PROGRAM EXECUTION

1.0 OVERVIEW

The focus of this exhibit is on execution management, which refers to the methods by which OPG as the Program owner will manage the delivery of all scope safely, on time, on budget, and to the required quality during execution. As noted in Ex. D2-2-2, certain of OPG's functional support groups are particularly focused on execution management and support. This schedule describes the activities to be carried out by these functions, along with key controlling activities to be undertaken during the Execution Phase.

The following components of execution management are discussed:

- Project Execution Support Function;
- Work Control Function; and
- Operations and Maintenance Function.

In addition, the following key controlling activities are described:

- Change Management;
- Cost Performance Monitoring;
- Reporting; and
- Oversight.

Together, these components will enable OPG to effectively and efficiently interface with engineering, procurement, and construction ("EPC") contractors; ensure that work is controlled and all changes are tracked using the integrated schedule and cost performance and monitoring tools; ensure worker protection, conventional and nuclear safety, environmental safety, and plant safety; ensure that all quality requirements are met; ensure that risks are appropriately managed; have appropriate reporting and effective internal and external oversight.

2.0 PROJECT EXECUTION SUPPORT FUNCTION

The Project Execution Support Function provides support across the major work bundles in four key areas during the Execution Phase, as follows.

The Construction Execution and Field Support team will support OPG's contractors by helping to ensure they are able to perform their work in a safe and productive manner to maintain the overall schedule. For example, this team will resolve issues in the field to help enable the contractor to complete its work, such as assisting with the resolution of missing equipment, interference with other work groups, or assisting with resolving constructability issues. This team also frequently monitors for changing risks during field execution. Effective construction and field support is recognized in the industry as a key aspect of managing large scale construction projects. In addition, based on industry best practices and operating experience, OPG's continuous, planned and sustainable support and monitoring of contractor activities will result in improved project performance.

The Quality Management team will perform quality surveillance at all stages of execution planning and in-field construction while also addressing critical and emerging issues. For example, this team will oversee the completion of work and ensure regulatory requirements are met through periodic checks of the documentation to ensure what has been done in the field is traceable, as required by Darlington's operating license issued by the Canadian Nuclear Safety Commission ("CNSC") and in compliance with CSA N286-12.

The role of the Nuclear Refurbishment Project Parts Integration team is to ensure consistency and integrity in the processes and systems utilized by project directors to manage those contractors that are involved in the purchase and delivery of parts. For example, this team will ensure the consistency of contractor information and track purchasing of parts by contractors and their subcontractors.

The Program Execution Strategy team will facilitate effective oversight of specific Execution Phase activities by, among other things, establishing a ready-to-execute plan, developing and implementing a division of responsibilities framework, establishing a project manager development plan to ensure quality resources are available for subsequent unit refurbishments, and facilitating insurance reviews and other execution phase oversight.

3.0 WORK CONTROL FUNCTION

As described in Ex. D2-2-2, one of OPG's functional support groups – the Work Control Function (now referred to as the Project Office Function) – plays a significant role during the Execution Phase. The Project Office Function is responsible for integrating, publishing and controlling the individual unit outage and execution schedules, and for ensuring all deliverables are known, communicated and completed in accordance with the planning and execution planning expectations. The Project Office Function ensures that a plan is in place during the preparation and execution of each Unit outage in order to manage overall readiness of the work. Each project team is accountable for ensuring that their individual plans and work readiness meet the quality and timeline expectations of the Project Office Function, as established through planning and execution planning work that has been undertaken.

The Project Office Function plans and coordinates the deliverables that are required pre-outage and leading up to, throughout and in closing out each of the unit refurbishment outages. This includes planning and coordination with respect to unit-specific scope, schedule, field risk identification and planning, unit execution cost and data integrity. In essence, this Function provides an integrating force and establishes processes, reports and metrics to ensure that the integrated set of projects is prepared, and subsequently executed, in accordance with a jointly developed and executable schedule.

During the Execution Phase, Project Office activities include:

- ensuring work activities are properly planned, prepared, coordinated and monitored using data systems, including ensuring parts and tools are readily available;
- ensuring logistics required during a refurbishment outage, including space, services, resources, permits and radiation protection, are planned, coordinated and executed;
- ensuring execution and integration of unit shut-down and restart activities, including layup, islanding and defueling activities and ensuring CNSC commitments are met;

- monitoring work processes, identifying opportunities for efficiency improvements and working with operations and maintenance to realize these improvements;
- scheduling the execution of inspection and maintenance work by external contractors, including for fuel channels, steam generators, feeders, turbine generator, islanding, shutdown and/or layup, and balance of plant;
- producing a detailed work execution schedule at a frequency required to ensure effective execution of the planned work;
- performing critical reviews of upcoming work to ensure projects are aligned and challenged to meet the execution window;
- optimizing critical path with due consideration for impacts on individual project costs;
- monitoring schedule contingency in the Level 2 schedule;
- ensuring that actual performance is monitored against established performance criteria by providing timely and credible explanations of variances in outage performance and producing appropriate metrics to describe execution status;
- ensuring appropriate problem solving and analysis when unacceptable performance deviations occur and that corrective actions are initiated and tracked to resolution; and
- providing and operating a Project Control Centre to manage work priorities and issue resolution as supported by operating experience from prior refurbishments.

There are a number of strategies that will be used by Project Office staff for schedule management during the Execution Phase. These include:

- the management of important integration points in the execution schedule, referred to as “critical evolutions”, which are points where key turnovers or handoffs take place between project stages or where multiple windows will be ending at the same time or where certain regulatory approvals are required. OPG has identified approximately one dozen such “critical evolutions” during the Unit 2 refurbishment outage. Effective management of these transitional periods during the life of the project is an important means by which OPG as program owner can help ensure success;
- establishing and operating a Project Control Center as a centralized clearinghouse for all scheduling and other issues that arise in the field during execution. This team will

meet every morning to review schedule and critical path activities and status. Plans will be issued on a weekly basis, both pre-outage and during the outage, with daily tracking being performed for critical path activities by the contractor and the Project Office Outage Manager. The Project Control Center will be organized using Single Points of Contact so as to be able to draw upon resources from all Functional Support Groups, such as Operations and Maintenance, Construction and Engineering, as needed; and

- developing and maintaining detailed logic drawings to map out the sequencing of work and to communicate important handoffs between OPG and contractors. The logic drawings allow the critical path to be calculated and monitored.

4.0 OPERATIONS AND MAINTENANCE FUNCTION

The Operations and Maintenance Function provides support to the major work bundles in respect of the unit being refurbished and also serves as the “custodian” of the operating units in the plant by ensuring that the refurbishment work does not adversely impact those operating units. Importantly, this Function will serve as the “controlling authority” for the units undergoing refurbishment within the construction island. In this role, the Operations and Maintenance Function is responsible for the safety of the plant, it’s workers, and the environment. This Function ensures that plant operation is in accordance with CNSC license requirements. OPG has established this Function within the Darlington Refurbishment Program (“DRP”) organization to ensure that the relevant structures, systems and components are maintained and refurbished to nuclear standards and returned to service in top-performing condition in terms of safety, reliability and production.

Key responsibilities for the Operations and Maintenance Function during unit refurbishment include:

- ensuring effective unit turnover and transition to minimize impact on refurbishment and plant operations;
- shutdown and lay up of the unit to allow refurbishment, and monitoring and maintenance of laid up equipment;
- oversight of activities for chemistry, as well as environmental and radiation protection;

- control of work protection and work authorization;
- start-up of the refurbished unit, including execution of modification commissioning plans, system restart plans, demonstration of readiness for service, and returning the unit to station operations; and
- managing non-radiological waste and waste disposal.

5.0 CHANGE MANAGEMENT

Change is inevitable in a project. A robust change management process provides guidance on how changes are assessed, implemented and reported. The primary purposes of change management are: (1) to control cost, schedule and scope changes against approved baselines; (2) to manage the proper allocation of contingency funds; (3) to document the nature and causes of changes; and (4) to analyze and minimize the impact of the changes on DRP scope, cost and schedule.

The key principles that OPG applies with respect to change management include:

- the executing organization will first attempt to mitigate the impacts of change so that change is managed at the lowest authorized level of the organization;
- change that has a significant potential impact on scope, cost and schedule is reviewed in detail and the recommended direction is approved at the appropriate level;
- only after a change is approved by the appropriate authority level is the work assigned for action by the executing organization; and
- changes are not made solely for the purpose of correcting performance issues that are within the control of the work program owner.

The change control process is applied from project inception through completion. The constraints of cost, schedule and scope will be continuously and rigorously managed by rejecting or approving changes and subsequently incorporating approved changes into the revised Program and performance measurement baseline, where applicable.

Details of OPG's Change Management Process are set out in Attachment 1.

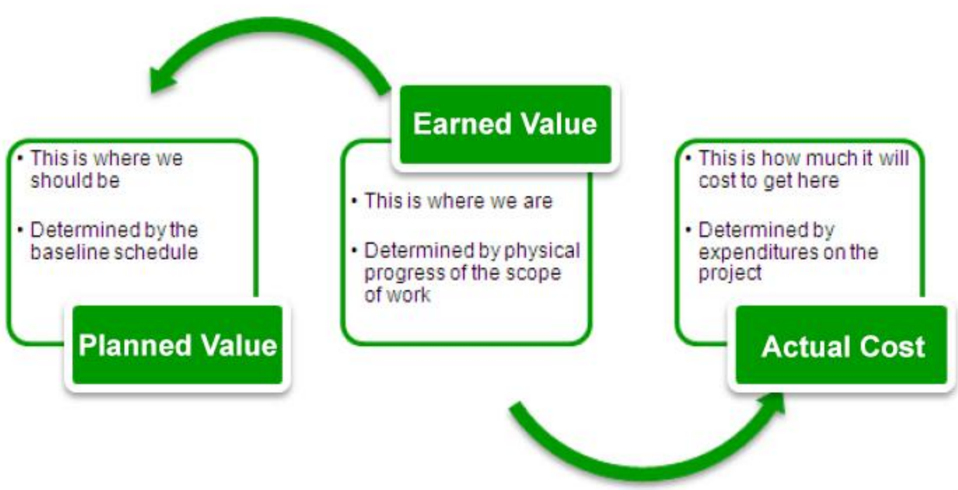
6.0 COST PERFORMANCE MONITORING

The Earned Value Management methodology is used by OPG as the primary architecture for DRP cost management and monitoring. Earned Value Management ("EVM") is a standard project management technique for quantifying and measuring project progress and performance. It not only compares actual costs against budgets, but also allows for continuous analysis of progress achieved against plan throughout the project timeline and across individual tasks forming part of a work component. In other words, the project "earns" progress as work steps are completed, thus allowing management to implement strategies should the project track "off-plan".

In order to conduct EVM analysis, three components are needed: (1) the Planned Value to be earned, (2) the Earned Value (physical progress percent complete against budgeted value), and (3) Actual Cost (from finance/accounting or contractor invoices and accruals). The Earned Value Process is illustrated in Figure 1 and further described below:

Figure 1

Earned Value Process Summary Diagram



Cost performance is measured using standard industry metrics at the program, project, and functional levels. The means by which these standard earned value metrics are calculated, and the significance of the resulting values, is demonstrated through the following scenario. In the scenario, assume that there are four valves that were to have been installed by the current date and that each has a budget or planned value of $1,000, for a total budget of $4,000. As of the current date, only three of the valves have been installed and the total amount spent has been $2,500. The cost of installing the fourth valve, based on experience installing the first three, is forecast to be $800. The standard earned value metrics would be as follows:

- *Schedule Performance Index ("SPI")* is a measure of progress achieved compared to planned progress (SPI = Earned Value / Planned Value). An SPI of 1.0 indicates that the project has completed all planned work. A value of less than 1.0 indicates that all work that was supposed to have been completed has not been completed. A value of greater than 1.0 indicates that work planned for the future has been advanced. Using the above scenario, the SPI would be $3,000/$4,000 or 0.75, which indicates that the project is behind schedule.
- *Cost Performance Index ("CPI")* is a measure of the value of work completed compared to actual cost incurred (CPI = Earned Value / Actual Cost). If the work was completed or 'earned' at the same cost as planned, the CPI would be 1.0. If the cost of the work was higher than planned, CPI will be less than 1.0 and if the work has been completed for less than the planned cost the CPI will be greater than 1.0. Using the above scenario, the CPI would be $3,000/$2,500 or 1.2, which indicates that the project is being executed more economically than had been planned.
- *Cost Variance* is the difference between the budgeted value of work performed and the actual cost of that work (Cost Variance = Earned Value - Actual Cost). For example, the Cost Variance is $3,000 - $2,500, or a favourable variance of +$500.
- *Schedule Variance* is the difference between the budgeted value of work planned and the actual cost of work performed (Schedule Variance = Planned Value – Earned Value). For example, the Schedule Variance is $4,000 - $3,000, or an unfavourable -$1,000.

