ONTARIO POWER GENERATION

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March 1, 2016

RESS & OVERNIGHT COURIER

Ms. Kirsten Walli
Board Secretary
Ontario Energy Board
P.O. Box 2319
2300 Yonge Street, 27th Floor
Toronto, ON M4P 1E4

Dear Ms. Walli:

Re: Application by Ontario Power Generation Inc. for 2017-2021 Payment Amounts (EB-2016-0152) – Confidential Treatment re Undertaking Responses

In accordance with Rule 10 of the Ontario Energy Board's ("**OEB**" or the "**Board**") *Rules of Practice and Procedure* and section 5.3 of the OEB's *Practice Direction on Confidential Filings* (the "**Practice Direction**"), OPG hereby requests confidential treatment for portions of three documents which are included as attachments to OPG's responses to undertakings J1.1, J1.2 and J1.3, arising from the February 27, 2017 oral hearing. The affected documents are listed in **Appendix 'A'**, which also identifies the specific page numbers where the redactions are located in each document and the specific reasons for each request.

OPG brings to your attention that the redacted documents that OPG is filing publicly in response to undertakings are non-confidential. This is regardless of whether the documents themselves may be otherwise marked as "Confidential" or "OPG Confidential". Such notations would have been applicable at a prior time in the history of the document.

Below, OPG sets out the reasons for its confidentiality requests, including the potential harm that could result from public disclosure of the relevant information.

In respect of the attachment associated with the response to J1.1, and in accordance with Procedural Order No. 4, OPG requests that the confidential portion of this document not be provided to the consultants or counsel for the PWU or Society of Energy Professionals who have not signed the OEB's form of confidentiality undertaking nor the affidavit referenced in Procedural Order No. 4.

Based on the various categories of confidential information requests, OPG has organized the responses and documents into the following attachments, which are included with the hard copy of this letter. For the electronic copy of this letter, filed through the RESS, only this letter and the non-confidential attachments are included. The attachments are as follows:

Attachment A: *Non-Confidential*, redacted versions of the documents that are the subject of this request. These items are intended to be placed on the public record. Please note that while some of these items may inadvertently be

marked "Confidential", these versions that contain redactions are no longer confidential.

Attachment B: *Confidential*, unredacted versions of the documents that are the subject of this request. These items are intended to be treated confidentially, and should only be provided to intervenors or their representatives who sign or have already signed, a Declaration and Undertaking in the prescribed form in this proceeding. The specific portions of these documents that constitute the confidential information are marked with red boxes.

In this request, OPG references prior Board decisions on the confidential treatment of OPG's information. As copies of these referenced materials were submitted earlier in this proceeding, OPG has determined that it is not necessary to file further copies of these materials with the present request. The information requested to be treated as confidential in this submission is consistent with those approved by the OEB in its November 1, 2016 Decision on Confidential Filings and Procedural Order No. 3.

Aside from the treatment requested above with respect to J1.1, OPG will provide each intervenor that signs or has already signed a Declaration and Undertaking in the prescribed form and files or has filed it with the OEB a copy of the confidential materials that are included in Attachment B.

On a final determination, should the OEB grant OPG's request for confidentiality, OPG proposes that the OEB order the confidential information to be disclosed, subject to any conditions the OEB may find appropriate, to only those persons that by then have signed, or that subsequently sign, a Declaration and Undertaking in the prescribed form in this proceeding.

In addition, consistent with section 6.2 of the Practice Direction, OPG requests that during oral proceedings any reference to information, which the Board has determined to be confidential, be conducted *in camera* so as to preserve its confidential nature.

At the conclusion of the proceeding, or in the event that the confidentiality request is refused, in whole or in part, and OPG in turn requests that some or all of the information that is the subject of this request be withdrawn in accordance with section 5.1.12 of the Practice Direction, all persons in possession of the said information will be required to promptly destroy or return the information to the OEB Secretary for destruction.

Reasons for Requesting Confidential Treatment

OPG is requesting confidential treatment relating to confidential information contained in a number of responses and documents, which based on their nature can largely be categorized as (a) OPG's commercially sensitive information, (b) contractor/vendor or third party references that may lead to reputational harm to those persons, and (c) collective bargaining documentation. OPG's reasons for requesting confidential treatment are set out below for each of these categories. The specific rationale for each particular request, listed by page number, is set out in **Appendix 'A'**.

(a) Commercially Sensitive Information of OPG and/or Third Parties

These items should be protected as confidential because they include OPG commercially sensitive information with respect to project cost contingencies or aggregate information that

would allow determination of such commercially sensitive information. Disclosure of this information could prejudice OPG's competitive position. Similar information was treated as confidential by the OEB either in this proceeding as approved in Procedural Order #3, or in OPG's previous applications, EB-2010-0008 and EB-2013-0321.

(b) Contractor/vendor or Third Party References

These documents contain certain commentary on the performance of specific contractors in the Darlington Refurbishment Program or OPG's internal assessment of a third party's information. Public disclosure of this information could potentially prejudice the competitive positions of the relevant parties and could also give rise to adverse impacts on existing relationships (contractual or otherwise) that OPG has with the parties or on relationships those parties have with others. In EB-2013-0321, the OEB agreed that disclosure of this type of information could lead to reputational harm to contractors. Accordingly, the OEB ordered this type of information to be treated as confidential (Hearing Transcript, Vol. 12). The OEB also accepted confidential treatment of information relating to performance of vendors in Procedural Order No. 3 of this proceeding.

(c) **Collective Bargaining Documentation**

These items include information relating to OPG's labour strategies. If disclosed, this information has the potential to interfere with future collective bargaining negotiations between OPG and the unions that represent its employees.

Yours truly,

[Original signed by:]

Barbara Reuber

Cc: John Beauchamp (OPG) via email
Charles Keizer (Torys LLP) via email
Crawford Smith (Torys LLP) via email

APPENDIX 'A'

Affected Attachments

J#	Response or Attachment	Location of Confidential Information	Reason(s) for Confidentiality Request
J1.1	Attachment 1	p. 2 of 4	Contractor/Vendor or third party references
		p. 3 of 4	Information on OPG's collective bargaining strategies - Labour Relations Sensitivity
		p. 4 or 4	Contractor/Vendor or third party references
J1.2	Attachment 1	pp. 9-10 of 21	Contractor/Vendor or third party references
		pp. 12-14 of 21	Commercially sensitive information – Contingency
		p. 17 of 21	Contractor/Vendor or third party references
J1.3	Attachment 1	p. 7 of 11	Contractor/Vendor or third party references
J1.3	Attachment 2	p. 3 of 3	Contractor/Vendor or third party references

ATTACHMENT 'A'

Non-Confidential, Redacted Documents

Executive Summary

Breaker Open and the start of the Darlington Refurbishment Project ("DR Project") Execution Phase occurred on schedule. OPG Management's November 10, 2016 report ("Management Report") to the DRC affirms the DR Project remains within the overall RQE control budget of $12.8 billion and that the DR Project's overall P90 schedule duration of 112 months is not challenged. The Management Report to the DRC adequately reflects the status of the Project and is generally focused on the DR Project's current key status points and risks. Over 3Q 2016, OPG's assurance programs have been effective at identifying issues. The DR Team has established a number of critical initiatives intended to improve work flow, accountability and overall management of the work in the field, the success of which will be monitored.

Looking forward, the Burns & McDonnell/Modus External Oversight Team ("EO Team") has identified certain issues that could have an impact on the Project if they are not addressed, including:

- The schedule for non-critical path work needed for reactor vault turnover being performed simultaneously with Defueling requires a significant ramp-up of resources, and the vendors' capability to support the schedule will require monitoring in light of past performance trends.
- While reporting has improved, OPG's method for verifying quantities of work performed and tracking of productivity would benefit from a focus on contractor direct work (or "wrench") hours and regular verification of contractors' actual hours performed by work package;
- Functional staffing levels remain below target; with ongoing efforts to fill the open positions, there are short-term needs to close resource gaps and meet challenges to integrate new hires into the DR Team;
- Contract Management activities need to progress while OPG implements a long-term strategy.

Evaluation of DR Project Status

The EO Team has identified the following key status points as of October 28th that should be considered for purposes of evaluating the DR Project's health as a whole.

Key DR Project Status Indicators	
Schedule Performance	OPG's work is on the critical path for a planned 167 days from Breaker Open to turnover of the vault to SNC/AECON on March 30, 2017 ("Segment 1"). The DR Team met its first challenges in the first week following Breaker Open and has responded well to issues as they developed. While the critical path Defueling work is currently on schedule, other non-critical path work is tracking behind the Project's P50 Schedule. While we see no current risk to the P90 Schedule, there has been a reduction of available schedule float for non-critical path work. Focusing solely on construction progress, as of Breaker Open, the DR Project had completed 10.3% of field work (including station pre-requisite projects) against a planned 12.3%, yielding an SPI for construction activities of 0.84. In August, management evaluated the priorities for Breaker Open and moved some non-critical pre-requisite work into Segment 1. Performance of other preparatory and pre-requisite work will require a ramp-up of resources and improved performance, as discussed below in Vendor Performance.
Cost Performance	The DR Team has maintained the 4-unit Project control budget of $12.8 billion through completion of the Unit 2 Estimate. The final Unit 2 Execution Phase schedule was baselined on September 16, 2016, resulting in minor changes to internal cost categories within the Unit 2

