discount on total payment. This resulted in a maximum cost of OPG of $70M as explained in the following paragraph.	$70M*

*Through to project completion, OPG paid an additional $1.9M for agreed additional scope and settled claims (Ex. D2-2-10, p. 102).

The target/maximum price established a deadband around the $80M target cost in which no sharing would occur. Amounts above the deadband would be shared equally until the maximum price of $90M was reached at which point all costs became the responsibility of CanAtom. In addition to the maximum price, the settlement had the following favourable features:

1) the target price was set at $80M, which was some $20M lower than the remaining cost to complete the project as estimated by CanAtom and, independently, by High Bridge;
2) the maximum price was set at $90M, some $10M lower than the estimated remaining cost to complete; and
3) OPG negotiated a $20M discount on the cost of the remaining work, such that OPG's actual maximum cost for completing this work would be $70M, or some $30M lower than the estimated cost to complete the project.

OPG submits that the negotiated settlement is prudent given that it included substantial discounts and a guaranteed maximum price.

2.1.11 Project Completion and Commissioning

Project Completion

As fully described in OPG's evidence (Ex. D2-2-10, Section 11), completion of the project was more complex than forecasted and took longer than scheduled. Substantial completion of construction, originally forecasted for year-end 2018, did not occur until November of 2019 and

the resolution of small outstanding construction items continued into early 2020 (Ex. D2-2-10, pp. 98, 102). The challenges in this phase chiefly involved completion of construction work packages and the effective integration of the many different trade groups required to work in the confined space of the D2O Storage Project at the same time (Ex. D2-2-10, pp. 98-100). OPG worked cooperatively with CanAtom to resolve bottlenecks and improve productivity, but the pace of construction continued to be slower than forecast (*Ibid.)*.

So long as the project was expected to be finished in time to receive heavy water from the Unit 3 refurbishment, then forecasted to occur in April 2020, OPG's priority was to complete all the remaining elements of the project safely and with quality, and prepare the testing and documentation required for commissioning. At the same time, the maximum price provided CanAtom with a substantial incentive to finish the project as soon as possible. Despite the schedule extension, OPG continued to forecast that the building would be ready on time to accept heavy water from Unit 3 (Ex. L-D2-02-AMPCO-088).

By early 2019, CanAtom was forecasting a loss of about $36M on the completed project (Ex. D2-2-10, p. 100). As construction completion lagged, this forecast grew to $77M (Ex. L-D2-02-SEC-108, Attachment 1; Ex. D2-2-10, p. 102). While OPG is unaware of the final total of CanAtom's loss on the D2O Storage Project, it exceeded $77M. These amounts represent funds CanAtom expended to complete the project that do not form part of OPG's requested in-service additions. In OPG's submission, this fact alone confirms the prudence of the settlement OPG negotiated with CanAtom, even without considering the substantial discounts to the cost of completion, as explained above.

Project Commissioning

Commissioning was the final step in ensuring that the project functioned as designed. All tanks and pipework had to be pressure tested and verified as clean (Ex. D2-2-10, p. 104). This meticulous process involved flushing all tie-ins with demineralized water, sampling the water chemistry, checking the fine mesh strainers installed to ensure no foreign material was introduced during construction, and draining the system. Results met or exceeded chemistry standards and no appreciable construction residue was found. Final commissioning was done

with heavy water, as was required to complete the operational pressure testing necessary for Technical Standards and Safety Authority approval (Ex. D2-2-10, p. 104).

Commissioning was completed by OPG with support from CanAtom. OPG paid CanAtom a total of $6.8M for this work (Ex. D2-2-10, p. 103). This amount is in addition to the cost of completing construction under the settlement, but is included in the $494.7M project capital cost that OPG seeks to recover in this application. Final commissioning was completed in November 2020 for the PHT system and in early 2021 for the moderator and TRF product and feed systems (Ex. D2-2-10, p. 104).

OPG's prudent completion of commissioning allowed the D2O Storage Project to begin accepting heavy water from Unit 3 on November 26, 2020 (Ex. L-D2-02-AMPCO-088; Tr. Vol. 1, p. 138).