Schedule Performance Index, CPI and variance metrics are all past-performance oriented. For the DRP, OPG also uses forecasts at the Program and project levels against approved life cycle estimates in order to proactively assess future success and take early corrective action where required. A key metric used for this purpose is *Forecast or Estimate at Completion*, which is determined by adding the Actual Cost and the Estimate to Complete (Estimate at Completion = Actual Cost + Estimate to Complete). For the example, the Estimate at Completion would be $2,500 + $800 based on the forecast provided, for a total of $3,300. Note that the forecast can be determined through a variety of methods, including simply by using the original planned value, or actual unit cost to determine the forecast. The *Variance at Completion* is equal to the Budget at Completion less the Estimate at Completion, which in the example is calculated as $4,000 - $3,300, or $700.

7.0 REPORTING

An integral part of successful project management is reliable and accurate performance information. Reporting provides this performance information through the collection, collation and presentation of data and information. The key objectives of reporting are to:

- ensure information is being communicated to the right stakeholders such that the appropriate decisions can be made, actions taken, or awareness generated;
- communicate the status of the program including any trends, variance from plan, and how the potential variance is being addressed or corrected; and
- ensure information is reliable, accurate and transparent.

OPG plans to issue annual status reports to the public for the duration of the Program through its website. This reporting will include a range of measures, including construction completion, cost performance, schedule performance and safety performance. Chart 1 illustrates the measures that will be provided in the public domain for the duration of the DRP.

Chart 1

Public Reporting on the DRP

Category	Measure
Progress	• Key Achievements • % Complete
Safety	• All Injury Rate
Quality	• Quality Compliance (metrics to be determined)
Cost	• Cost Performance Index • Life-to-date cost • Forecast to Complete • Estimate at Complete
Schedule	• Schedule Performance Index • Status of Key Milestones • Critical Path Progress • Forecasted Completion Dates

8.0 OVERSIGHT

OPG has developed and implemented an assurance plan that is comprised of several layers of oversight, including from Program staff, external contractors, Program leadership, enterprise leadership and external advisors. The plan ensures appropriate oversight during the execution readiness and Execution Phase of the Program, with a focus on key risk areas. Specifically, oversight will help to ensure that the DRP meets safety, quality, cost and schedule expectations, that issues are identified and resolved expeditiously, and that transparent and accurate information flows up to the Board of Directors.

OPG's oversight and assurance processes are supported by transparent, timely and accurate information flows to support decision making at appropriate levels within the organization. Key aspects of OPG's DRP oversight include:

- *project-specific oversight processes and practices* based on risk management, operating experience, contract requirements, scope of work and reviews of contractor performance by each of the Project Management Teams, as well as by the Project Execution Support Function (see: section 3.2.1 of Ex. D2-2-2);
- *oversight of the Executing Organization* (see Ex. D2-2-2, Figure 1) by the DRP leadership team and by Program functions, including the:

   - *Managed Systems Oversight Function*, which provides programmatic oversight based on risks and themes emerging from operational experience, project oversight data, and Program and project risks (see section 3.2.6 of Ex. D2-2-2). Through the Program Assurance Group, the Managed Systems Oversight Function conducts surveillances across the projects focused on identifying emerging problems and opportunities in time to address them, including: process improvement, lessons learned and providing coaching and assistance to the project team and contractors as part of an effective risk management culture; and
   - *Planning and Controls Function*, which ensures cost and schedule compliance including forecasting, change management, and milestone adherence, effective risk management, and complete and accurate metric and progress reports.
- *OPG's Internal Audit group*, which provides oversight in a broad range of areas such as scheduling, cost estimates, contractor procurement, quality assurance, cost management, contractor time keeping and EPC contracts. OPG's Internal Audit group has functional independence from management. The Internal Audit group publishes the results of audits in a report and requires management actions be assigned, and tracked to completion. The results of all audits are presented to OPG's Chief Executive Officer and the OPG Board of Directors;
- the *Refurbishment Construction Review Board* ("RCRB"), which supports Program level oversight by the Chief Nuclear Officer and the Chief Executive Officer. The RCRB provides independent assessments of DRP progress, estimates and schedules for early intervention and correction of any shortfalls in execution. The RCRB is comprised of approximately six external members with expertise in nuclear plant operations, mega-projects and relevant regulatory requirements, typically with support from one internal OPG member. It meets quarterly and reports directly to OPG's Chief Executive Officer and its Chief Nuclear Officer. The RCRB will also provide the OPG Board of Directors with an annual report on the scope and execution of the DRP; and

- the *Darlington Refurbishment Committee of OPG's Board of Directors*, which supports Program level oversight by OPG's Board of Directors. During the Definition Phase, OPG's Board of Directors engaged BMcD/Modus to provide oversight support. A copy of the final quarterly oversight report from BMcD/Modus to OPG's Board of Directors in respect of the Definition Phase is provided in Attachment 2. OPG's Board of Directors has recently re-engaged BMcD with Modus as subcontractors, to provide independent oversight services during the Execution Phase. BMcD will validate the accuracy and transparency of reports from the DRP to the Darlington Refurbishment Committee and validate that DRP assurance processes at the Program level are healthy, robust, and reviewing the right areas.

ATTACHMENTS

Attachment 1:	OPG's Change Decision Criteria and Management Process
Attachment 2:	BMcD/Modus Final Quarterly Oversight Report to the OPG Board of Directors

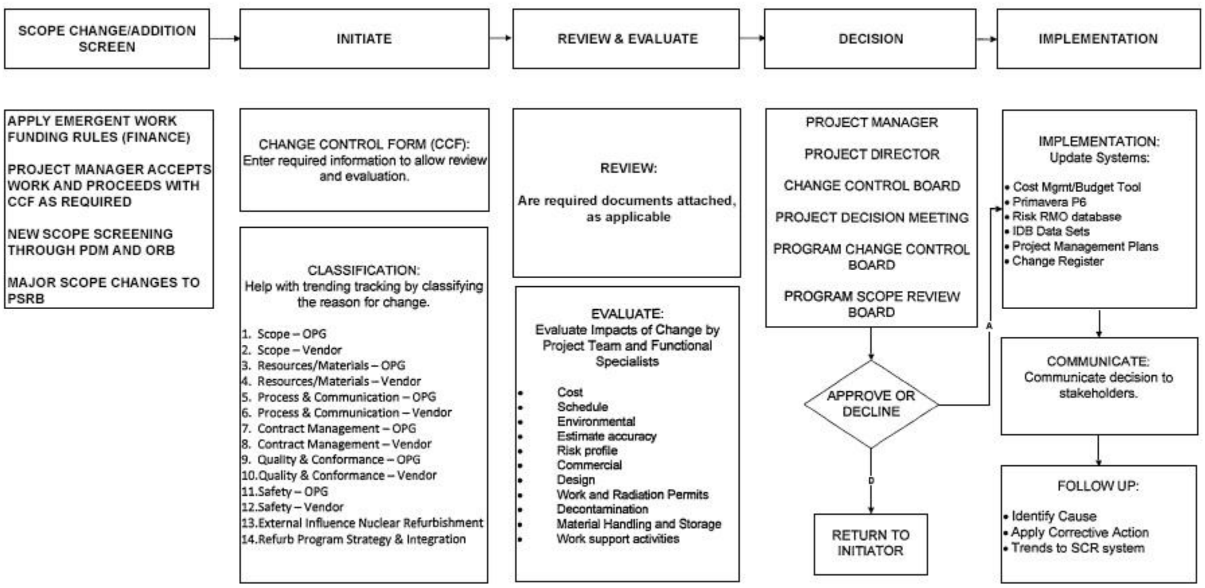
OPG'S CHANGE MANAGEMENT PROCESS

1.0 CHANGE MANAGEMENT PROCESS

OPG's Change Management process is made up of five key steps, which are illustrated in Figure A-1 and further described below.

Figure A-1

Change Management Process Overview



1.1 Screening, Scope Changes/Additions

All proposed scope changes (including removal and additions) are screened by managers and subject matter experts.

1.2 Initiation

The initiator starts the process by describing the change in a Change Control Form ("CCF"). The change is then classified by the reason for the change (see Figure A-1 for classifications). All CCFs must:

- show business rationale or justification for the requested change;

- show technical supporting documents if applicable;
- show cost estimates, if applicable, prepared by OPG and/or contractors in sufficient detail to allow review, including hours, rates, quantities and assumptions (contractor estimates are reviewed and validated by OPG estimators);
- show a resource loaded schedule with affected activities and critical path impacts listed, if applicable;
- identify impacts to the work breakdown structure including to the overall Program, if applicable;
- identify impacts to the risk register, including listing any additional risks, closed risks, changes in impacts on probability, schedule and cost and mitigating actions required;
- show a listing of the Work Packages affected by the proposed change;
- identify impacts to remaining contingency;
- identify the impact to the project life cycle estimate at completion, and provide a definitive estimate at completion and compare to the approved budget; and
- show any other relevant supporting documents that facilitate review and evaluation of the change.

1.3 Review and Evaluate

The evaluation of the impacts of the change on the Program or project is integral to the success of the change management process. If required, the CCF is routed to the appropriate functional support group or subject matter experts for an independent evaluation of the impacts of the change. Impacts that must be independently evaluated are cost, schedule, basis of estimate, estimate-at-completion and risk.

1.4 Decision

The core expectations relating to the change procedure are that: (a) change is managed at the lowest level of the organization that has the authority to do so, (b) change with a significant potential impact on Program or project scope, cost and/or schedule is reviewed in detail, and (c) the recommended direction is approved at the required level, as set out in Figure A-1. For example, depending on the level of impact to the project or Program, changes may be referred to the Change Control Board or the Program Change Control Board, as required.

The Change Control Board is chaired by the Senior Vice President of Refurbishment Execution (or delegate). Other voting members come from the Darlington Refurbishment Program ("DRP") senior management team, Nuclear Refurbishment Finance, and the functional support groups, including the Engineering Function, Project Execution Support Function, Planning and Controls Function, and Operations and Maintenance Function.

The Program Change Control Board is chaired by the Vice President, Planning and Controls. Other voting members come from Nuclear Projects' senior management team, Darlington Generating Station, Nuclear Refurbishment Finance, and the functional support groups, including the Engineering Function, Planning and Controls Function, and Contract Management Function.

1.5 Implementation

The final decision and disposition of a CCF will be communicated in writing to all stakeholders listed on the CCF. The status of a CCF will be changed to "Approved", and follow-up actions, if any, are tracked to completion.

Report to

Darlington Refurbishment Committee

Board of Directors

November 12, 2015

Darlington Nuclear Refurbishment Project

Burns & McDonnell
Modus Strategic Solutions

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Low Moderate High
No Change
Decreasing Increasing

I. Executive Summary

Burns & McDonnell Canada Ltd. and Modus Strategic Solutions Canada Company ("BMcD/Modus") provide the following Report to the OPG Board of Directors ("BOD") regarding the status of the Darlington Nuclear Generating Station's Refurbishment Project ("Project" or "DR Project") as of October 30, 2015. This report provides the summary of our team's assessment of the DR Team's development of the Release Quality Estimate ("RQE"). This report also summarizes the DR Team's current status of "post-RQE" work that will be its focus going forward, assuming the Board of Directors' approval of RQE at the November 2015 meeting and subsequent shareholder approval, as well as the status of work that is currently being executed on the Prerequisite ("Campus Plan") work and the DR Project.