	budget, but with no impact on the control budget or the P90 schedule. There were some contingency draws, notably for the Shut-down Layup ("SDLU") bundle, totaling $25M for Unit 2 and $80M overall, which were based upon ES Fox's updated estimates that included added scope and work forecasts since RQE. The Unit 2 budget is $3.4 billion with $677 million contingency.
Vendor Performance	Within Segment 1, the major contractors have non-critical path work needed to prepare the vault for turn-over on or before March 30, 2017. ❖ SNC/Aecon's new Site Director has initiated a number of positive changes, and the RFR team has identified potential performance improvements that could improve both cost and schedule. SNC/Aecon is also addressing resource gaps and optimizing its organization for execution. SNC/Aecon's progress on the Reactor Waste Processing Building ("RWPB") remains on schedule. SNC/Aecon's scope has increased in Segment 1 to incorporate the unit islanding and support tasks which will be required for vault turnover, though this is simply a transfer of existing scope and the overall Unit 2 cost is unchanged. ❖ [redacted]
Project Controls and Risk Management	The Project Controls Team has implemented systems for managing and controlling the work that are representative of industry best practices. The team is currently performing quality control checks to ensure full cost and schedule reporting alignment, which may take several more weeks or months, though this effort is essential to ensure that the reports generated are accurate. With respect to Risk Management, in our August report we identified that certain technical performance risks were added post-RQE. The DR Team is reporting that it is managing these risks. In addition, the DR Risk Team is providing increased focus on risk mitigation and is receiving support from DR Management and Corporate Enterprise Risk Management.
Safety and Quality	The DR Team has identified an increase in safety events, and as a result the DR Team has increased its focus on identifying controls and field processes in order to increase risk-based oversight of the vendors' activities as appropriate. OPG has established a number of field protocols aimed at monitoring the contractors' work which, if effective, should enhance tracking of performance and mitigate safety and quality issues, though these processes need to be tested in the field.
Construction Checkout and Testing	The DR team is increasing focus on vendor performance associated with Construction Checkout and Test ("COAT") and Construction Completion Declaration ("CCD"). Properly performing the COATs and assembling and reviewing all associated documentation is a comprehensive effort that can impact the schedule if not addressed timely. Completing COAT and CCD activities for the Breathing Air System presents a critical near term opportunity to measure performance and adjust processes.

Project and Program Assurance

The DR Team's Performance Assurance Group ("PAG"), Enterprise Risk Management and OPG Internal Audit have developed and are executing robust plans for assurance activities. Within the quarter, PAG prepared a root cause assessment of vendors' CWPs development, identifying negative trends and repeated issues. In response, the DR Team introduced oversight initiatives focused on improving communications, increasing accountability and changing some of the outage-based behaviours. These initiatives have promise though their impact on the work will need to be proven.

OPG Project Team

OPG's Project leadership has implemented the Division of Responsibility for all work groups and a number of new processes focusing on improving accountability that grew out of OPEX from the Readiness to Execute period. The DR Team and the vendors have had multiple field readiness reviews/challenges to ensure the workers have the necessary tools, equipment and support to effectively execute the work, in order to enhance schedule and budget performance.

OPG remains under-staffed based on its U2EE projections. The current plan calls for OPG to add resources from its current level of [redacted] in Q1 2017. OPG's ability to hire, train and integrate these new hires into the current staff will be a challenge in the coming months.

Project Risks and Strategic Considerations

The EO Team offers the following analysis of certain forward-looking risks and strategic considerations that could impact the P90 schedule. OPG's assurance providers (including our team) have encouraged the DR Team to move from an outage to a construction mindset; the DR Team's leadership agrees that there is a need to implement more of a traditional Project execution model. To that end, the following are opportunities for improvement:

Risk Area	EO Team Observations
Performance Reporting	Performance reporting relies upon the vendors to accurately report progress and the owner's validation. As noted, OPG has the systems and resources in place to support performance reporting; however, OPG Management should consider the following improvements to more accurately analyze and measure the DR Project's status and craft labour productivity: ❖ The DR Team's focus on daily scheduled task completion, which is an outage trait, needs to be paired with a focus on the resource hours needed to perform the direct work (aka "wrench hours") and percent completion of work over time. This transition is in progress. ❖ OPG needs its vendors to report their actual field execution hours in a method consistent with how they report earned value progress. OPG management is addressing this with its vendors. However, until this gap is corrected, OPG will lack a powerful tool to hold the vendors accountable to their work estimates.
Commercial Management	OPG is currently assessing a company-wide enterprise approach to commercial management. In the meantime, there will be a significant increase in the volume of work associated with

	documenting and tracking potential commercial issues, including: initiating, responding and tracking correspondence with vendors; tracking contractual milestones; monitoring schedule and performance issues; providing prompt notice of vendor deficiencies; and assisting in supporting the OEB case. The current Contract Management team has capable leadership, though the planned out-sourcing of the resources to fill this function needs to be progressed.
Vendor Performance	The performance by some of the vendors to date presents risks to Segment 1 and beyond if not mitigated. ❖ As noted, for the current Segment 1 work, from September to November 2016, ES Fox will need to ramp-up its weekly earned value production to meet the schedule and then maintain that level of progress through the first half of the Unit 2 DR Project. [redacted] Based on performance trends to date, the EO Team sees a risk that BOP and SDLU work could place greater demands on management's time and could impact key project milestones. This trend should be monitored closely. ❖ SNC/Aecon is currently preparing for vault turnover, unit islanding work and completing the RWPB, all of which support its critical path retube and feeder replacement work. SNC/Aecon is also performing rehearsal work in the vault mock-up with the goal of testing and improving its performance. [redacted] SNC/Aecon's new site leadership has instituted changes and increased accountability within the organization to address these issues.

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Darlington Nuclear Refurbishment Program - Unit 2

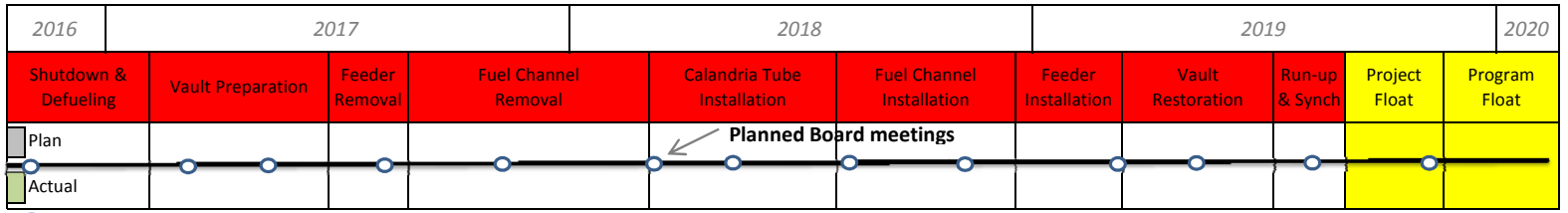
APPENDIX 1: CRITICAL PATH SCHEDULE PERFORMANCE

Performance of Critical Path against Working and High Confidence Schedule

Period Ending: 28-October-2016

OVERALL UNIT 2 STATUS

U2 Critical Path Series



	Shutdown & Defueling	Vault Preparation	Feeder Removal	Fuel Channel Removal	Calandria Tube Installation	Fuel Channel Installation	Feeder Installation	Vault Restoration	Run-up & Synch	Project Float	Program Float
Days Ahead / (Behind) Schedule	(1) 0										
Plan Duration (days) **1231**	114	141	66	192	147	141	96	108	65	45	115
Working Schedule Series Completion Date	6-Feb-17	27-Jun-17	1-Sep-17	12-Mar-18	6-Aug-18	25-Dec-18	31-Mar-19	17-Jul-19	20-Sep-19	4-Nov-19	27-Feb-20
High Confidence Schedule Series Completion Date	19-Feb-17	2-Aug-17	19-Oct-17	2-Jun-18	13-Nov-18	18-Apr-19	7-Aug-19	5-Dec-19	27-Feb-20	Not Applicable	
Forecast /Actual Series Completion	(2) 6-Feb-17	-	-	-	-	-	-	-	-	(4) 0	0%
Forecast / Actual Series Duration	114	-	-	-	-	-	-	-	-		
Variance from Working Schedule Plan ahead / (behind)	0	-	-	-	-	-	-	-	-		
Variance from High Confidence Schedule Plan ahead / (behind)	(3) 13	-	-	-	-	-	-	-	-	**Float Used**	**% Used**

STATUS OF CRITICAL PATH

(1) Critical path is through the Shutdown and Defueling series. As at October 28, critical path is slightly ahead of the working schedule. Details on current series performance are provided in Appendix 2 - Current Critical Path Series.

(2) Forecast completion of the series remains as per working schedule.

(3) Forecast completion of the series is 13 days ahead of the high confidence scheduled completion.

(4) As at October 28, zero schedule float has been allocated to the project.

STATUS OF NON CRITICAL PATH ACTIVITIES

There is currently a low risk of non-critical path activities becoming critical path.

Non-critical path activities in progress include lay-up of the conventional (non-radiological) systems in which the systems are drained and protected from corrosion; and completion of the in-station pre-requisite projects that were re-scheduled into the Unit 2 Refurbishment. Currently, 12 of 25 pre-requisite projects are complete, and the remaining 13 projects are on track to meet their schedule completion dates.

Other non-critical path activities include the Vault Vapour Recovery System valve replacement, work protection permitry for the conventional side of the station and pre-requisite activities on the Re-tube and Feeder Replacement and Turbine Generator projects.