2.1.12 Conclusion

Designing, engineering and constructing the D2O Storage Project was an extremely complex undertaking. This first-of-a-kind design required the development and integration of numerous systems in tight quarters to ensure the safety, constructability, operability, and maintainability of the project. Ensuring the seismic stability of the building, addressing the multiple streams of heavy water that the project was built to store, and minimizing the project's emissions were among the challenging design goals that the project met. As OPG's witness, Mr. Reiner, testified, "It is the most complex modification we are undertaking in the DRP." (Tr. Vol. 2, p. 109).

Constructing a seismic dike 15 m below ground and about 2.5 m below the water table is inherently difficult. While OPG was well aware of the level of the water table, it is the precise hydrology and geology of the site that determined the degree of water ingress and these subsurface conditions can only be known upon excavation.

The presence of low levels of tritium in the site's soil and the water and the numerous buried services to be moved or removed added to the challenge. While the existence of these conditions was largely known, the precise levels of tritium and the specific subsurface conditions, much less the cost to address them, were not known at the time the project commenced. The fact that construction took place within the protected area of an operating nuclear station undergoing

refurbishment also added to the task of organizing the many workers on the project site at any one time.

The design complexity and challenging construction caused the project to take far longer than anticipated under the initial EPC contract, but that schedule was never realistic for a project of this complexity. OPG's original schedule was about three years and four months from project commencement to final in-service (Ex. D2-2-10, Attachment 2m, pp. 5-6). In contrast, Bates White used six years as a realistic construction schedule, assuming no extraordinary delays (Ex. D2-2-11, Attachment 3, p. 9). As the project entered construction, it became clear that the early estimates of project cost and schedule, developed before preliminary design was complete and without any appreciable engineering, were significantly understated.

OPG managed the challenges in design and construction prudently. When the initial contractor on the project repeatedly failed to meet its schedule commitments and offered ever-increasing cost forecasts, OPG, after attempting resolution, terminated the contract. In response to rising cost claims by the second contractor, OPG stopped work on the project. Work was allowed to proceed only after the parties negotiated a comprehensive settlement that eliminated the performance fee for past work, substantially discounted the remaining work and established a guaranteed maximum price to complete the project. That guaranteed maximum price resulted in the contractor's cost to complete the project being at least $77M more than what is included in OPG's requested rate base addition.

The completed project will yield benefits to Ontario electricity consumers for decades, throughout the operating lives of the refurbished Darlington and Bruce generating stations. In the end, OPG's cost to complete the project reflects the true cost of constructing the heavy water storage facility, as established by the Bates White team of independent experts. For these reasons, OPG should be permitted to include the remaining $494.7M of project cost in its nuclear rate base and to recover the corresponding revenue requirement impacts accumulated in the CRVA for the period prior to the effective date for the payment amounts that include this project in rate base.

2.2 Issue 13.2

Are the balances for recovery and the proposed disposition amounts in each of the deferral and variance accounts related to OPG's nuclear and regulated hydroelectric assets appropriate?

Please see submissions above on Issue 7.6. This issue is denoted as "Partial Settlement" solely because of the CRVA balances associated with the D2O Storage Project. Issue 13.2 is otherwise settled. The resolution of Issue 7.6 will effectively resolve the remaining unsettled issue regarding the CRVA balances associated with the D2O Storage Project that are recoverable in this application because the entries to this account flow directly from the approved capital amounts.[23]

[23] As explained at Ex. H1-1-1, p. 20, the revenue requirement impacts of D2O Storage Project investments have been recorded in the CRVA as they have been placed in service. These revenue requirement impacts will continue to be recorded in the CRVA until the effective date of nuclear payment amounts that reflect this project's inclusion in the rate base. OPG's application has sought to clear the December 31, 2019 CRVA balance related to the D2O Storage Project. Based on OPG's investments in the D2O Storage Project, this CRVA balance is a debit of $58.1M at year-end 2019. The derivation of the CRVA additions for 2016-2019 is shown in Ex. H1-1-1, Table 16 and further discussed in Ex. J3.2.