A. RQE

OPG and the DR Team have been working toward developing a realistic RQE for the DR Project since 2009. The major focus of the DR Team over this time period has been the development of detailed cost estimates of sufficient quality and basis in order to establish a four-unit, program level ***control budget*** for the DR Project. In order to develop the control budget, the DR Team needed to mature the planning to the point where the cost estimates were substantively based. While the DR Team will continue to refine the unitized estimates for each of the four units in order to make specific funding requests, the control budget, if accepted by the Board, will be the baseline against which both the stakeholder confidence and public trust will be measured.

Megaprojects ($1 billion or more in cost) are often adversely impacted by overly optimistic initial cost estimates that do not fully consider the risks and complexities inherent in such undertakings. The DR Team is aware of the industry track record and has taken reasonable steps to account for the particular risks of CANDU refurbishments and develop its cost estimates accordingly. In order to properly communicate the nature of the DR Project's estimate and approximate appropriate contingency, OPG has chosen to utilize the guidance of the Association for the Advancement of Cost Engineering International ("AACE International"). OPG's strategy in this regard is aligned with reasonable and acceptable industry practice for a multi-year, multi-phase megaproject.

In our last report (October 2015) we noted that the month leading up to the November Board Meeting would be challenging given the amount of work the DR Team had left to complete. The DR Team met each of its goals, including:

- Finalizing the target price negotiations with SNC/Aecon on the RFR contract;
- Completing outstanding actions regarding all of the sub-projects from the initial round of senior management-level reviews and revising cost projections accordingly, and vetting the results of those changes;
- Firming up and vetting direct cost estimates and associated critical path schedule basis; and
- Performing integrated reviews of contingency and developing recommendations for amounts of contingency "buckets" and which entity (i.e. project, executive management, BOD) should control those buckets.

With these activities accomplished, the DR Team has completed the work necessary for establishing its control budget, and as an additional benefit, the team has an improved understanding of the Project. Based on our nearly three years of oversight of the DR Project's planning, BMcD/Modus believes the process used for developing the control budget and critical path schedule that form the basis for RQE meets or exceeds industry thresholds. The control budget is based, most notably, on well-defined scope and detailed engineering, which has sufficiently matured to allow classification using the AACE International guidelines in the manner OPG intended for RQE. In addition, the level of detail in the RQE control budget is in line with our experience for projects of this nature and should form the basis for a robust project controls regime that will be used to track progress.

Given the complexity and length of the DR Project, it is impossible for OPG to predict all of the issues that the DR Team may confront during execution. In order to reasonably incorporate the risk of these unknown issues, it is important to build a deterministic-based contingency augmented by a strong risk-management process and stochastic Monte Carlo model. Over the course of the Definition Phase, the DR Team's risk management approach has matured and the team has put into place a robust process for modeling and monetizing contingency that considered the issues experience on prior CANDU refurbishments as well as issues previously encountered by OPG. In the course of developing the RQE contingency, all project and function managers increased their focus on risk matters to ensure that risks were reasonably identified; response plans were established; and occurrence probabilities and impact quantification were developed. The DR Team performed a reasonable amount of challenge and review of the risks. While risk management and contingency development has many subjective aspects, the DR Team's process is well constructed and executed. It is in the upper percentile of comparable project practices. As with any complex megaproject, contingency values can never be perfect, though OPG has developed contingency at an appropriate level of maturity for establishing the Project's control budget.

While there is still considerable work ahead for the DR Team to further refine its estimates, schedule and execution planning for each of the Project's units, the DR Team has substantially met the goals it set in 2009 at the DR Project's inception for its Definition Phase. With RQE's completion, the DR Team is focusing on ensuring the documentation needed to substantiate its decisions is properly archived and available for future needs, including the unit-specific estimates and future regulatory proceedings. The team has set a goal of completing the RQE document archive by the end of 4Q 2015. We discuss the process used to derive RQE's control budget and recommendations for further refinement in the Unit 2 Estimate[1] that will be issued prior to the Execution Phase in 2016.

B. Status of Prerequisite Projects

We have noted the need for Projects & Modifications ("P&M") to provide greater confidence that the remaining key Campus Plan Projects, most notably D20 Storage and EPG 3, can be completed in time to support Refurbishment and meet current cost estimates. Providing such confidence depends as much on progress in the field as it does on P&M providing requisite metrics and progress reports so that this work can be accurately forecasted and managed. P&M has made good progress over the past month with D20 Storage. The Project Controls team is now tracking quantities of installed concrete by Ellis Don, the civil contractor, which will allow for better forecasting. Ellis Don has also added a second shift to increase its production. All of these efforts have improved the outlook for the foundation work, though P&M must continue to track Ellis Don's progress in order to confirm that it can meet its recovery schedule dates for turnover to SNC/Aecon of November 30, 2015 for the south side of the D2O West Annex Basement and December 22, 2015 for the seismic dyke.

As P&M's attention begins to shift to SNC/Aecon, P&M is closely monitoring the SNC/Aecon's recovery of initial delays in its preparatory activities, including procurement and prefabrication of process piping. P&M has assigned key staff [redacted]. P&M's ability to manage this transition should be further enhanced by performance metrics SNC/Aecon is providing for its critical path activities. The other key prerequisite project being performed by SNC/Aecon is the Reactor Waste Processing Building ("RWPB"). Site work is ongoing while SNC/Aecon continues to develop its full execution cost estimate and schedule.

Another key project, the Emergency Power Generator 3 ("EPG 3"), is being performed by ES Fox. Based on ES Fox's assessment, the civil construction of this project is currently approximately 20% complete, though ES Fox and P&M must still agree to a cost estimate and full performance schedule to progress the work. SNC/Aecon's performance with D20 Storage and RWPB and ES Fox's performance with EPG 3 should be a leading indicator of OPG's ability to open breaker on time in October 2016 for Refurbishment and provide important lessons learned going forward.

C. Readiness for Execution

With the completion of RQE, the Definition Phase also completes, and assuming BOD approval, the Execution Phase of the Project will formally begin. As we have noted, the key work ahead before Unit 2's Breaker Open in October 2016 will be focused on its "Readiness to Execute" plan ("RTE") in which the DR Team intends to live-test its plans for unit execution using pre-requisite work. During this time, the DR Team intends to, among other things: complete all execution processes and procedures; finalize its execution schedule and confirm the schedule's critical path and sub-critical paths for Unit 2; develop and test all of its tracking metrics for execution work; finalize tracking methods for vendor performance and

[1] The Unit 2 Estimate has also been referred to as the "Unit 2 Check Estimate". However, because the term "check estimate" has a particular meaning within the industry, we prefer use of the term Unit 2 Estimate.

procurement, and; finalize the Division of Responsibility ("DOR") and staffing for the execution organization. The Readiness to Execute is an aggressive plan that has multiple deliverables and will involve effort from the entire DR Team, and will leverage the work the DR Team has already accomplished with the vendors to prepare for execution. We have recommended that the DR Team schedule as many of the activities as possible in a resource-loaded, logic-based schedule and track its progress in the same manner as any project. The DR Team has initiated its Readiness to Execute planning in earnest and should be prepared to provide the BOD and senior management with meaningful progress reporting.

II. DR Project RQE – Summary of BMcD/Modus Assessment

A. Overview

RQE represents the culmination of the DR Team's efforts in the Definition Phase. In order to formulate our opinions regarding RQE, BMcD/Modus have performed two in-depth assessments:

- Assessment of the DR Team's Process for Developing RQE ("RQE Assessment");
- Assessment of OPG's Critical Path Schedule, on which RQE is based ("Critical Path Assessment").

This report summarizes these detailed assessments which provide the DR Team with our view of RQE and identify certain issues and challenges the Team should consider in its continued preparation for Unit 2's Execution Phase and beyond. In summary, the RQE Assessment and Critical Path Assessment conclude that:

- The estimates developed for the multiple sub-projects have the requisite basis to establish a meaningful control budget;
- OPG met the broad goals for RQE it established at the outset of the Definition Phase and in doing so followed acceptable industry practice, including its use of the guidance of AACE International that OPG chose for specific guidance in its estimating, risk and schedule development;
- RQE is based upon sufficiently mature scope and engineering definition, as well as an understanding of necessary operational experience ("OPEX") and lessons learned from prior refurbishments and other similar megaprojects, and reasonable alignment with the vendors who are performing the work;
- The DR Team and OPG as a company have adequately assessed the DR Project's risks and have reasonably approximated contingency necessary to offset those risks over time;
- The critical path for the Project was developed using a deterministic approach that considered past similar evolutions, simulated work in the Mock-Up reactor and reasonable assessments of potential improvements in key work series;
- The critical path has been captured using acceptable scheduling practices and resource curves have been sufficiently analyzed and incorporated into the estimate for the current phase of planning;
- The DR Team has a comprehensive plan to prepare for the Execution Phase of the Project; and
- The areas of RQE that are less mature – namely that Balance of Plant ("BOP") and Shut-down/Lay-up ("SDLU")–have adequate contingency for the known risks and uncertainties.

1. OPG's Goals and Adherence to AACE International Guidance

In order to aid OPG in its development and characterization of the RQE estimate, OPG appropriately chose to utilize AACE International's Cost Estimate Classification System[2], which explains the importance of these guidelines and the intent of their general use:

[2] See AACE's Recommended Practice No. 17R-97, Cost Estimate Classification System (November 29, 2011) and Recommended Practice No. 18R-97 Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries (November 29, 2011)

An intent of the guidelines is to improve communication among all of the stakeholders involved with preparing, evaluating, and using project cost estimates. The various parties that use project cost estimates often misinterpret the quality and value of the information available to prepare cost estimates, the various methods employed during the estimating process, the accuracy level expected from estimates, and the level of risk associated with estimates,… improving communications about estimate classifications reduces business costs and project cycle times by avoiding inappropriate business and financial decisions, actions, delays or disputes caused by misunderstandings of cost estimates and what they are expected to represent.

AACE recommends that cost estimates be categorized into five different "Classes" based on the project's level of maturity and definition. Class 5 estimates are based upon a low-level of project scope definition and therefore these estimates have the highest amount of uncertainty and the lowest level of accuracy. In contrast, a Class 1 estimate should have little uncertainty and very high accuracy. As noted in our past assessments of the DR Team's cost estimates (4c and 4d), this approach was appropriate and allowed for better understanding of the nature of RQE.

Pursuant to the Nuclear Refurbishment Project RQE Cost Estimate Plan (NK38-PLAN-09701-10235):

The target classification of the RQE cost submission is AACE Class 3 with an expected 50% level of confidence on the point estimate and accuracy range, exclusive of applying escalation, interest and management reserve, within:

Class 3	*Level of Project Definition: 10% to 40%*	*Budget authorization or control*	*Accuracy Range:* *L: -10% to -20%* *H: +10% to +30%*

An assessment of the class of estimate achieved by each project bundle will be performed by the NR Estimating Team based upon AACE Recommended Practices and the nature of the project scope of work.

As stated above, AACE International's guidelines use maturity level of project definition deliverables as the primary characteristic for classifying estimates. In its procedure, OPG listed the specific deliverables that would need to be developed in order to sufficiently advance the Project to support an RQE within the target Class 3 classification.

Based on our RQE Assessment, we concur that the DR Team has sufficiently matured the work in these areas in order to support RQE as a Class 3 estimate and establish a control budget. We do note that some bundles lack Class 3-level maturity (i.e. BOP and SDLU) while others have been deemed Class 2 (RFR). These differences in maturity are not unusual for projects of this complexity, and the DR Team has a full understanding of those parts of the work that need greater definition.