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Darlington Nuclear Refurbishment Program - Series

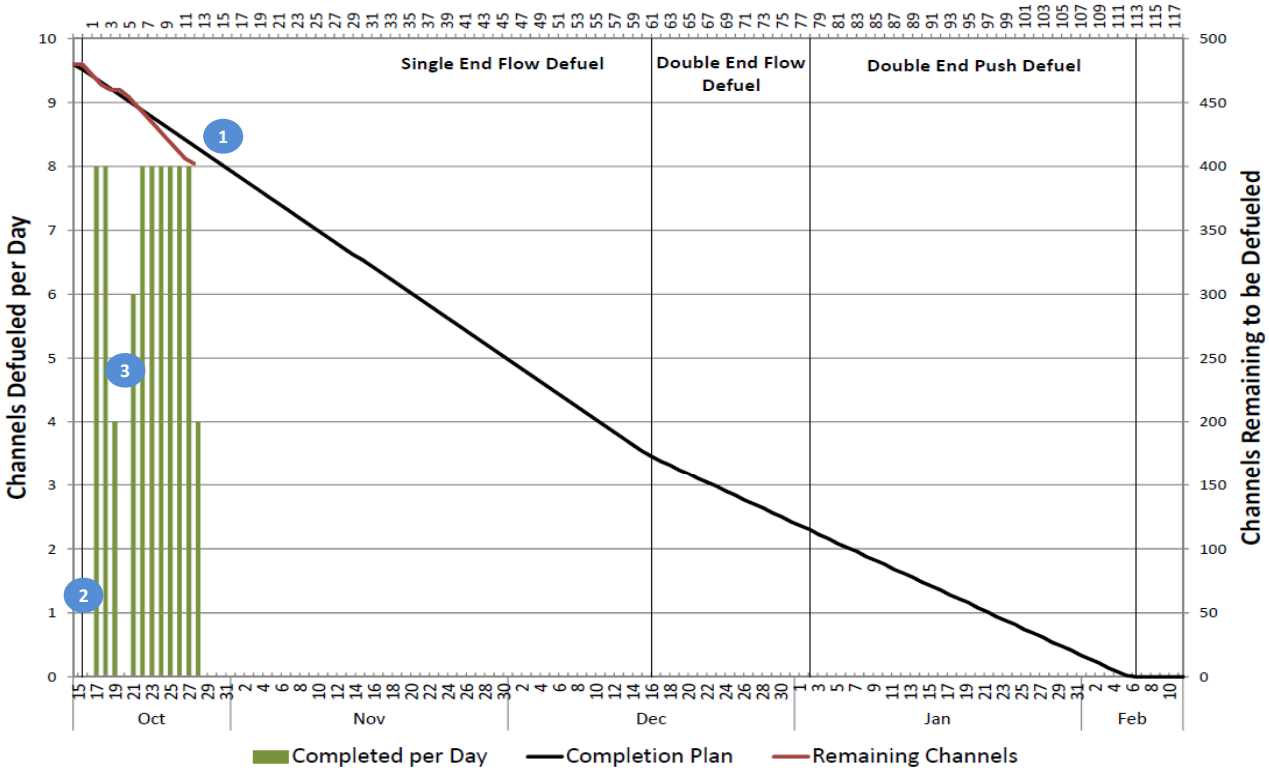
APPENDIX 2: CURRENT CRITICAL PATH SERIES PERFORMANCE

Detailed Status of the Current Series Including Commodity Installation/Removal

Period Ending: 28-Oct-2016

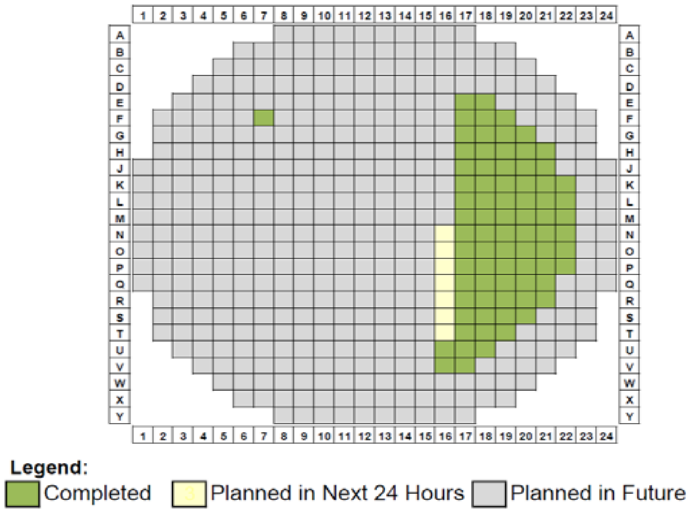
CRITICAL PATH SERIES

SHUTDOWN & DEFUELING **IN PROGRESS**	The first critical path series includes the shutdown of the unit, and the safe removal of all fuel from the reactor core in a cost effective manner in order to minimize outage duration. Flow defueling is the preferred method to defuel the reactor and relies on flow of the primary heat transfer coolant over fuel to "wash" fuel into fueling machine.



Series Completion	Working Schedule	High Confidence Schedule	Forecast	Variance to Working Schedule
Series Duration (days)	114	127	**114**	**0**
Series Completion Date	6-Feb-17	19-Feb-17	**6-Feb-17** (4)	**0**

Channels Defueled	Working Schedule	Actual	Variance to Working Schedule
# Channels	60	**78**	**+18** (5)
% Complete	12.5%	**16.3%**	**3.8%**



EXPLANATORY NOTES

1. Current performance, as at October 28, is ahead of the working schedule.
2. The reactor was shut down event-free on October 15, as planned; however the commencement of the defueling campaign was delayed by 1 day due to challenges with cooling the heat transport system to the specified temperature. This delay is now fully recovered.
3. Defueling was temporarily halted to accommodate planned maintenance on the defuel trolley, and the planned installation of reactor start-up instrumentation to allow continuing monitoring of the core.
4. The forecast completion of the Shutdown and Defuel Series is February 6, 2017 as planned.
5. As at October 28, an additional 18 channels were defueled compared to plan.

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Darlington Nuclear Refurbishment Program - Unit 2

APPENDIX 3: KEY MILESTONES - UNIT 2 EXECUTION

Significant Unit 2 Critical Path Execution Milestones

Period Ending: 30-Sept-2016

PROGRAM MILESTONES

Line	Milestone	Working Schedule	High Confidence	Forecast/ Actual	Status	Explanatory Note
1	Unit 2 Breaker Open	15-Oct-16	15-Oct-16	15-Oct-16	COMPLETE	
2	Defuel Complete	6-Feb-17	19-Feb-17	6-Feb-17		
3	Bulkheads Installed	24-Mar-17	11-Apr-17	24-Mar-17		
4	Start of Feeder Removal Window	27-Jun-17	2-Aug-17	27-Jun-17		
5	Re-tube Waste Processing Facility In Service	15-Jun-17	31-Jul-17	15-Jun-17		
6	Feeder Removals Complete	1-Sep-17	19-Oct-17	1-Sep-17		
7	Fuel Channel Removals Complete	12-Mar-18	2-Jun-18	12-Mar-18		
8	Calandria Tubes Installed	6-Aug-18	13-Nov-18	6-Aug-18		
9	Fuel Channels Installed	25-Dec-18	18-Apr-19	25-Dec-18		
10	Feeders Installed	31-Mar-19	7-Aug-19	31-Mar-19		
11	Vault Restoration Complete	17-Jul-19	5-Dec-19	17-Jul-19		
12	Low Power Testing and Heat Up Complete	21-Aug-19	25-Jan-20	21-Aug-19		
13	Unit 2 Synchronized To Grid	10-Sep-19	16-Feb-20	10-Sep-19		
14	Unit 2 Returned to Operations	20-Sep-19	27-Feb-20	20-Sep-19		

On Plan for Working Schedule Date

Past Working Schedule Date but on or Before High Confidence Schedule Date

Past High Confidence Schedule Date

ONTARIO POWER GENERATION

Darlington Nuclear Refurbishment Program - Unit 2

APPENDIX 4: UNIT 2 PRE-REQUISITE PROJECT PERFORMANCE

Completion Status of In-station Pre-requisite Projects

Period Ending: 30 Sept 2016

PROGRAM MILESTONES

Line	Milestone	High Confidence Date	Need Date	Status	Explanatory Note
1	73455 – Calandria Seal Replacement			COMPLETE	
2	73370 - Powerhouse Steam Venting System			COMPLETE	
3	73711 – Work Control Area			COMPLETE	
4	73380 – Unit 4 Shield Tank Over Pressure Protection			COMPLETE	
5	73398 – Replacement of Emergency Service Water Line 60			COMPLETE	
6	73740 – Installation of Unit 2 Wi-Fi			COMPLETE	
7	73380 – Unit 3 Shield Tank Over Pressure Protection			COMPLETE	
8	73472 – Primary Heat Transport Header Tie-ins			COMPLETE	
9	31710 – Shutdown Cooling Heat Exchanger			COMPLETE	
10	73741 – Negative Pressure Containment Islanding			COMPLETE	
11	73712 – Radiation Protection Office			COMPLETE	
12	73467 – Construction Island Barriers			COMPLETE	All field work complete.
13	73769 – Adjustor Rod SHIM (Unit 1, 3, 4)	15-Oct-16	8-Feb-17		Project was installed as per the commitment; however, a design issue was identified which prevents SHIM mode from being declared available. A path forward has been established which supports SHIM being made available by bulkhead installation in February 2017.
14	73716 – Additional Washrooms	7-Jan-17	6-Feb-17		
15	73715 – Non Contaminated Work Shops	11-Jan-17	6-Feb-17		
16	73113 – RFR Primary Heat Transport Header and Bellows	30-Jan-17	23-Mar-17		
17	73592 – Vault Vapour Recovery System	15-Feb-17	23-Mar-17		
18	73742 – Decontamination Room S107 Upgrade	25-Feb-17	25-Feb-17		
19	73545 – Dry Air for Conventional Systems	28-Feb-17	28-Feb-17		
20	73538 – Service Air Capacity Enhancement	1-Mar-17	1-Mar-17		
21	73277 – Turbine Crane Inspections and Repairs	15-Mar-17	15-Mar-17		
22	73643 – Unit Power Electrical Distribution System	12-Apr-17	12-Apr-17		
23	73537 – Breathing Air Capacity Enhancement	24-Mar-17	15-Apr-17		Risks associated with the completion of design, and material delivery are being actively managed by the project teams to ensure that the breathing air enhancement is in-service by the need date.
24	73113 – RFR Power and Infrastructure	15-Jun-17	15-Jun-17		
25	73714 – Contaminated Shops and Scaffold Storage	30-May-18	30-May-18		