During the Definition Phase, the DR Project's scope was substantially developed and supported with detailed engineering packages. With some exceptions, the detailed engineering packages were prepared in sufficient time for that scope to be adequately assessed and estimated by the DR Project's EPC vendors. Additionally, as we noted in our 3Q 2015 report to the DRC, the process the DR Team used for validating and vetting the cost estimates for the Project's bundles has followed the approved DR Project RQE Cost Estimate Plan, and the result of this process was as intended – the vendors' estimates for project cost have been classified so that management understands the underlying quality, accuracy and reasonableness. This knowledge aided management in identifying potential risks in performance, gaps in the vendors' planned approaches, and areas to shore up for the future unit-specific cost estimates.

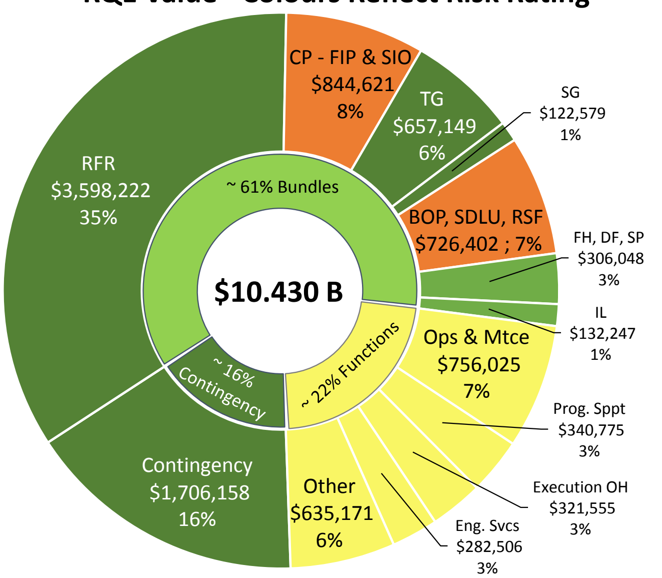
Moreover, with this effort complete for the control budget, the DR Team is better positioned for all of its remaining cost estimating work, which will be considerable during the Project's lifecycle. The Unit 2 Estimate the DR Team intends to deliver in the 3Q of 2016 to the Board of Directors will support that unit's execution. The team is committed to performing a similar estimate prior to each unit's execution. In addition, projects of this type must have ongoing cost estimate support for evaluating potential change orders, claims and cost overruns. The process the DR Team has used for RQE should be adaptable for each of these future needs.

In addition, with the development of the control budget, the DR Team has advanced its understanding of the Project's estimated costs such that it should no longer need to depend upon AACE International's cost estimate classification. The DR Team has now established its own measuring stick. With the exception of those projects (BOP and Shut-Down/Lay-up) that have not advanced to Class 2/3 designation and which still need to reach appropriate maturity, OPG should henceforth measure its progress against the control budget without further regard to AACE International classification.

2. Summary of RQE Elements

In the following sections, we discuss in summary fashion: the basis for each of the DR Project's major cost elements; how these estimates were developed and characterized; the risks identified for each bundle, and; recommendations for further maturation of the estimates.

RQE Value - Colours Reflect Risk Rating



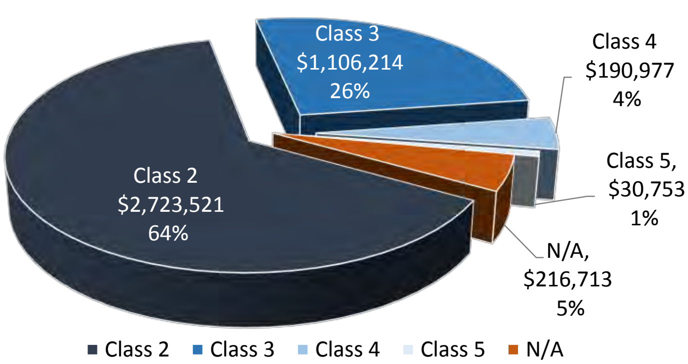
Note 1: Excludes Interest, Escalation, Inflation, and Management Reserve, $3.171B, for a total DR Project cost of $13.6B
Note 2: Contingency as a percent of estimate to complete is 29%
Data Source: RQE Total Cost Snapshot 4.vFinal - October 21, 2015

<u>Figure 1</u>

The adjacent **<u>Figure 1</u>** shows the updated RQE control budget values for each of the major sub-projects, or bundles, as well as the OPG Functional costs and contingency (in 2015$). Figure 1 shows the entire control budget including Definition Phase costs of $2.3B.

<u>Figure 1</u> also provides context for the relative size and percentage of each component of RQE. The three largest parts of RQE are: RFR (35%); OPG Functions (22%); and Project and Program Contingency (16% of the total control budget and 29% of the estimated cost to complete). The Turbine Generator and Steam Generator projects (7%), Campus Plan Projects (8%), and BOP, Shut-Down/Lay-Up, and Retube Support Facilities (7%) are the next largest slices of the budget.

AACE Classification of RQE Estimate to Complete



Note 1: Excludes Interest, Escalation, Inflation, Contingency, and Functional costs
Note 2: N/A - Not Applicable
Data Source: RQE Total Cost Snapshot 4.vFinal - October 21, 2015

<u>Figure 2</u>

<u>Figure 2</u> provides a depiction of the estimate class applied to each sub-project (or "bundle") per AACE International guidance and OPG's governance for RQE.

Below, we provide a brief update regarding the status of each of the major inputs to RQE in which we summarize the basis of the estimates that are being included in the control budget; the method and depth of vetting the DR Team applied to those estimates; a summary of the basis of the control budget's contingency, and; a summary of the current issues each project should address during the Ready to Execute period leading to breaker open.

B. Schedule Basis for RQE

Establishing a control budget for a construction project requires an understanding of the project's planned schedule. In particular, setting the control budget requires the ability to identify the execution critical path and the resources necessary to support it, as the critical path influences a large portion of the project's costs and the risks on which contingency is based. As a result, we performed a Critical Path Schedule Assessment as a part of our RQE evaluation to determine whether the DR Project's schedule provides sufficient underpinning to the RQE control budget.

Our Schedule Assessment is based upon our review of four main phases of the schedule: Pre-requisite projects to breaker open; defuel and drain with system shutdown / layup; re-tube and feeder replacement; and system commissioning / return-to-service. Due to the current maturity of the integrated schedule, we have focused on the critical path work and schedule only, covering primarily the following questions:

- Does the process used to develop the schedule conform with the DR Project's contracts and approved scheduling plans and procedures;
- Is the basis for the critical path well defined and documented;
- Does the resulting schedule match the documented critical path basis utilized in monetizing the cost estimates; and
- What work remains to complete the schedule and increase quality (i.e. Does the schedule reflect an executable plan for the DR Unit 2 Outage?).

As part of RQE, the DR Team has developed the integrated schedule's critical path at a level consistent with the overall project status. Due to several issues, including delays in issuing purchase orders, the projects have varying stages of schedule maturity. As a result, many of them (particularly those for Balance of Plant) are not detailed enough to be execution-ready schedules. For a large number of DR Project's bundles, implementation planning and work order development are in the early stages and overall integration between OPG Operations and outside vendors is not yet complete. These details are the subject of the next phase of schedule maturity that will occur during the Readiness to Execute period. However, we have determined that the schedule is sufficient for purposes of supporting RQE and is adequate as a baseline for the critical path durations. The DR Team recognizes that much work needs to be done over the next several months in order to have a fully integrated executable schedule.

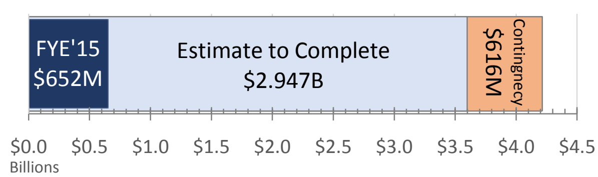
C. Project Summaries

<u>RETUBE AND FEEDER REPLACEMENT (RFR)</u>

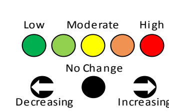
Retube and Feeder Replacement Project Summary

Control Budget:	$4,214,626,000
RQE Base Cost:	$3,598,222,000
Estimate to Complete:	$2,946,571,000
Contingency (as a Percent of ETC):	$282,820,000 (10%)
(Project + Program Allocated Cont.):	$616,404,000 (21%)
Estimate Class:	Class 2 (95%) Class 3 (5%)
Percent of RQE:	35%

Control Budget
$4.215B



Risk Perspective



1. RFR Basis of Estimate

RFR is the single largest element of the RQE and its budget reflects the overall importance of this work to the DR Project. The RFR cost estimate was developed over the past three years by SNC/Aecon, the project's EPC contractor, under the terms of contract executed between the parties on February 8, 2012. SNC/Aecon prepared four separate estimate submittals, each intended to be a further refinement of the prior estimate. SNC/Aecon's current estimate was updated and finalized on September 18, 2015 and forms the basis of the target price contract the parties intend to finalize prior to the Board of Directors meeting. OPG's estimating team confirmed that the underlying quality of this estimate is Class 2. The most significant supporting facts for this classification include:

- The final target price value of $2.750 B (2015$) has been fully negotiated and is based on mutually agreed upon project durations and schedule contingency, and encompasses 12.9M work hours, project management, supporting tasks, fee and all other costs;
- SNC/Aecon has designed and procured the specialized tools needed for the work. Some of the schedule task durations used in the estimate basis are derived from actually using the tools on the Mock-Up reactor and timing the results;
- All detailed engineering for Unit 2 is complete;
- Construction Work Packages ("CWP's") have been prepared and submitted as a part of the estimate;
- All 53,000 pages of the SNC/Aecon's submission were vetted by OPG's subject-matter experts;
- Both OPG and SNC/Aecon have teams with considerable experience on prior CANDU refurbishment projects and much of that experience has been incorporated into the estimate;
- Tool design has been significantly improved over those used in prior refurbishments, increasing reliability and making the tools easier to use;
- Training on the full-scale Mock-Up, which has never been done on prior refurbishments, should significantly increase the trades' performance in the field;
- Risk identification and contingency planning have been thoroughly performed and known risks are incorporated into the base schedule durations and work planning efforts.

2. Vetting and Characterization of Estimate

Over the course of the 3+ years of SNC/Aecon's estimate development, OPG worked collaboratively with SNC/Aecon to ensure that its final Class 2 estimate plan and pricing of the work would be, when delivered, reasonable and achievable. This collaborative review process was intended to ensure that SNC/Aecon's estimate accounted for OPEX from past refurbishments, improvements to the tool set for Darlington and the value of the planning effort to date, including the full-scale Mock-Up at the Darlington Energy Centre ("DEC"). On May 8th, 2015, SNC/Aecon presented its first draft of the Class 2 estimate to OPG, [redacted]

From this point through September 2015, OPG engaged SNC/Aecon in a detailed vetting process aimed at reducing the overall cost estimate, providing substantive basis for SNC/Aecon's portion of the critical path, and challenging the nature of SNC/Aecon's stated risks and contingency. The OPG and SNC/Aecon teams established a review and vetting process that was driven by subject-matter experts from each team with specific experience in prior CANDU refurbishments. This process was extremely successful at achieving consensus between the subject-matter experts, who objectively agreed with the underlying schedule durations in most instances. In fact, there were only minor disagreements over a small handful of items with a value of approximately $12M of the nearly $750M of direct craft performance estimates. As we noted in our last report, the process utilized to reach these final estimates was extremely detailed and rigorous, which should provide confidence in the results of the vetting process.

3. Contingency

Contingency related to the RFR work is split between the following major buckets:

- The contract includes a contingency amount that can be utilized to resolve issues without impact on the target price. SNC/Aecon is holding, as part of the Target Cost, contractually required contingency in which the parties agreed to a set amount based on the results of the base cost development. The basis and monetization of this contingency was heavily vetted by the subject-matter experts and senior management. The resulting 13.5% contingency totaling $368M is largely based on a deterministic analysis of the potential duration for work task performance and other discrete risks that could impact the work, as monetized with the use of Monte Carlo simulation. The DR Team has assumed for purposes of the control budget that this contingency will be utilized.
- OPG is holding $282M of contingency at the project level which includes discrete risks not carried under the contract.
- OPG is also holding $334M for schedule uncertainty which, due to the RFR project's significant critical path duration, is based on the modeled difference in impact to the critical path between SNC/Aecon's "most likely" (or P50) schedule and OPG's "late finish" (or P90).