On Plan for High Confidence Date

Past High Confidence Date But on or Before Need Date

Past Need Date

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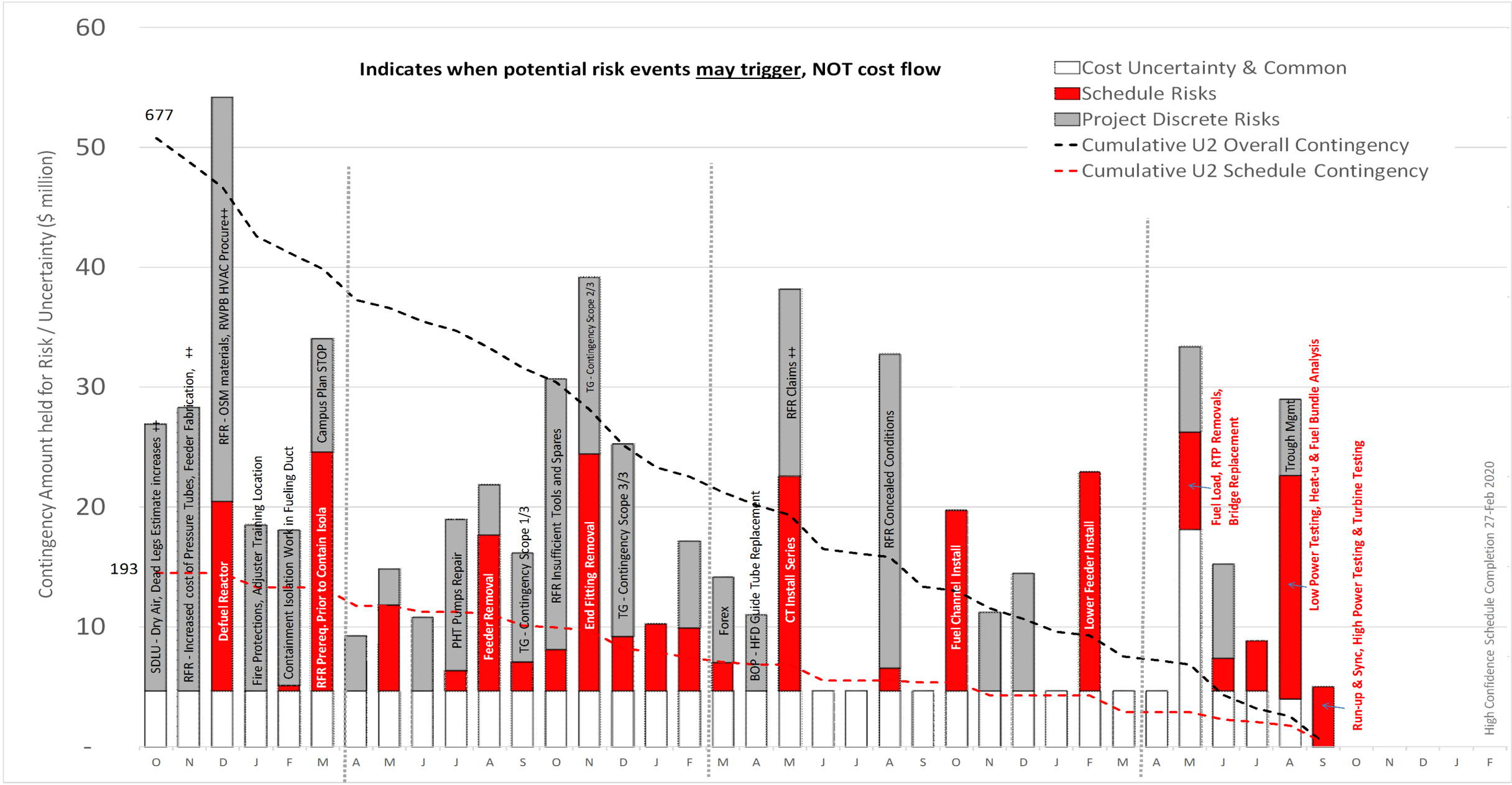
Darlington Nuclear Refurbishment Program - Unit 2

APPENDIX 6: RISK MAPPING FOR UNIT 2 EXECUTION

Risk Events and Contingency ($) Mapped to the Unit 2 Working Schedule

Period Ending: 30-Sep-2016

RISK MAPPING



	Lead In			Removal												Inspection & Installation														Lead Out						Float Contingency 5 Months				
Year	2016			2017												2018														2019										
Month	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Project Discrete Risks	22	24	34	14	13	9	5	3	6	13	4	9	23	15	16	-	7	7	6	16	-	-	26	-	-	7	10	-	-	-	-	7	8	-	6	-	Schedule Impacts will shift base + contingency costs into the 5 month float period				
Schedule Risks	-	-	16	-	0	20	-	7	-	2	13	2	3	20	5	6	5	2	-	18	-	-	2	-	15	-	-	-	18	-	-	8	3	4	19	5					
Cost Uncertainty & Com	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	18	5	5	4	-					
Total by Segment	**180**			**214**												**187**														**96**						**677**				
%	27%			32%												28%														14%						100%				

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Darlington Nuclear Refurbishment Program - Unit 2

APPENDIX 7: KEY TECHNICAL RISKS FOR UNIT 2 EXECUTION

Technical Risks Being Actively Managed by the Program

Period Ending: 30-Sep-2016

KEY PROGRAM RISKS AND MITIGATION STATUS

Line	Status	Risk Description	Mitigation Plan
1	–	**Foreign material in the Primary Heat Transport (PHT) System leading to fuel defects impacting refurbishment** Foreign material within the PHT system damages assets or creates fuel defects, resulting in cost and schedule impacts	There is a risk that upon completion of the refurbishment installation series it is discovered that the implementation of the foreign material exclusion programs were less than adequate, resulting in the potential for foreign material inclusion damaging the asset or increasing the risk of fuel defects. This would result in a need to flush the PHT system and hot condition the fuel, and will have a direct impact on the cost and critical path schedule. Fleet level engineering and operations analysis is currently underway to fully assess the risk. Mitigation strategies to perform crud bursts and chemistry controls are underway. Flush and hot conditioning is being planned for within the Unit 2 critical path schedule, and ultra-clean foreign material exclusion principles are being applied into the work planning and training. Engineering ultra-clean specs are well underway, and Refurbishment Maintenance, along with Refurbishment Construction, is in progress of developing detailed implementation plan to meet the ultra-clean foreign material exclusion specifications.
2	–	**Significant discovery work inside the Calandria impacting the refurbishment schedule**	There is a risk that a large amount of discovery work is identified upon inspection of the inside of the Calandria vessel. This will have a direct impact on cost and schedule delays to the re-tube removal and/or install segment of critical path. This would be caused by concealed conditions and limitations in the ability to examine/inspect Calandria internals prior to refurbishment. Limitations to inspection (concealed condition) imply that nothing further can be done, beyond internal Operating Experience (OPEX) reviews and chemistry analysis to determine conditions within the Calandria that may require remediation, which is underway. This is a High Impact Low Probability risk. Contingency has been allocated in the event that the risk is realized during Unit 2 inspection.
3	–	**Hoisting or rigging failures resulting in worker injury or schedule delays**	The Refurbishment project includes significant hoisting and rigging activities such as turbine spindle lifts and lifts over the vault during execution. These lifts put personnel at risk of injury or death and the project at risk of schedule delay and cost impact if not executed event-free. Recent industry OPEX, such as the fatality at Arkansas One NGS, indicates that there is a need to apply extensive rigor and detail in the critical lift program. Mitigation to date includes OPEX reviews and integration by the vendors performing Turbine Generator lift work and focus on communication and integration of INPO Event Report - Lifting, Rigging, and Material-Handling Concerns. All Critical Lift Plans are reviewed by Engineering and Safety and subsequently accepted by OPG Civil Engineering and Conventional Safety. The Hoisting and Rigging subject matter expert will do a final review and approval for use to ensure proper rigor is built into lift plans.
4	–	**Primary Heat Transport (PHT) pump breakdown stopping flow defueling process** Planned flow defueling would be unavailable requiring use of push defueling, and extension to the critical path.	There is a risk of failure of one of the PHT pumps which would make the planned flow defueling impossible, requiring the use of dummy bundle push defueling for the entire reactor greatly extending the schedule and therefore cost of the project. Multiple forms of risk mitigation are currently underway, including reactor safety examination of the possibility of running three pumps instead of four. It is confirmed that the action resulting from a PHT motor failure will be to replace the motor, or move to push defueling. Contingency dummy fuel bundles, which will be used for push defueling, are being fabricated and delivered to site prior to their potential need date.

– No change over period ↑ Improvement ↓ Decline High Risk Low Risk

ONTARIO POWER GENERATION

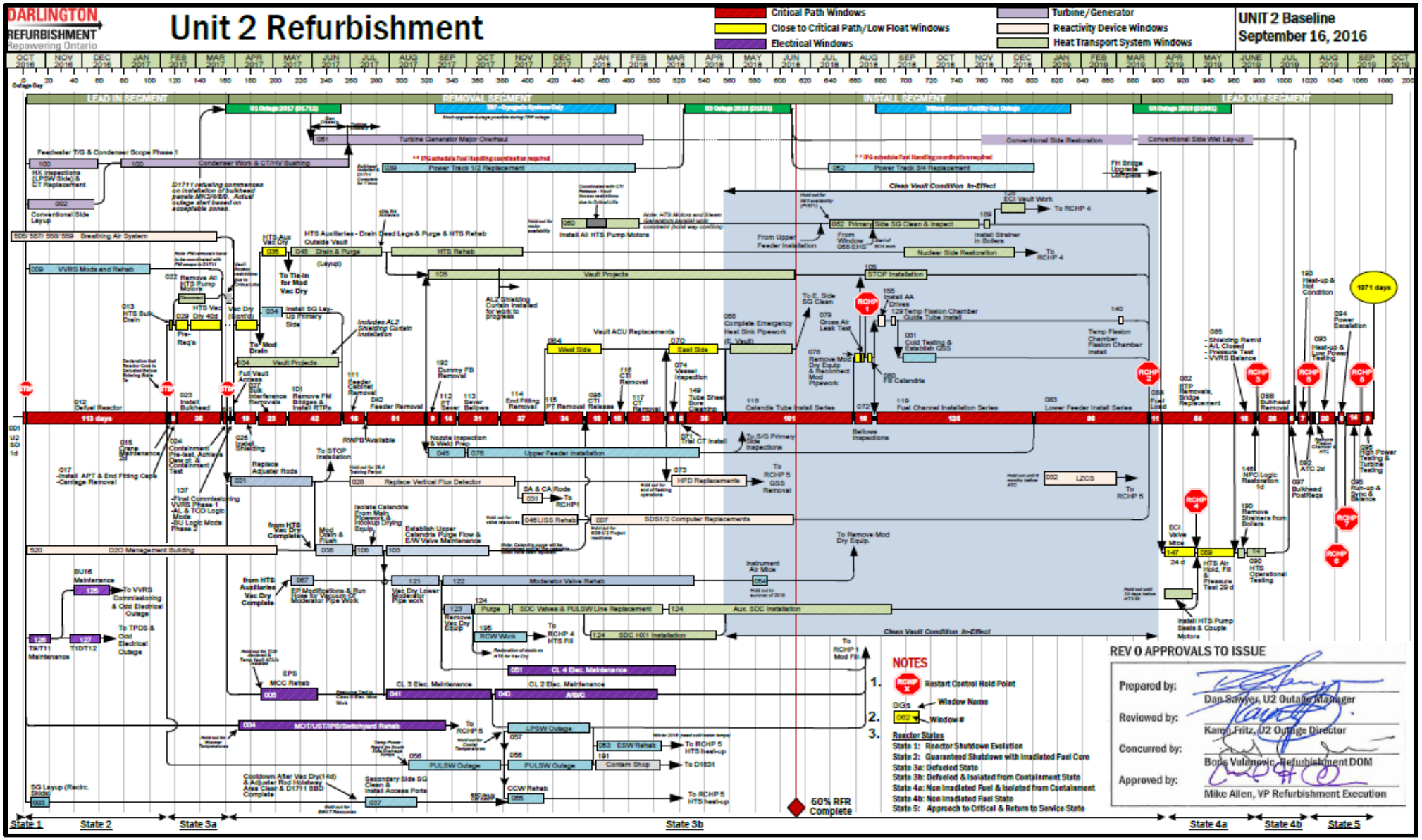
Darlington Nuclear Refurbishment Program - Unit 2

APPENDIX 8: UNIT 2 LEVEL 1 SCHEDULE

Baseline Schedule

Period Ending: 30-Sep-2016

Unit 2 Refurbishment



ONTARIO POWER GENERATION

Darlington Nuclear Refurbishment Program - Unit 2

APPENDIX 9: UNIT 2 SEGMENT 1

Defuel and Containment Isolation

Period Ending: 30-Sep-2016

Unit 2 Refurbishment

DARLINGTON REFURBISHMENT Repowering Ontario

S1

Unit 2 Refurbishment: SEGMENT 1 Defuel + Containment Isolation

167 days: October 15, 2016 – March 30, 2017

Critical Path Windows
Electrical Windows
Conventional Layup
Heat Transport Vacuum Dry
Other required S1 work

Baseline U2 S1
September 16, 2016

October 2016 | November 2016 | December 2016 | January 2017 | February 2017 | March 2017 | April 2017

10/2 10/9 10/16 10/23 10/30 11/6 11/13 11/20 11/27 12/4 12/11 12/18 12/25 1/1 1/8 1/15 1/22 1/29 2/5 2/12 2/19 2/26 3/5 3/12 3/19 3/26 4/2 4/9

2 Conventional Side LAY-UP

Drain & Protect (Lay-up) Conventional Systems from Corrosion

To inhibit corrosion damage to secondary side steel piping systems caused by moisture, temporary dehumidified air is provided. (11) Dry Air skids will be installed at various points to force warm air through the pipework in order to achieve acceptable dryness.

Layup Completion for the following systems:

DHA1:	Main Condenser
DHA2:	Boiler Feedwater
DHA3-4:	Main Condensate
DHA5:	Main Steam
DHA6-7:	Extraction Steam
DHA8-9:	Main Steam Reheat
DHA10:	D/A, Condensate Make Up & Storage Tanks
HP1:	PFW Pumps (Main & Aux)

09-Jan-17 Systems Declared in Lay-up

21-Oct-16 OPS Apply Drain OTO's & Drain — 01-NOV-16 Install Dehumidifiers and Establish Airflow Path — 29-Dec-16 Commision and Dry Conventional System

Unit 2 Shut Down 15-Oct-16

West RAB Brake Repair

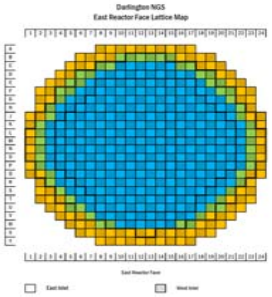
First things first…

Shutdown Unit 2

Unit 2 will start reducing power at 22:00 hrs on Friday Oct 14. At midnight (Oct 15th at 00:00 hrs) Operators will fire Shutdown System #2 to take the Unit deeply sub-critical. The Heat Transport System will be cooled down to 80 C to allow defueling of the reactor to take place. Years of planning has led us to this milestone to open the breaker on the first Darlington Refurbishment Unit!

1 DEFUEL

The reactor will be entirely defueled prior to turnover to the Joint Venture who are going to be performing the Retube of the Unit 2 reactor and replacing feeders. The majority of the defuel campaign will be accomplished via flow defueling using the Heat Transport pumps however it is estimated that 124 dummy fuel bundles (11 per channel) will need to be installed in the low flow channels allow push defueling to empty the channel.



1 — 270 Channels: Single End Flow Defuel — 06-Dec-16 — 86 Channels: Double End Flow Defuel — 02-Jan-17 — 124 Channels: Double End PUSH Defuel

Declaration that Reactor Core is Defueled Before Entering State 3a

Defuel Complete 06-Feb-17

STOP

Window 017 Install APF, End Fitting Caps & Radiation Shielding

E&W Carriage Removal Complete 17-Feb-17

2d — 9d — 5d Calandria Seal Leak Test

08-Feb-17 Window 015 Vault Crane Maintenance Complete

Heat Transport Motors Disconnect and Uncouple 33120-PM1, PM2, PM3, PM4 — 5 days

Remove Heat Transport Motors — 5 days

Vault Access Coordination for HT Motors due to Vault Access restrictions during Critical Lifts

4 PRIMARY HEAT TRANSPORT SYSTEM VACUUM DRY

The entire HT system must be drained & dried before the retube of the reactor can begin. Once Operators have drained it through normal pipework, the Heat Transport system will be put under vacuum in order to 'boil off' the rest of the water. A Vacuum Drying Skid will be attached to the HT system to perform this. The water vapor will be condensed in receivers and sent through piping to the storage tanks outside of Unit 2. It is expected to take 40 days to completely drain & dry the HT system

11-Feb-17 Vac Dry Prereqs — 04-Mar-17 — 22-Mar-17 Heat Transport Vacuum Dry

HTS Bulk Drain

Containment Pressure Test Declared Complete 30-Mar-17

STOP

Window 23 Bulkhead Installation — 35 days — Bulkhead Installation Complete 24-Mar-17

6d — Window 24 Containment Pressure Test

To the start of Segment 2 Window 137

3 'ISLAND' Unit 2 from the DNGS Operating Units

A large steel bulkhead to bridge the gap where the fueling machines access the U2 reactor will be installed during this window. This bulkhead will form part of the temporary containment boundary which will physically separate Unit 2's containment from the operting units.

5 VERIFY UNIT 2 is isolated from containment

The containment test is conducted to verify the integrity of the new containment boundary.