In total, OPG is carrying $616M in contingency for RFR or RFR-related risks over and above the contingency that is built into the contract. With a remaining cost for RFR of $2.33B, this equates to 26%. Given the track record of prior CANDU refurbishments, the work performed to identify performance risks and the overall importance of RFR to the work, this level of contingency appears, at this stage, to be appropriate.

4. Summary and Remaining Issues

BMcD/Modus have been closely monitoring the development of SNC/Aecon's cost estimate and OPG's vetting of same, and believes the process the parties used to develop the cost estimate was robust and produced an estimate with significant detail. Moreover, we have witnessed the relationship between the parties substantially improve at every level, which will be important as issues arise. Based on the initial commercial goals the parties set forth, the contract appears to have thus far driven appropriate behaviours and a beneficial result.

With the Class 2 Estimate and target price agreement in place, the RFR team's attention is now turning to execution. The major near-term focus will be on the following:

- Recovery of procurement dates for some components: SNC/Aecon's procurement is generally lagging behind, though some of this lag is driven by aggressive contract milestones, not actual needs for the material. This is currently being addressed by the joint SNC/Aecon and OPG RFR team who have established a "war room" similar to that exercised for the Class 2 estimate development.
- Retube Waste Processing Building ("RWPB") estimate, schedule and performance: the work on RWPB continues while the estimate and schedule preparation continues. The $167M estimate included in RQE was presented as an upper limit estimate, though SNC/Aecon's final estimate and execution plan needs to be fleshed out before that can be definitively stated.
- Logistics need further refinement: SNC/Aecon needs to devote further attention to its supporting activities for material and tooling logistics during the Execution Phase.
- SNC/Aecon's construction organization needs to be built.
- Execution Phase schedule needs additional work and must align with the Project's work breakdown structure so that metrics for reporting progress can achieve needed fidelity.
- SNC/Aecon needs to remobilize in the DEC and make full and beneficial use of the Mock-Up to practice tasks and

train workers (this work is commencing as of the end of October).

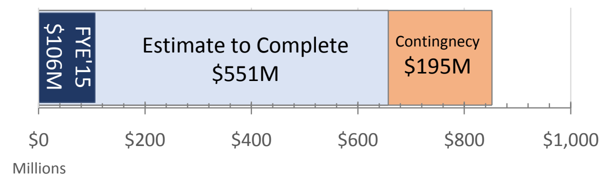
Each of these elements will provide necessary information regarding cost, schedule, risk and overall confidence as the DR Project advances that can be rolled into the Unit 2 Estimate.

TURBINE GENERATOR (TG)

Turbine Generator Project Summary

Control Budget:	$852,004,000
RQE Base Cost:	$657,149,000
Estimate to Complete:	$551,203,000
Contingency (as % of Estimate to Complete):	$194,855,000 (35%)
Estimate Class:	Class 3 (85%) Class 2 (15%)
Percent of RQE:	6%

Control Budget
$852M



Risk Perspective

1. Turbine Generator Basis of Estimate

The Project's Turbine Generator work consists of two significant evolutions: (1) maintenance work; and (2) digital controls change-out for Unit 3, Unit 1 and Unit 4. In 2014, the DR Team decided to postpone the controls change-out for Unit 2 until the conclusion of the DR Project in order to reduce the risk of the Unit 2 work. Thus, the risk profile for the Project changes significantly with Unit 3, which will be the first of three units that will have a full replacement of the original TG controls during Refurbishment. The digital controls upgrade will be a first time evolution for OPG and will require significantly more planning than the limited maintenance scope for Unit 2. The risk profile of the subsequent units has been developed with this in mind. Based on the risk profile of similar controls replacements, the decision to delay Unit 2 appears to have been prudent.

Unit 3 will also be the first replacement of the generator mid-section and stator rewind. A new stator will be installed for Unit 3, and the existing Unit 3 stator will be rewound and installed in Unit 4. These evolutions have been planned sufficiently in advance that this work should not be a threat to the schedule of the later units.

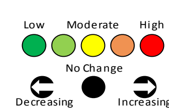
OPG has accepted SNC/Aecon's Class 2 Estimate for the Turbine Generator for Unit 2, and Alstom has completed its detailed design. SNC/Aecon and Alstom have submitted their full estimates for the subsequent units, which are characterized as Class 3 in nature. These estimates are expected to be fully accepted before the Board of Directors meeting.

2. Vetting and Characterizing the Estimate

Vetting of the Turbine Generator Project estimates came in two phases. Alstom, the original equipment manufacturer ("OEM"), is supplying parts and engineering per a fixed price. That contract was assigned to SNC/Aecon for management after its team was awarded the labour portion of the work. SNC/Aecon's estimate followed much of the same structure as its RFR effort, including successive iterations of the estimate from Class 5 to Class 2. The final Class 2 estimate that forms the basis of the target price with SNC/Aecon was the test case for OPG's estimating process which was robust and laid the groundwork for the RFR estimating vetting that followed thereafter.

3. Contingency

The total contingency of $194.8M equates to 35% of the project's remaining cost. The TG bundle includes three contingency buckets: (1) $27.9M for cost uncertainty; (2) $49.8M for discrete risks identified by the Project Team; and (3) $117M for potential component replacement based on the results of concealed condition assessments on each unit's turbine generator. This contingency bucket was vetted and classified using the OPG estimating process. The team has fully examined the potential schedule impact of discovery work and believes it has reserved sufficient non-critical path



time for major component procurement and replacement in the event such work is required.

4. Summary and Remaining Issues

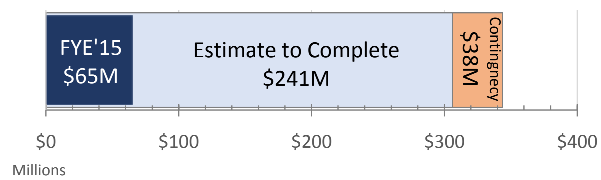
BMcD/Modus monitored the process used for vetting the TG estimates, and we believe this effort was robust and resulted in further maturation of the estimate. SNC/Aecon's plan for execution was fully explored and significant cost reductions were realized for RQE. As stated above, the Unit 2 work is essentially routine maintenance, though the performance of that work will allow for improved understanding and efficiency for the future units. The controls change-out for Unit 3 needs to be further examined so that the team is assured the labour hours are properly estimated and risks from schedule impacts are mitigated. These will be issues for future unit estimates.

FUEL HANDLING, DEFUELING AND SPECIALIZED PROJECTS (FH, DF, SP)

Fuel Handling, Defueling and Specialized Projects Summary

Control Budget:	$343,890,000
RQE Base Cost:	$306,048,000
Estimate to Complete:	$240,888,000
Contingency (as % of Estimate to Complete):	$37,842,000 (16%)
Estimate Class:	Class 3
Percent of RQE:	3%

Control Budget
$344M



Risk Perspective

1. Fuel Handling, Defueling and Specialized Projects Basis of Estimate

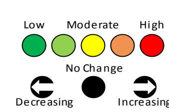
In summary, the scope of these project bundles includes: (1) Defueling each of the reactors to begin refurbishment, which is the first major evolution on the critical path and fully in OPG's control; (2) Fuel Handling equipment replacement to increase the likelihood of the power track maintaining operation through the Refurbishment outages; and (3) Specialized Projects to replace out of-date components to the Darlington Shutdown System computers, and replacement of the vault coolers that have reached the end of their useful lives. The work for these sub-bundles is directed by OPG, with the DR Team and the Darlington Station working cooperatively, with vendors supplying engineering, parts and labour for portions of the work. OPG decided to minimize the number of engineering changes to these critical components by calling for "like-for-like" replacements and thus limited the potential risk of execution.

While the total cost estimate for Fuel Handling/Defueling/Specialized Projects constitutes only about 3% of the total cost of the DR Project, each of these projects could strongly influence the critical path. Defueling each of the Project's reactors is the first critical path activity in the Unit 2 outage, and this is a first time evolution for Darlington. Ensuring the Fuel Handling components work throughout the DR Project is OPG's responsibility, as OPG will seek to maintain the operation of the running units during each defueling period of each unit's refurbishment. For these reasons, the planning, scheduling and risk mitigation of this work is extremely important. The DR Team has been focused on evaluating the past defueling evolutions at other CANDU plants and scrubbing the planned durations to the extent possible.

2. Vetting and Characterizing the Estimate

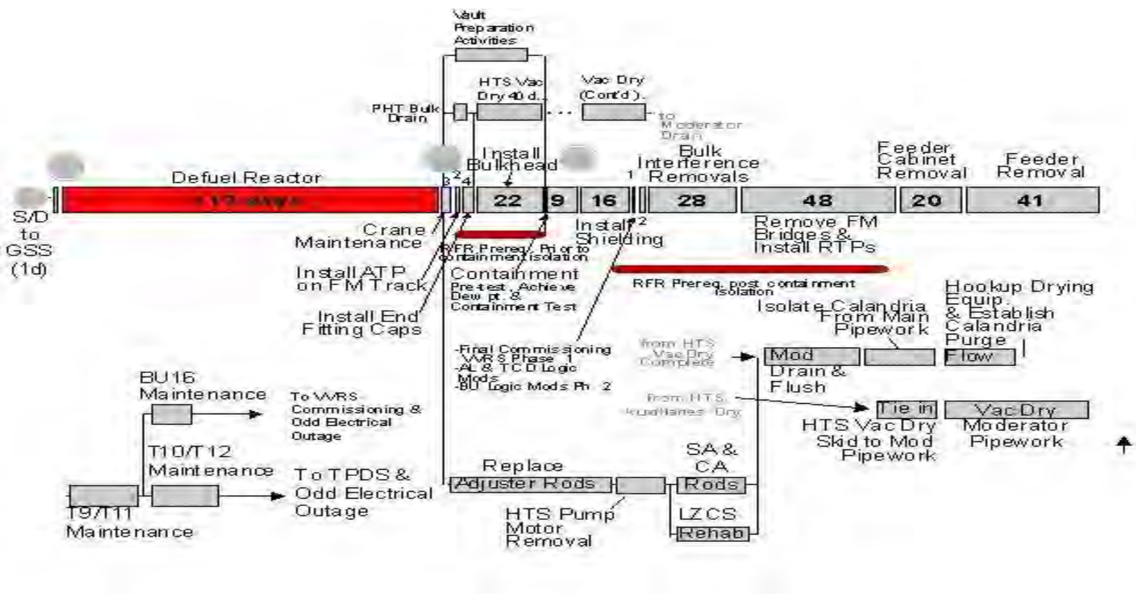
The process for vetting the estimates for these sub-projects was robust, included a team drawn from the station and the project and involved an assessment of reasonable performance in light of past CANDU refurbishment execution, station and vendor performance, and the first-of-a-kind nature of some of this work. It was the latter that drove the estimated Class 3 designation, as the Defueling/Fuel Handling team needed at least one unit's performance before committing to tighter cost estimates.

The current assessment from the Defueling team shows the best case for defueling is 90 days, the most likely (i.e. P50) is 113 days, and the 90% confidence level duration is 134 days. **Figure 3** below depicts the criticality of the defueling duration



at the beginning of the Project.

Figure 3



The Defueling Project Team believes these same durations should be utilized for all four units, as the learning curve for performing defuel will have limited value in improving performance over time. The team believes the 90 day best case is strictly a function of core hydraulics and cannot be improved, while the worst case is based largely on the potential for equipment failure. In the course of deriving these point durations, the Defueling team has dispositioned OPEX from Bruce Power and Pickering and has consulted with its vendor, GE/Hitachi. The due diligence performed by the Defueling team has greatly improved the DR Team's understanding of this critical duration.

3. Contingency

Each of the sub-bundles within this Project is carrying contingency that was assigned on the basis of the work's approximated risk. The following depicts the level of contingency assigned to each:

Bundle	Base Cost Estimate	Est. to Complete	Contingency	% Contingency on ETC
Defueling	$39.6	$10.6	$5.4	51%
Fuel Handling	$158.6	$144.7	$19.6	14%
Specialized Projects	$107.9	$85.5	$12.8	15%
Total	$306.1	$240.8	$37.8	16%

The Fuel Handling and Specialized Projects contingency appears to be appropriate based on the "like-for-like" nature of the work, while the Defueling bundle is carrying a significantly higher percentage due to the risk of delaying the critical path. The discrete risks identified for this work tend to be schedule-focused, which seems appropriate.

4. Summary and Remaining Issues

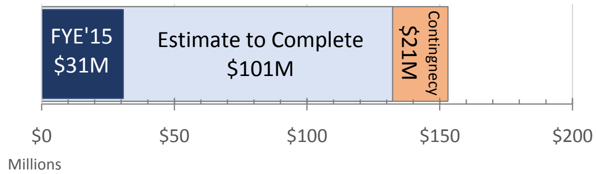
The Defueling/Fuel Handling teams have done a very good job of rooting out the risks and finding mitigation approaches. The commissioning of the test fuel handling equipment is complete and the team accelerated the schedule to maximize the amount of practice the teams can perform in advance of breaker open. OPG's performance of these projects will be under tremendous scrutiny going forward, so practice and proving-out processes for documenting progress will be important during the Readiness to Execute phase.

ISLANDING (IL)

Islanding Project Summary

Control Budget:	$153,104,000
RQE Base Cost:	$132,247,000
Estimate to Complete:	$101,418,000
Contingency (as % of Estimate to Complete):	$20,857,000 (21%)
Estimate Class:	Class 3
Percent of RQE:	1%

Control Budget
$153M



Risk Perspective

1. Islanding Basis of Estimate

The various islanding projects are relatively small in cost but are very significant to the DR Project's success. The design of the Darlington plant makes isolating a single unit for refurbishment a challenge. These projects include: (1) Installing a bulkhead that isolates the Refurbishment unit reactor vault from station containment once the irradiated fuel has been removed from the core, which will allow both airlock doors to be opened to facilitate worker and material transfer into/out of the vault, thus significantly improving RFR worker efficiency. Bulkhead installation is the single largest element of the Islanding Project and its performance will be by SNC/Aecon; (2) Establishing barriers and access control around the Refurbishment Island to keep the Refurb station staff from entering operating unit areas and to keep Station workers from entering Refurbishment work areas; and (3) Establishing terminal points on station systems to allow them to be isolated from the operating units to the maximum extent possible.

2. Vetting and Classification

The majority of the cost for the Islanding work is being carried under SNC/Aecon's contract and was estimated by SNC/Aecon using essentially the same process as it did for RFR.

3. Contingency

The total contingency of $20.86M equals 21% of the remaining costs. The largest and most significant driver of contingency is the potential impact on the DR Project's schedule from potential delays installing the bulkhead. The risk register for Islanding appears to be appropriate for its current state of maturity.

4. Summary and Remaining Issues

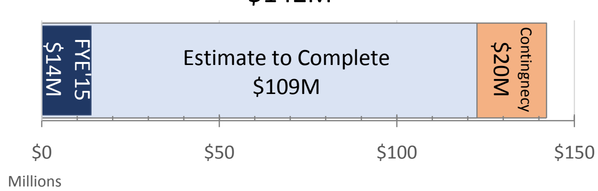
The DR Team has performed extensive reviews of plant conditions and OPEX, particularly from Bruce Power, and its efforts appear to have isolated and mitigated the risks to the extent possible. There will be some Islanding work during the Readiness to Execute phase that will allow the team to test its processes and metrics for the larger, more important scopes after breaker open.

STEAM GENERATOR (SG)

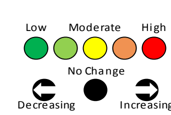
Steam Generator Project Summary

Control Budget:	$142,171,000
RQE Base Cost:	$122,579,000
Estimate to Complete:	$108,589,000
Contingency (as % of Estimate to Complete):	$19,592,000 (18%)
Estimate Class:	Class 2 (72%) Class 3 (28%)
Percent of RQE:	1%

Control Budget
$142M



Risk Perspective



1. Steam Generator Basis of Estimate

The scope of the Steam Generator Bundle is largely composed of maintenance work, including the following: (1) Primary side cleaning; (2) Secondary side cleaning (Tubesheet Water Lancing); (3) Access Port installations (modification); (4) Inspection and Repair (Primary and Secondary Side); (5) Divider Plate Inspections, Boiler Open/Close & Inspection Support; (6) Lay-up work, and; (7) Bleed Cooler Inspection. All of the work has been executed in other plants. The contract for the work was let to a joint venture of B&W and CANDU Energy, a subsidiary of SNC Lavalin.

2. Vetting and Classification of the Estimate

The SG work is classified as Class 2 due to the nature of the work and the fixed-price contract.

3. Contingency

The project is carrying $19.6M in contingency (18% of remaining cost) which is largely driven by the potential for discovery work, and coordination issues with RFR and OPG's Inspection Maintenance Services.

4. Summary and Remaining Issues

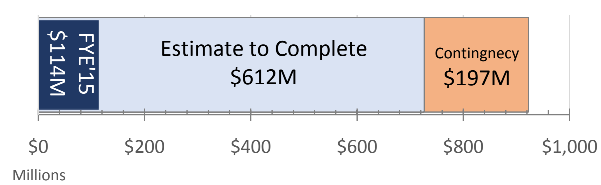
The development of the SG project has proceeded well and the work planning is well underway. The risks discussed above with coordination and the Project's schedule appear to be the most important factors for the team to consider. The performance of the Primary Side Cleaning is currently planned to be the only work other than RFR to extend past the 60% window designated for non-critical path work.

Balance of Plant, Shut Down Lay-up and Refurb. Support Facilities (BOP, SDLU, RSF)

BOP, SDLU, and RSF Project Summary

Control Budget:	$922,940,000
RQE Base Cost:	$726,402,000
Estimate to Complete:	$612,043,000
Contingency (as % of Estimate to Complete):	$196,538,000 (32%)
Estimate Class:	Class 2 (1%) Class 3 (53%) Class 4 (39%) Class 5 (6%)
Percent of RQE:	7%

Control Budget
$923M

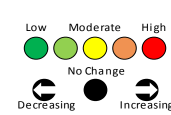


Risk Perspective

1. BOP, SDLU and RSF Basis of Estimate

This work scope includes a number of smaller to medium-sized packages. Approximately two-thirds of the work is based on design modifications, while the rest of the work is like-for-like replacement of aging components. The DR Team completed detailed engineering for the modification projects in time for the August 15, 2015 milestone, with some minor exceptions. The BOP work includes seventeen unique sub-projects that range in value from approximately $700,000 to $66M, and the scope includes replacement of components, electrical cable, and inspect and repair/replacement of valves. SDLU consists of twenty-eight different sub-projects and includes a number of prerequisites for construction, including breathing air for workers in the vault and barriers, as well as lay-up of plant systems for the unit being refurbished. RSF consists of building, improving and maintaining shops and other facilities for use during construction. The majority of this work has been released to ES Fox under the terms of the ESMSA contract.

The majority of the BOP work will be performed during the first 50-60% of the refurbishment schedule, with the goal of keeping BOP work off the critical path. Much of the SDLU and RSF work will proceed breaker open, but maintenance of the lay-up of systems will stretch throughout the length of the Project.



2. Vetting and Characterizing the Estimates

These project bundles are the least mature in the Refurbishment scope, which is reflected by their respective estimate classifications; 1% is Class 2, 53% is Class 3, 39% is Class 4, and 6% is Class 5. Based on our observations, these characterizations by the estimating team appear to be appropriate. The DR Team has set aggressive goals to receive all of ES Fox's remaining BOP/Shut-Down/Lay-up/RSF estimates to a Class 3 level by no later than January 2016. The OPG estimating team is collaborating with ES Fox's estimators on these remaining estimates to keep the process on schedule and test the quality of the estimates.

3. Contingency

These bundles' contingency is broken down as follows:

Bundle	Base Cost Estimate	Est. to Complete	Contingency	% Contingency on ETC
Balance of Plant	$430.0	$353.6	$125.3	35%
Shut-Down/Lay-up	$218.0	$196.8	$53.1	27%
Refurbishment Support Facilities	$78.4	$61.6	$18.1	29%
Total	$726.4	$612.0	$196.5	32%

The drivers for contingency include: (1) cost uncertainty due to the maturity level of the packages and the recent completion of supporting detailed engineering; (2) potential upfront delays to Refurbishment causing early schedule issues; (3) past performance of ES Fox on the Campus Plan Projects; and (4) potential for discovery work.

ES Fox's performance on the Campus Plan Projects provides vital OPEX that the team has considered in identifying risk for these projects. The DR Team is aware of the issues [redacted] and are attempting to mitigate those issues. [redacted] The OPG scheduling team has recognized these shortcomings and worked with ES Fox to improve the deliverables. 45% of the BOP and Shut-Down/Lay-Up work estimates are in the Class 4 or 5 range, which increases the risk of estimating uncertainty for these projects. Moreover, the risk profile of these projects should reflect the risks from ESMSA vendor performance. The BOP and Shut-Down/Lay-Up project teams have identified discrete risks related to vendor performance. Additionally, OPG has included some program-level contingency due to the past track record of these vendors in the event performance issues resurface during Refurbishment.

4. Summary and Remaining Issues

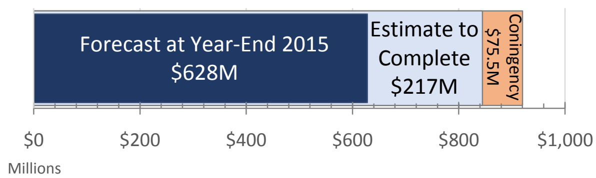
BOP and Shut-Down/Lay-Up will be under significant scrutiny once the DR Team's focus shifts to the Readiness to Execute plan. ES Fox must continue its planning work with more detailed and mature estimates, execution schedules and development of Construction Work Packages. The DR Team has placed a challenging goal of having all of the BOP projects proceed to their respective Gate 3 between late November 2015 and January 2016. To do so, ES Fox will need to complete the detailed level 3 execution schedules, Class 2/3 estimates and Construction Work Packages to support these gates. The BOP team has set interim milestone dates with ES Fox for these deliverables which may be too aggressive for the DR Team to receive quality work product.

CAMPUS PLAN PROJECTS (CP – F&IP AND SIO)

CP – F&IP and SIO Project Summary

Control Budget:	$920,079,000
RQE Base Cost:	$844,621,000
Estimate to Complete:	$216,713,000
Project Contingency ***(as a Percent of ETC):*** ***(Project + Program Allocated Cont.):***	$41,525,000 (19%) $75,458,000 (35%)
Estimate Class:	Not Applicable
Percent of RQE:	8%

Control Budget
$920M



Risk Perspective

1. Budget Status

There are six active Campus Plan Projects in execution at this time with the Refurbishment Project Office ("RPO"), the RFR Island Support Annex ("RFRISA") and Replacement of Buried ESW Piping approaching completion. There are two other pre-requisite projects, the Auxiliary Heat System ("AHS") which for budgetary purposes was reclassified as a Station project though P&M is still managing the work. The costs for AHS are no longer carried in RQE. The other pre-requisite project, the Refurbishment Waste Processing Facility ("RWPB") is being performed by SNC/Aecon under the RFR Definition Phase contract and is not part of P&M's reporting.

We have noted in past reports that while the remaining dollars involved in the Campus Plan Projects do not necessarily have a significant monetary impact to RQE, certain of the projects, most notably D20 Storage and EPG 3, remain a risk to breaker open of Unit 2. These projects' completion dates have shifted over time and further delays could result in drawing attention away from the Readiness to Execute plan. Overall, the entire portfolio of Campus Plan Projects experienced $76.3M in base cost growth from 4d to RQE, an increase of 9%, which resulted in contingency drawdowns from the allocated budget amount set in 4d. P&M is currently forecasting an Estimate to Complete ("ETC") for all remaining Campus Plan and SIO work of $216,713,000.