New Breathing Air System Installation

Install Mechanical Portion of Breathing Air System
Install Electrical – Breathing Air
Install Software and Computer Upgrades
Commission Breathing Air Outside Vault — 17-Jan-17

New Breathing Air Tie-in for Refurbishment use in Unit 2 will be performed at the start of Segment 2

Breathing Air Final Tie-in and AFS

Segment 1 Major Electrical Scope

21-Oct-16 W126: T9/T11 Maintenance — 11-Nov-16 W125: BU16 Maintenance — 10-Jan-17 To VVRS Commissioning and Odd Electrical Outage

15-Nov-16 W127: T10/T12 — 20-Dec-16 To TPDS and Odd Electrical Outage in S2

Window 009: VVRS Modifications

W009: VVRS Modifications — 29-Jan-17

To Containment Pressure Test

Window 100: Feedwater, T/G and Condenser Scope

W100: Feedwater, T/G and Condenser Scope

State 1: Reactor Shutdown Evolution | State 2: Guaranteed Shutdown with Irradiated Fuel Core | State 3a: Defueled State | State 3b: Defueled & Isolated from Containment State

ONTARIO POWER GENERATION

Darlington Nuclear Refurbishment Program

APPENDIX 10: CONVENTIONAL SAFETY PERFORMANCE

Bundle and Vendor Performance Year-To-Date

Period Ending: 30-Sep-16

SAFETY PERFORMANCE - YEAR TO DATE (YTD)

All Injury Rate (AIR)	Actual		Target	Status	Trend
Nuclear Refurbishment Program					
	Previous	Current			
OPG and Vendor Refurbishment Staff	[4] 0.24	0.55	0.24		↓

EXECUTIVE SUMMARY

Safety performance over the quarter has declined as a result of four medically treated injuries; one on the Turbine Generator pre-requisite project; and three within the Facilities & Infrastructure and Safety Improvement Opportunities projects. All injuries were minor in nature, and employees returned to work with zero lost days. Two High Maximum Reasonable Potential for Harm (MRPH) events occurred in the quarter on a Safety Improvement Opportunities Project.

# of Days Since a Lost Time Injury	2,464	Since Jan. 1, 2010

BUNDLE SAFETY PERFORMANCE - YEAR TO DATE (YTD)

		AIR	ASR	Safety Injuries			Safety Incidents			
Line	Project Bundles Additional Project Bundles will be added as they commence work on site.	*All Injury Rate*	*Accident Severity Rate*	# Lost Time Injury	# Medical Injuries	# First Aid Injuries	# High MRPH	# Med. MRPH	# Level 1 Work Protection Events	Hours Worked
1	Re-tube & Feeder Replacement									
2	Turbine Generator									
3	Fuel Handling & Defueling									
4	Shutdown Lay-up									
5	Islanding									
6	Balance of Plant									
7	OPG Refurbishment Staff									
8	**Unit 2 Refurbishment Performance**									
9	Facilities & Infrastructure and Safety Improvement Opportunity Projects									
10	**Nuclear Refurbishment Performance**	**0.55**	**0.00**	**0**	**5**	**18**	**4**	**1**	**0**	**1,831,725**

VENDOR SAFETY PERFORMANCE - YEAR TO DATE (YTD)

Excluding Owner-Only Metrics

		AIR	ASR	Safety Injuries			Safety Incidents			
Line	Vendors Additional Vendors will be added as they commence work on site.	*All Injury Rate*	*Accident Severity Rate*	# Lost Time Injury	# Medical Injuries	# First Aid Injuries	# High MRPH	# Med. MRPH	# Lvl 1 Work Protection Events	Hours Worked
1										
2										
3										

OWNER-ONLY SAFETY PERFORMANCE - YEAR TO DATE (YTD)

1	Refurbishment Project Office	0.00	0.00	0	0	0	0	0	0	11,718
2	Re-tube Waste Processing Building	2.54	0.00	0	2	0	0	0	0	157,485

EXPLANATORY NOTES

[1] A worker on the [redacted] was treated for an eye irritation, received eye drops, and returned to work. The vendor has upgraded eye protection requirements as a result of the incident.

[2] Three medically treated injuries occurred over the quarter, and an additional one in June. A worker on the [redacted] twisted his arm; a worker on the [redacted] cut his finger; a worker on the [redacted] bumped his head, and another cut his forehead. All employees returned to work for their next scheduled shift with no lost time.

[3] Two High Maximum Reasonable Potential for Harm (MRPH) events occurred in the quarter on the [redacted] for a total of three High MRPH events year-to-date. The first occurred while lifting the exhaust stack into the upright position. A sling broke causing the lower end of the stack to drop approximately three feet. There were no injuries as a result of this incident, and corrective actions have been taken to prevent re-occurrence. The second incident occurred when a worker unknowingly accessed an unapproved scaffold, exposing himself to a height greater than three meters. In both incidents, performance management was performed by the vendor, which resulted in suspensions and terminations primarily for the trades supervision on these projects.

[4] The previous All Injury Rate Reported has been adjusted to account for a first aid injury that occurred in June which was reclassified to a medically treated injury, impacting the All Injury Rate.

ONTARIO POWER GENERATION

Darlington Nuclear Refurbishment Program

APPENDIX 11: QUALITY PERFORMANCE

Bundle and Vendor Performance Year-To-Date

Period Ending: 30-Sep-2016

QUALITY PERFORMANCE - YEAR TO DATE (YTD)

Overall Quality Performance	Status		Trend	Days Since Last Q-EFDR
Nuclear Refurbishment Program				
	Previous	Current		
				None YTD

EXECUTIVE SUMMARY

The overall quality performance has improved to white over the quarter since there were no significant quality issues identified by OPG or Vendors in the period. The Quality Performance report has been enhanced to reflect the year-to-date performance as opposed to the period, which is in alignment with safety performance reporting. Details on incidents over the quarter are detailed in the explanatory notes below.

BUNDLE QUALITY PERFORMANCE - YTD

Line	Bundles	*Quality Event Free Day Resets (Q-EFDR)*	*Regulatory Non-compliance Events*	*Non-conformance Corrective Action Requests*	*OPG Station Condition Records with Major Impact*	(4) *Rework (Execution)*	*Average # of revisions per closed-out Engineering Change*	*Comprehensive Work Package Non-compliances*	*Work Plan Non-compliances*	*Inspection & Test Plan Non-compliances*
1	Re-tube Feeder Replacement	[redacted]								
2	Turbine Generator									
3	Fuel Handling & Defueling									
4	Steam Generator									
5	Balance of Plant									
6	Refurbishment - Ops & Maintenance									
7	Refurbishment - Other Functions									
8	**Nuclear Refurbishment Performance**									
9	Facilities & Infrastructure and Safety Improvement Projects									
10	**Nuclear Refurbishment Performance**	**0**	(1) **1**	(2) **2**	(3) **4**	**0**	**1.6**	**41**	**18**	**37**

(5)

VENDOR QUALITY PERFORMANCE - YTD

Line	Vendors	*Quality Event Free Day Resets (Q-EFDR)*	*Regulatory Non-compliance Events*	*Non-conformance Corrective Action Requests*	*Vendor Corrective Action Requests*	*Rework (Execution)*	*Average # of revisions per closed-out Engineering Change*	*Comprehensive Work Package Non-compliances*	*Work Plan Non-compliances*	*Inspection & Test Plan Non-compliances*
1	[redacted]									
2										
3										
4										
5										

EXPLANATORY NOTES

(1) The regulatory non-compliance event is the previously reported issue related [redacted] quality control process and records on the [redacted] (a non-refurbishment project). However, the event is included in this report as it relates to a refurbishment vendor's quality process. Interim actions have been taken to prevent reoccurrence and corrective actions are in progress.

(2) There have been no new Non-conformance and Corrective Action Requests raised in the quarter. The two year-to-date events reflect the previously identified issue [redacted], and the [redacted] issue related to less than acceptable operational safety focus.

(3) One OPG Station Condition Record (SCR) with Major Impact was initiated over the quarter. The SCR documented the challenges to complete preparation of Comprehensive Work Packages, Work Plans and Inspection & Test Plans as per the plan. Corrective actions are in place to ensure all documentation is in place prior to the need date.

(4) The Rework (Execution) indicator has been added as a quality performance measure. It reflects the number of rework incidents that have an impact greater than $100K, or delay on critical path greater than six hours. There have been no execution rework events year-to-date.

(5) Non-significant non-compliances for Comprehensive Work Packages, Work Plans and Inspection & Test Plans are tracked for trending purposes.

ONTARIO POWER GENERATION

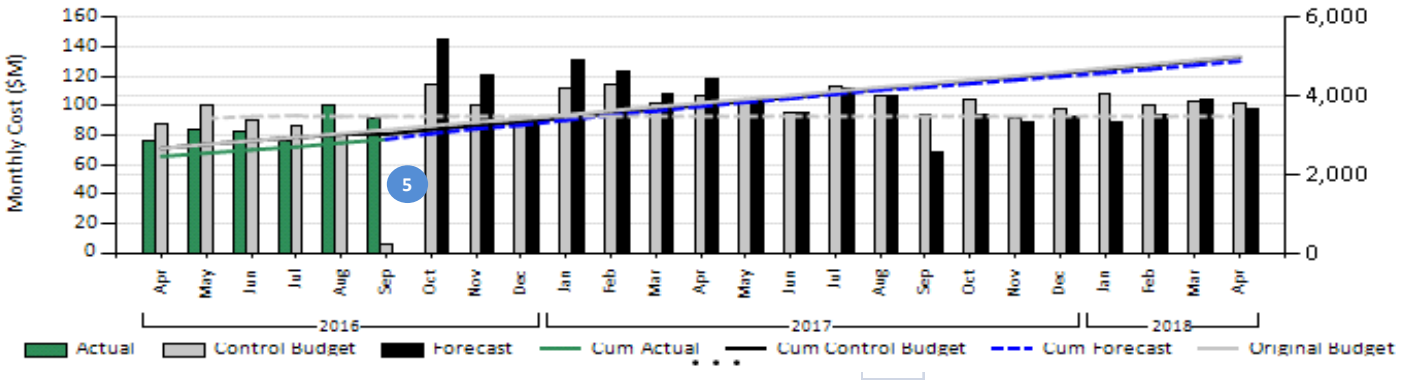
Darlington Nuclear Refurbishment Program