2. Contingency

Based on the history of these projects, the velocity of change and the volume of remaining work, the $75.5 million in remaining contingency needs to be closely tracked to ensure it is enough to cover any remaining cost issues with completing these projects. In particular, D20 and EPG3 pose the greatest risk to the remaining Campus Plan Contingency, and EPG 3's final cost estimate has not been fully vetted and approved. P&M's change control process needs to be monitored so that the use of contingency is readily identified and so there are sufficient funds going forward. In Section III below we discuss the status of these projects and describe some of the risks that could cause the base costs for these projects to increase.

FUNCTIONS

With the exception of Operations & Maintenance, the remaining functional groups that compose the DR Team jumped in size from 4d to RQE. The non-Operations & Maintenance groups' cost estimates increased in aggregate from $1.28B (2015$) to $1.53B, an increase of 20%. The largest gains were for the Execution Organization (48%), Contract Management (38%) and Managed Systems Oversight (42%). Operations & Maintenance's budget decreased by from $1.1B (2015$) at 4d to $0.81B for RQE, a reduction of 27%. This reduction was due primarily to identification and removal from the DR Project of non-Refurbishment Operations & Maintenance costs.

The DR Team has high confidence in the extent of the estimates it has prepared for RQE and are all-inclusive of what could reasonably be identified for staffing at this time. However, the pace of the proposed ramp-up of the DR Team's staff is aggressive and will be very difficult to meet. In order to meet the plan, the DR Team would have to increase from 770 to just over 900 (17%) staff in less than 3 months. The team has been chronically under-spent during the Definition Phase, and missing these major ramp-up dates will further impact the accuracy of the team's staffing forecasts.

The commitment from the NPET to further rationalize and organize the functions on the basis of a division of responsibility matrix ("DOR") has been held over to the Readiness to Execute phase. The DR Team committed to putting a DOR in place that defines each function's accountability and responsibility by early 1Q 2016, which in turn should result in optimizing the organization. While the DR Team's goal for RQE was to identify the outer cost limit for the functions, BMcD/Modus is more concerned that the DR Team operate efficiently, have highly qualified and skilled resources, and actively manage the field work during the Execution Phase. The team has considerable work ahead to meet these goals.

D. Summary of RQE Risk and Contingency

As part of our assessment of RQE, BMcD/Modus has focused a lot of time and attention on the DR Team's development of contingency for the Project's control budget. Our review focused on the development of input factors, the Monte Carlo stochastic modeling, results analysis, and finalization of RQE contingency provisions. Specifically, we focused on the following aspects of the DR Team's contingency development:

- Whether the processes used for capturing risks were sufficiently robust;
- The extent to which contingency is properly modeled; and
- Whether the risks and associated contingency amounts were properly monetized.

The DR Team's development of the contingency for RQE compares favorably with what our team has observed in the industry. While risk management and contingency development has many subjective aspects, the DR Project's process is well constructed and executed. It is probably in the upper percentile of comparable project practices. Nonetheless, because of uncertainties and unknowns, contingency values are not perfect, but the DR contingency process likely contributes to a reliable and defensible RQE.

1. Contingency Process

OPG prepared and approved the RQE Contingency Development Plan NK38-NR-PLAN-09701-10006 in Q1 2015, establishing the approach for developing the RQE contingency and describing the associated contingency development principles and processes. The Plan established a contingency process utilizing a number of AACE recommended practices for contingency development. It appropriately states that the practices will be supplemented with the expert opinion and judgment of the NPET (Nuclear Projects Executive Team) to ensure there is confidence that the contingency estimate is robust and sufficient to deal with the risks and uncertainties characterized at the time of RQE.

Six basic buckets were addressed in developing the RQE contingency:

1. **Cost Estimating Uncertainty** - The project managers and function leads provided three point estimate uncertainty ranges.
2. **Schedule Uncertainty** – Uncertainty range estimates for critical path durations were provided to the risk team by the project managers. Schedule cost impact was determined by applying a daily "burn rate" to any schedule impacts. Allocation of schedule contingency between the affected project and the overall program critical path was carefully addressed.
3. **Discrete Risks** - Discrete risks from the project, program and function Risk Registers were reviewed and post-mitigation probability of occurrence values were finalized. Quantitative cost & schedule impact values were developed with associated three point ranges as model input. In addition, provision for risk event recurrence over the four units was established for model input.
4. **High Impact Low Probability Risks** – The Board of Directors Controlled Contingency was established deterministically to address these issues and to provide for some coverage of unanticipated items beyond control of the DR team.

5. **Campus Plan/ F&IP –** The nature of Campus Plan risk registers, estimates and schedules required that contingency be established a through a combination of stochastic, deterministic and expert judgment means. Probabilities and impact ranges for the discrete risks were updated. Cost elements were assigned uncertainty ranges. The results of the risk probabilities and impact quantification with three point ranging, along with estimate uncertainty ranges were then submitted for Monte Carlo analysis. The Monte Carlo contingency values were assessed by P&M's management and deterministic adjustments were made for RQE. The stochastic and deterministic numbers were then compared and justifiable adjustments were made. In addition, program contingency was added to reflect the historic performance issues associated with Campus Plan projects.

6. **Insurance Uncertainty** – A premium cost point estimate and pessimistic/optimistic uncertainty range was provided by Finance and factored into the contingency calculation.

In developing the contingency at the project level, the DR Team took care to ensure there was no double-counting or duplication. From our review, the team was successful in not over-generating the contingency.

2. Vetting of Risks and Contingency

The RQE contingency was subjected to many stages of review and vetting. The RFR project received focused attention from SNC/Aecon and the DR Team, given its overall importance to the Program. The process used for vetting the base contract amounts also resulted in thorough understanding and development of the risk model.

For the various projects the Risk Team conducted contingency workshops, where subject-matter experts challenged, critiqued and provided constructive feedback. After the workshops, members of the risk team met with the respective managers to update data that was entered into the @RISK Monte Carlo model and preliminary results were obtained. Those results were analyzed and changes were made to the model and input data was refined. To monetize schedule impact, Finance reviewed cash flow projections and developed a point estimate for daily burn rate and an associated uncertainty range. That approach is considered reasonable.

The DR management team recommended establishing a contingency to be controlled at the Board of Directors level. This was done by considering deterministic estimates primarily based on experience-based judgement. Other considerations included OPG's risk tolerance, the budget ceiling, and the overall established contingency. Provisions for "Black Swan" (high impact low probability) risks were considered in establishing this layer of contingency. Factors included acts of God, the labor and political environment, vendor defaults, nuclear safety or security events, unforeseeable scope increases, and financial matters. No strict rules or best practices exist for estimating low probability/high impact events and the subjective approach employed by DR is not uncommon.

3. The Monte Carlo Model

The DR Team used modeling experts from the Palisade Corporation[3] to develop a Monte Carlo simulation method for the Project. In Palisade's final report, which focused on the RQE contingency process, Palisade stated that the model used by the DR Team contains all the elements of risk management's best practices and contains well-defined methodology as its foundation. Palisade also cited the collaboration of risk experts interfacing with project/functional managers and SMEs.

The RQE Monte Carlo model is extremely robust and comprehensive. All four units are addressed in one integrated fashion. Over 2600 three point estimates were used to model outcome (maximizing use of three-point range estimating contributes to the veracity of the input by allowing the source to avoid conservative single value "plug-in" numbers). Over 470 discrete risks were analyzed. Approximately 273 risks were included in the contingency calculation, which 55 were program/function related and 218 were from projects. Close to 800 estimate uncertainties were analyzed and 128 schedule activities assessed across the four Units.

[3] Palisade Corporation provides widely accepted @RISK software system to a global base of customers and consults on the process for developing stochastic tools for understanding and quantifying risks and uncertainties.

A schedule correlation factor of 70% is included the contingency model, reflecting interdependence of schedule activities. In addition, because DR is a multiple unit project, provisions to address risk recurrence are incorporated based on project and functional manager input.

4. Contingency Results

The resultant contingency amounts are reflected in **Table 1**. Monte Carlo based values are at the P90 level for Projects/Bundles/Functions and for allocated Program Contingency. "P90" means that, based on the inputs and model structure, there is a 90% confidence that the contingency value is appropriate to cover the risks and uncertainties analyzed by the model.

Table 1

RQE Contingency Summary

Contingency Element	P90 Amount ($x1,000)[4]	Basis	Simplified Contingency Draw Approval Requirements[5]
Projects/Bundles/Functions	$851,648	Monte Carlo analysis of Discrete Risks and Schedule/Estimating Uncertainty[6]	If less than $100K – Project Manager approves for trending with no contingency draw until accumulated. Then…[7] …If greater than $100K and less than $5M – Project Manager and Project Director approves contingency draw. [8] …If greater than $5M, CCB approves[9]
Program	$854,475	Monte Carlo analysis of Discrete Risks and Schedule/Estimating Uncertainty	Program Change Control Board ("PCCB")[10]
Board of Directors Controlled Contingency	$800,000	Subjective analysis of unanticipated/uncontrollable items (Vendor default, Labor/political matters, etc.	PCCB + CEO or DR Board Committee[11]
Total Contingency	$2,506,123		

The third column in **Table 1** reflects the DR Project's recommendation for the management of contingency. It should be noted that the Board has not yet provided approval of this process. In determining level of control for contingency, it may also be beneficial for the Board to review contingency at both the P50 and P70 levels. We will provide a comprehensive review of how OPG intends to monitor and use contingency in our Change Management Assessment Report that will be issued later this year.

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[4] *See* RQE Total Cost Snapshot 4 October 21, 2015.
[5] Other provisions are in place based on percentage of baseline and for schedule changes impacts.
[6] *See* Campus Plan Exception described earlier in this report.
[7] Change costs are trended and do not result in contingency draw unless the project/bundle/function can't absorb the cost. At that point, approval is based on the amount of accumulated cost impact for the affected project, bundle, or function.
[8] N-MAN-00120-10001 PC-12 "Nuclear Refurbishment Program Change Management Section 6.1.
[9] *Ibid.* Section 6.1. The Change Control Board ("CCB") is comprised of: VP Refurbishment Execution, Director Refurbishment Engineering, Director Refurbishment Operations & Maintenance, Director Refurbishment Planning & Controls, Director Refurbishment Unit Outage, and Director Nuclear Controllership.
[10] *Ibid.* Section 5.13. The Program Change Control Board ("PCCB") is comprised of NR Dir. Planning & Controls, SVP NR, VP Nuclear Finance, VP Assurance, VP NR Engineering, VP Refurbishment Execution and VP Operations & Maintenance.
[11] *Ibid.* Section 6.4.4.

5. Observations and Recommendations

As stated, BMcD/Modus have found the process OPG has utilized for developing contingency to be sufficiently robust to support RQE. However, risk management is not a once-a-year exercise; it should be considered a pillar of project management. Thus, we have made certain recommendations for further enhancing the management of risk and governing the appropriate use of contingency established in the control budget:

- With some exceptions, the DR Team chose to monetize contingency utilizing the experience of the project managers as opposed to developing detailed estimates that were vetted by the OPG estimating team. We recommend that for the Unit 2 Estimate, OPG utilize the same estimating process for the contingency as it does for the base costs.
- OPG should ensure that significant contributors to contingency are justified and well documented. Justification of components such as: a) the broad application of schedule correlation; b) schedule burn rates; and c) levels of management control over contingency should be well documented.
- The infrastructure for identifying and managing risks has been in place for several years, though to a large extent, the program has been relegated to the "important, but not urgent" category as projects and functions focused on day-to-day challenges. While the RQE contingency process required the projects and functions to devote considerable attention to risk and contingency development effort, we observed some of that focus wane as the RQE effort was completed. Momentum and a sense of urgency for risk management needs to be maintained through the Execution Phase. The DR Team should consider making the discussion of risks and risk management a greater priority in its internal communications.
- Consideration should be given to developing information and training sessions that discuss the value of the risk program not only for development of RQE contingency but also the importance of sustained (or increased) efforts in executing and managing the DR Program. (This is also important for documenting and managing internal OPEX).
- OPG needs to increase senior management visibility and risk program advocacy throughout the organization.