APPENDIX 12: PROGRAM FINANCIAL PERFORMANCE

Cost Performance of the Program Against Plan

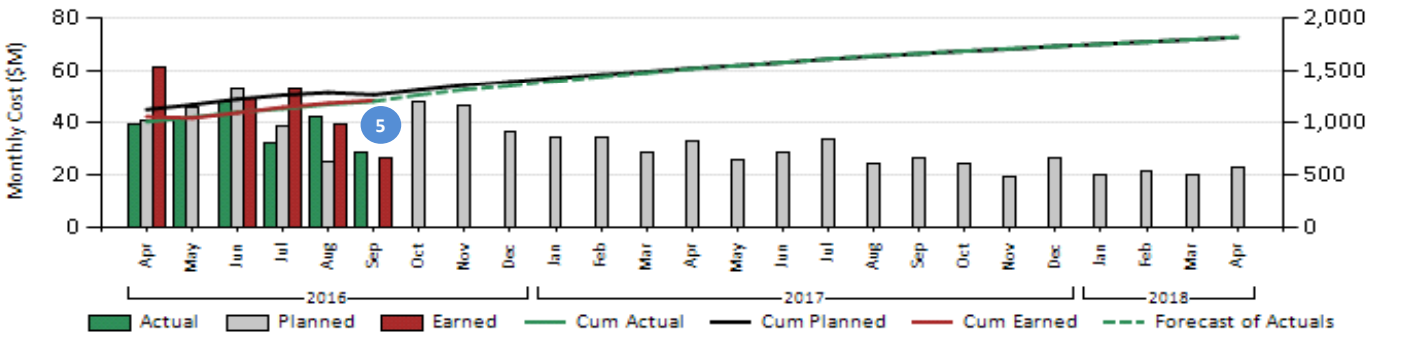
Period Ending: 30-Sep-2016

LIFE-TO-DATE COST PERFORMANCE FOR THE PROGRAM



Life-To-Date	
Original Budget	1 3,143,801
Control Budget	3,032,799
Actual	2,900,320
Variance-to-Control Budget	2 (132,479)
% of Control Budget Spent	96%

LIFE-TO-DATE EARNED VALUE FOR THE PROGRAM



Life-To-Date	
Planned Value	1,258,903
Earned Value	1,205,350
Actual	1,196,114
Variance-to-Planned Value	(62,789)
Cost Performance Index	3 1.01
Schedule Performance Index	4 0.96

EXPLANATORY NOTES

1. The original budget reflects the high confidence Release Quality Estimate approved by the Board of Directors in November 2015. The control budget is the approved plan that performance is measured against, and which currently reflects the revised Unit 2 cost established on September 30.
2. Life-to-date cost variance is $133 Million below plan, $29 Million attributable to lower than planned OPG resources, and $104 Million due to the timing of planned work, specifically:
   i) $28 Million underspend within the Facilities & Infrastructure and Safety Improvement Opportunities projects,
   ii) $25 Million underspend in planning and procurement activities for the subsequent units, largely within the Re-tube & Feeder Replacement project; and
   iii) $38 Million on Re-tube & Waste Processing Building project, and $13 Million underspend on the remaining core projects.
3. CPI has declined slightly to 1.01; however, continues to indicate that the work performed has been completed for less than originally budgeted. These efficiencies are largely due to fewer resources required to perform the work or lower vendor costs.
4. Schedule performance measured against the working schedule, has improved over the period at 0.96 as a result of the alignment of the Unit 2 schedule and cost baseline issued on September 30. The program remains slightly behind plan as a result of delays in completing the F&IP and SIO projects, and the Unit 2 pre-requisite projects.
5. The reduced plan within September 2016 is an artifact of the schedule and cost alignment that occurred on September 30.

ONTARIO POWER GENERATION

Darlington Nuclear Refurbishment Program

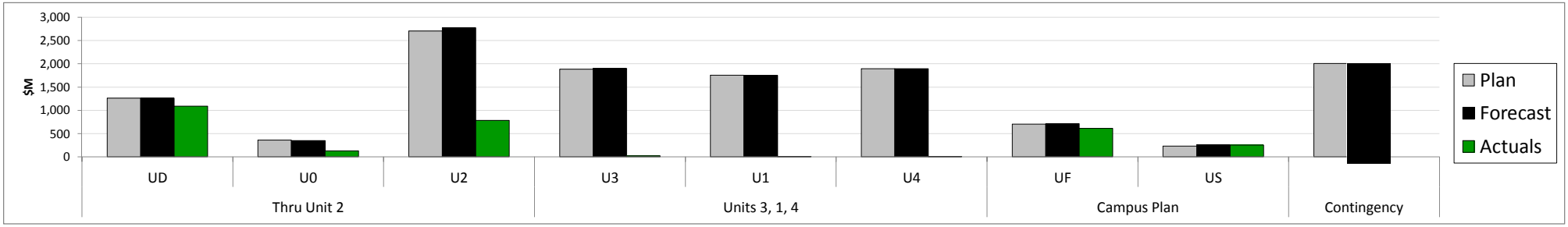
APPENDIX 13: PROGRAM FINANCIAL PERFORMANCE BY UNIT

Financial status of the Program by Unit

Period Ending: 30-Sep-2016

		Cumulative (Life-To-Date)					At Completion of Program		
		a	*b*	*c = b - a*	*d*	*e*	*f*	*g*	*h = f + g*
Line #	Description	Plan (PV)	Actual (AC)	Cost Variance	CPI	SPI	Plan	Life-to-date Actual Contingency Drawdown	Forecast
	Unit D - Definition Phase Work	1,086	1,092	6	0.99	1.01	1,262	[redacted]	[redacted]
	Unit 0 or Unit Common	173	129	(44)	1.38	0.83	361	[redacted]	[redacted]
	Unit 2	846	785	(62)	1.06	1.03	2,704	[redacted]	[redacted]
	Thru Unit 2	**2,105**	**2,006**	**(99)**	**1.05**	**1.00**	**4,326**	[redacted]	[redacted]
	Unit 3	40	26	(14)	1.21	0.81	1,884	[redacted]	[redacted]
	Unit 1	6	0	(6)	-	-	1,756	[redacted]	[redacted]
	Unit 4	5	0	(5)	-	-	1,895	[redacted]	[redacted]
	Units 3, 1, 4	**51**	**26**	**(25)**	**1.21**	**0.65**	**5,535**	[redacted]	[redacted]
	Unit F - Facilities & Infrastructure Projects Work	658	616	(43)	0.93	0.84	702	[redacted]	[redacted]
	Unit S - Safety Improvement Opportunity Work	237	252	15	0.89	0.98	230	[redacted]	[redacted]
	Campus Plan	**895**	**868**	**(28)**	**0.91**	**0.89**	**933**	[redacted]	[redacted]
	Contingency	[redacted]					2,006	[redacted]	[redacted]
	Total	3,033	1 2,900	(133)	1.01	0.96	12,800	0	2 12,800

Note: - CPI and SPI are calculated on Deliverable Based work packages only.
- All Values Include Interest and Escalation



EXPLANATORY NOTES

1. Actual cost to date is $2.9 Billion, $133 Million under spent; $28 Million in Facilities & Infrastructure due to delays in completing planned work; $99 Million through Unit 2 due to lower than planned resources, and rescheduling of planned work; and $25 Million for planning and procurement for subsequent units.
2. 4-Unit cost estimate remains within $12.8 Billion.
3. Total contingency drawdowns, as per Appendix 14, is [redacted]

ONTARIO POWER GENERATION

Darlington Nuclear Refurbishment Program

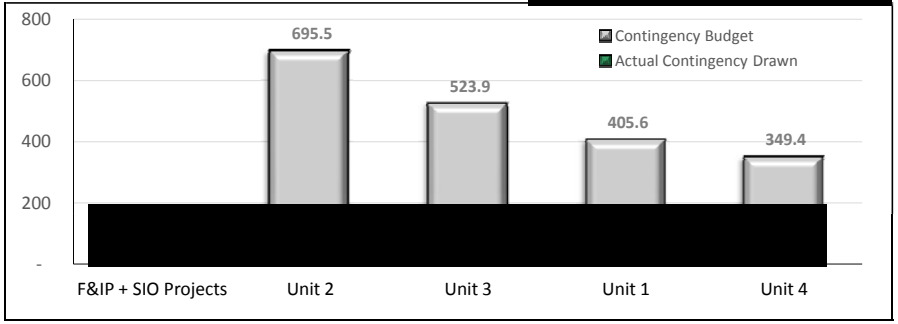
APPENDIX 14: PROGRAM CONTINGENCY MANAGEMENT

Financial Status of the Program Contingency by Unit

Period Ending: 30-Sep-2016

CONTINGENCY DRAWDOWNS BY UNIT AGAINST TOTAL PROGRAM BUDGET

Line #	Unit	Contingency Budget	LTD Actual Contingency Drawdown	Remaining Contingency	% Drawn
1	UF/US - F&IP & SIO Projects	31.9	[redacted]		
3	U2 - Unit 2	695.5			
4	U3 - Unit 3	523.9			
5	U1 - Unit 1	405.6			
6	U4 - Unit 4	349.4			
	Total	(1) **2,006.3**			