Finally, it is important to understand that stochastic processes for developing contingency values do not create conclusive "answers". They serve as statistical tools to inform management regarding a basis for establishing and justifying contingency. These tools do not manage or mitigate risks; only management can do so. Therefore, management focus on risks needs to be strong and ongoing.

E. Remaining Work – Program Level

1. Quality Assurance

The DR Team is in the process of tying-up the remaining loose ends in the RQE submission and is performing quality assurance checks to ensure there are no major data fidelity issues in the control budget. The following are the priorities the team is using to ensure the quality of the RQE submission:

- All costs need to be supported by the documentation necessary to tie all numbers to their source;
- Risk registers need to incorporate any changes that came from NPET reviews; and
- The RFR team must close-out review SNC/Aecon's full Class 2 submission that OPG received on September 18, 2015 to ensure that there are no significant gaps or unresolved issues prior to locking down the target price.

The process for close-out of 4d was not given priority status, which elongated its close-out. The team is putting appropriate focus on close-out of RQE at this time.

2. Schedule

A major component of the Readiness to Execute plan will be developing and finalizing the Unit 2 execution schedule with all work at the appropriate level of detail. The DR Team's original goal of having the full execution schedule completed for RQE was not met, though as noted, the control budget is supported by a well-defined critical path and windows for non-critical path work have been vetted and considered. We believe that the DR Team has done sufficient schedule work to support RQE, though considerable work remains before the schedule is execution-ready. BMcD/Modus will be providing our comments and recommendations regarding the schedule development as the work progresses.

3. Documentation

The DR Team developed considerable documentation in support of RQE that must be properly archived through a document control process which is directly traceable to the RQE. The team intends to implement a robust Integrated Data Base where the documentation will ultimately reside. The organization of this documentation should consider the future needs of subsequent cost estimates, configuration management, commercial uses and requirements for substantiating the basis of Project costs for regulatory purposes. Once the IDB is set-up, we recommend testing the sufficiency of the organization of the documents to ensure the documents are accessible and comprehensive. The team has put a goal of completing the document archive by the end of 2015.

III. Status of Campus Plan Projects

The outlook for completion of the largest and most significant remaining Campus Plan Projects – D20 Storage and Emergency Power Generator 3 ("EPG3") – had generally improved, though there are significant remaining issues and risks that have impacted both these projects' schedules and cost estimates.

A. D20 Storage

Ellis Don continues working on the foundation for D20 Storage, and SNC/Aecon is preparing to complete the building and perform the mechanical, electrical, HVAC and steel/structural erection. Ellis Don's work must be substantially completed before SNC/Aecon can start its work in the basement of the D2O building. P&M has bifurcated its team to simultaneously focus on Ellis Don's progress and SNC/Aecon's preparation.

Ellis Don's recent progress has ramped up since our last report. As of October 30, 2015, P&M reported Ellis Don to be 83% complete with its foundation work, and had only two walls and one staircase left to pour. Ellis Don's progress has been positively impacted by adding a second shift to increase the volume of work. In addition, the P&M team has benefitted from assigning an experienced project manager to oversee the civil construction and from the Project Controls effort to field verify and report Ellis Don's progress.

The DR Team's Program Status Report dated October 23, 2015 stated that Ellis Don's "concrete placement in the basement is expected to be completed by December 22nd for the north section and 1-2 weeks later for the south section." The current schedule (as of October 30 in OPG's network) shows Ellis Don completing its work on December 26, 2015 however with the increase in production and with good weather, their completion date could move forward. Ellis Don's recent improvement makes completing the foundations in mid-to-late-December much more likely. Turnover of the entire site from Ellis Don to SNC/Aecon will likely miss the contractual date of November 30, 2015. However, Ellis Don is currently working on a recovery schedule so that it will turn over the West Annex Basement on November 30, 2015 and the seismic dyke by December 22, 2015. SNC/Aecon has fallen behind in its pre-fabrication of piping that is on its critical path, and has further indicated that it may accept partial acceptance of the site on November 30th. However, since its piping work and tank setting is on critical path, the value of SNC/Aecon's partial site acceptance may be minimal until it can recover its critical work streams. Due to the fact that both contractors will be working in a confined space, it will be important for OPG to carefully manage this transition. The contractors' schedule progress needs to be accurately recorded and based on recent objective progress so that OPG can document this transition for commercial purposes.

SNC/Aecon has prepared and revised its cost estimate and schedule (which still requires final vetting and disposition of its basis of estimate), and is now producing metrics that are reporting its progress based on quantities of work. These early metrics are showing SNC/Aecon is behind by approximately 2-3 weeks in its procurement and prefabrication of piping. The baseline schedule shows SNC/Aecon's plan to meet all of the project's key milestones; however, as noted these dates are likely to be impacted. Schedule updates from SNC/Aecon need to be properly captured so that an accurate forecast of any impact can be properly documented and managed. [redacted] SNC/Aecon intends to do so once it has secured agreements with its major structural, civil and HVAC subcontractors. SNC/Aecon has committed to reporting key subcontractor status via earned and actual work hours against its plan, which should provide P&M with enough information to track this key work.

The current SNC/Aecon schedule is based on the D2O project meeting an interim deadline of June 28, 2016 to accept water from Unit 2 so that there is confidence that Refurbishment of Unit 2 can proceed. This deadline was initially set about 1 year ago when the DR Team reviewed the need for a contingency plan for D20 Storage in the event the building could not be completed. We have recommended that P&M and Refurbishment re-examine this milestone if it is able to implement one of the alternatives it is currently reviewing for draining primary heat transport and moderator water from Unit 2. If an effective mitigation strategy can be implemented, it could allow deceleration of some of the work which could potentially reduce the overall risk of construction. However, such a deceleration should only occur if it is supported by objective progress data from field progress that substantially improves the confidence of all concerned that D2O Storage Facility will be available for Refurbishment of Unit 2.

B. EPG 3

OPG has committed to placing EPG 3 in service prior to Unit 2's breaker open. The civil construction is currently approximately 20% complete, and ES Fox intends to set the EPG unit by the end of November. Construction has previously been impacted by issues with plant tie-ins and unforeseen underground conditions. In its Project Status Report issued October 29, 2015, P&M reports that "Corporate milestone "Generator In Place" – Nov 30, 2015 currently at risk." While there is a recovery schedule in place, the Project Status Report currently shows that the Turnover/Available For Service milestone is not forecasted to occur until August 5, 2016 (323 days late), only two months in advance of breaker open. Furthermore, it should be noted that neither the additional forecasted costs ($21.3M over the approved amount of $88.2M) nor the recovery schedule have gone through a gate for final approval. The gate approval was originally scheduled for September 11, 2015, but that has been delayed until 4Q 2015. It is critical for OPG and ES Fox to agree on a schedule that is doable and predictable as soon as possible.

In its Project Status Report, P&M reports that "Engineering holds remain on a number of packages to incorporate design input from LLM Vendors. Holds to be resolved by Dec 2015." These engineering issues should not impact the civil work, though some involve changes to allow the stock generator to meet OPG operational requirements which could impact the installation or in-service date of the EPG unit if they are not resolved in time. The VP of Engineering and Sargent & Lundy have established a process for working through these issues and bringing more timely visibility to engineering issues as they arise on ESMSA (Campus Plan, BOP and Shut-Down/Lay-up) projects.

P&M also identified EPG 3's commissioning as a risk. "This is a first time evolution for these modifications and there is limited commissioning experience with this type of equipment. The risk is that the commissioning of this new system may take longer and be more challenging than anticipated/estimated resulting in numerous work interruptions/clarifications and extension to the schedule or missing AFS (OPEX from Pickering Temporary Emergency Power System)." To mitigate this risk, the DR Team has assigned a dedicated manager to lead the commissioning effort, though the schedule should accommodate the time needed for commissioning with these risks in mind.

P&M's Program Status Report dated October 23, 2015 showed the forecast as $115M, and noted that, "the forecast is expected to increase by an additional $5-10M. The increase is a result of additional costs to recover schedule delays that occurred during excavation and fuel line relocation, design changes based on newly available equipment information, and additional resources and time allotted for commissioning. This cost increase can be accommodated within the available contingency." P&M further noted in the October 27th Project Status Report that, "Significant costs increases are being addressed with contractor. SCRs in place," and "A new gate package will be prepared to identify the new EAC and schedule completion," which P&M anticipates having in 4Q 2015. The gate approval was originally scheduled for September 11, 2015, but that has been delayed until 4Q 2015. It is critical for OPG and ES Fox to agree on a cost estimate and schedule that is doable and predictable as soon as possible.

IV. Readiness to Execute Planning

With the completion of RQE, the DR Team intends to shift its entire focus to the Readiness to Execute plan. The team has developed detailed milestones and has established forums for progressing deliverables. In our review, we believe the Readiness to Execute plan is comprehensive and should provide a solid basis for testing the DR Team's execution planning. There are certain parts of the plan that are intended to deal head-on with key project risks; in future reports, BMcD/Modus intends to focus on certain key aspects of the readiness work, including the following:

- **Procurement:** The DR Team is piloting processes for tracking and overseeing vendor procurement, and is enhancing the warehouse capacity for the storage of materials and equipment. The risks for procurement are well known and documented in the industry, and OPG and its vendors are already experiencing some issues that will need to be managed carefully. Transparent reporting of status and identification of problem areas are the most effective means for mitigating those problems.

- **Project Team Development**: With the DOR in place, the team intends to sort out accountabilities and test its responses to real-time work situations. As part of this exercise, the team needs to review protocols for frequency and timing of key meetings and expectations for key communications.

- **Completion of Construction Work Packages**: Completing CWPs for the remaining work will require substantial effort, and is a necessary prerequisite for developing the schedule. In particular, BOP work packages must be completed by April 2016 to support the schedule and Unit 2 Estimate development.

- **Schedule Development**: The DR Team intends to iterate the baseline schedule two times prior to breaker open. In its Rev. B schedule, the team will flesh out all of the work known for RQE, which will expose certain areas in the schedule that are potentially problematic. During the first half of 2016, the schedule will be further refined, with Rev. C supporting the Unit 2 Execution Phase. In the process of developing the schedule, the DR Team should review lessons learned from the schedules prepared by SNC/Aecon and ES Fox for the Campus Plan Projects. These schedules are a leading indicator of how these vendors will schedule work (if allowed) for the Refurbishment. There are a number of issues with the vendors' current approach ([redacted]) that if not corrected will inhibit the schedule's ability to properly calculate and forecast the work. Not correcting these deficiencies will cause OPG to be reactive throughout the Execution Phase. Moreover, the Campus Plan Projects have also learned the importance of planning commissioning tasks well in advance, so that execution of the work (including physical testing, preparation of a multitude of documents and turnover activities) is performed in a manner that allows for the work to be accepted. These details need attention in the final Rev. C schedule.

- **Reporting and Metrics**: The DR Team has considerable work planned to improve metrics and reporting as part of the Readiness planning. It intends to put in place a new cost tracking system and developing metrics that will provide useful tools for project management. The team is committed to basing these systems on installed quantities which is standard in the industry. Much of the DR Project's current controls suite is based on financial reporting, which has its place but is not appropriate for field execution. In addition, the team needs to define a single source of data so that there is fidelity across all reports. BMcD/Modus will be closely reviewing the team's efforts in developing its reporting regime.

- **Unit 2 Cost Estimate**: The culmination of the Readiness to Execute activities will be the development of the Unit 2 Estimate for the BOD's approval. The work performed for RQE should position the team for this exercise, though it should consider lessons learned from the RQE effort and develop a Unit 2 Estimating Plan. As part of that plan, the DR Team should consider using the same RQE processes and protocols for all of the Unit 2 Estimate. During RQE, a decision was made to vary from the approved estimating process for some of the components of the estimate, including PMT costs, functional costs and the discrete risks. With the goal of the Unit 2 Cost Estimate being to tighten the estimates, the established process used for vetting EPC costs will allow for more formative vetting of these costs, increasing their reliability.