EXECUTIVE DISCUSSION

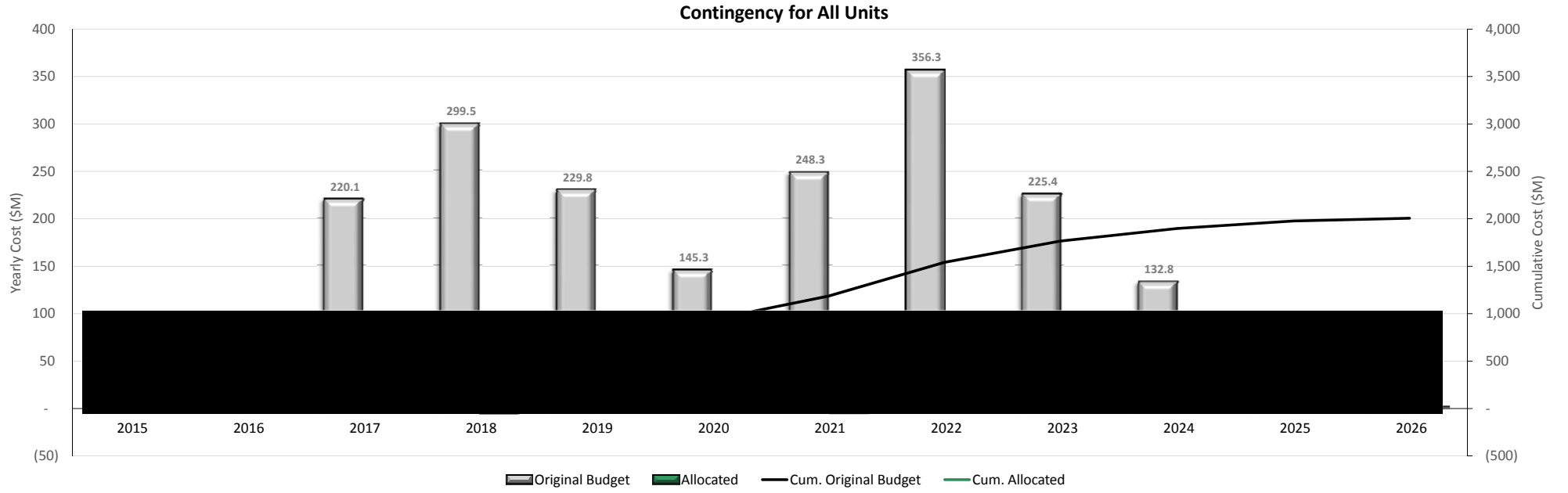
(1) The contingency budget for each unit is aligned with the $2,006 Million of contingency reported in the Unit 2 Execution Estimate provided to the Board in August 2016.

(2) The current contingency allocation for the 4-unit refurbishment is [redacted] (also shown in Appendix 13) of which [redacted] is for Facilities & Infrastructure (F&IP) and Safety Improvement (SIO) projects; [redacted] is for the Unit 2 projects and [redacted] is for subsequent unit work. Note: [redacted] was drawn from Unit 2 contingency to fund a SIO project, and is reflected in both Appendix 13 and 14.

Over the quarter, [redacted] of contingency was allocated to the projects through the change control process; [redacted] to the Facilities & Infrastructure and Safety Improvement projects; [redacted] to the Unit 2 projects; and [redacted] to future unit project work.

CONTINGENCY DRAWS DURING THIS PERIOD

(3) Contingency draws during the period are largely due to the Balance of Plant bundle, specifically the drying of the Primary Heat Transport Auxiliary System dead legs which is a result of refinement in the scope. Further drawdowns are attributed to cost overruns on the Containment Filtered Venting System project and changes in contracting strategies within the DRP.



ONTARIO POWER GENERATION

Darlington Nuclear Refurbishment Program - F&IP and SIO

APPENDIX 15: FACILITIES & INFRASTRUCTURE AND SAFETY IMPROVEMENT OPPORTUNITIES PROJECTS

Cost and Schedule Performance

Period Ending: 30-Sep-2016

COST DETAIL ($ MILLION)

		Cumulative (Life-to-Date)					At Completion of Project				In-Service Date			
		a	b	c=b-a	d	e	f	g	h	j	k	m	n	o
Line	Project Title	Plan (PV)	Actual (AC)	Variance	CPI	SPI	Original Budget (OB)	Estimate at Completion (EAC)	Variance from Original Budget	Variance from Last Period	Need Date	Current Forecast	# Months Float	Variance from Last Period
1	Heavy Water Storage & Drum Handling Facility	332.3	296.7	(35.6)	0.93	0.84	381.2	1 381.1	(0.0)	0.0		May 2017	0	0
2	3rd Emergency Power Generator	117.2	124.7	7.5	0.87	0.96	115.0	2 132.9	17.9	3.9	Mar 2017	Dec 2016	3	2
3	Containment Filtered Venting System	80.0	88.7	8.6	0.90	1.00	80.6	3 94.0	13.4	5.0	Dec 2016	Nov 2016	1	2
4	Shield Tank Over Pressure Protection	19.3	19.2	(0.0)	0.90	1.01	14.1	4 32.7	18.6	1.6	U1-D1711 U2-DNRU2	U1-D1711 U2-DNRU2	0	N/A
5	Balance of Pre-Requisite Projects In-Service	337.3	326.2	(11.1)	*	*	327.1	328.2	1.0	(3.9)	IN SERVICE			
6	**Subtotal Campus Plan Before Contingency**	**886.2**	**855.6**	**(30.6)**	**0.89**	**0.81**	**918.0**	**968.9**	**50.9**	**6.6**				
	Project Contingency (included)	*	*	0.0	*	*	[redacted]							
7	**Program Contingency**	*	*	*	*	*								
8	**Total Campus Plan including Contingency**	**886.2**	**855.6**	**(30.6)**	*	*								
Portion of the Re-tube & Feeder Replacement Bundle														
9	Re-tube Waste Processing Building	127.1	89.5	(37.6)	1.43	0.84	192.0	193.4	1.4	2.5	Jul 2017	Jun 2017	1	0

Notes: * Indicates not applicable. The CPI and SPI calculations exclude project management costs and support tasks which are considered level of effort. PHT = Primary Heat Transport

EXECUTIVE DISCUSSION

1. There is a risk that the cost to complete the facility will increase. OPG is currently negotiating with the vendor to resolve irregularities in the estimate and agree to any required change orders. At that time, the estimate will be evaluated. The final in-service date for the Heavy Water Storage Facility has been maintained since the previous report. Contingency measures for temporary heavy water storage utilizing existing station facilities have been developed to mitigate potential impacts of a delayed in-service on the Unit 2 execution schedule.
2. The estimate to complete the project has increased since the last report as a result of delays in construction, and additional commissioning costs. As previously identified, due to the complexities of the commissioning process and site integration, the in-service date of the 3rd EPG has been delayed to December 15 with remaining risks. The IIP Change Control Process was initiated, and the CNSC has accepted a change to the regulatory commitment, with a revised need date of March 2017.
3. The estimate to complete the project has increased since the last report as a result of delays in construction and additional commissioning costs. The in-service date is November 30. The IIP Change Control Process was initiated, and the CNSC has accepted a change to the regulatory commitment, with a revised need date of December 2016.
4. The forecast to complete the installation of the STOP modification on all four units is $32.7 Million; however, $16.1 Million represents the cost to rectify a pre-existing system condition, and address design changes to the system. Of $16.1 Million, [redacted] in contingency has been drawn down from the Unit 2 program contingency. As previously identified, the remaining [redacted] was under assessment for funding by the Nuclear Projects Portfolio. This assessment concluded that the additional cost is to be funded by Refurbishment contingency. The STOP modification and system design changes were installed and successfully tested on Unit 3 during the fall station outage. Unit 1 STOP modification and system correction is planned for the next Unit 1 outage in spring 2017. This outage has been rescheduled to occur after the Unit 2 Bulkhead installation to minimize interferences.
5. A total of [redacted] of additional contingency, above the contingency allocated during the Release Quality Estimate, is required to complete the projects based on the current estimates. Of the [redacted], [redacted] related to the additional STOP scope to rectify the pre-existing system condition as discussed in Note 4 above. Additional details on contingency use are contained in Appendix 14 - Contingency Management.

ONTARIO POWER GENERATION

Darlington Nuclear Refurbishment Program

APPENDIX 16: KEY PROGRAM RISKS

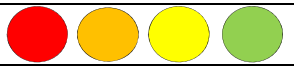
Risks Being Actively Managed by the Program

Period Ending: 30-Sep-2016

KEY PROGRAM RISKS AND MITIGATION STATUS

Line	Status	Risk Description	Mitigation Plan
1	-	**Vendor Performance** Poor vendor performance will negatively impact safety, quality, cost and/or schedule.	Vendor Performance continues to challenge the Refurbishment program. Plans to improve collaborative activities with the vendors for Engineering, Procurement and Construction have been developed and are in progress. This includes active management and assisting vendors in removing barriers to work. The Nuclear Construction Supervisor Academy is operational and has processed many vendor supervisors with positive feedback and results to date. The academy is integral to improving vendor supervisory performance. A second set of integrated schedule reviews was conducted at offsite meetings in late June and yielded a number of opportunities to resolve issues prior to breaker open. Integrated resource plans are in place for RFR JV and ES Fox; resource plans have been reviewed and accepted by OPG for various projects. Integrated field readiness walk downs at T-6 months and T-3 months with refurbishment and vendor teams will also promote better vendor performance overall in the field portion of the work.
2	-	**Availability/Retention of Project Leadership** Key project personnel with the required skill set will not be in place for the full refurbishment program resulting in impacts on performance.	Focus remains on establishing a strategic resourcing framework for the project under the RQE approved budget with the right organizational design and ensuring the right leadership pipeline is in place for future unit refurbishments (Units 3, 1, 4). Phase 2 of the Nuclear Fleet Bench Strength Improvement Plan is in progress. The Simplified Hiring item on the Nuclear Refurbishment top 10 priority list have been completed, with the central resourcing team currently in place and single point of contacts assigned to support each organization in the expedition of staffing needs. The resource plans have been compared against RQE staffing forecasts to ensure alignment.
3	-	**Availability of Skilled Craft Resources/ Supervision** Key skilled craft resources may not be available when required for the Execution Phase.	Focus continues on the onboarding for trades workers and the New To Nuclear (NTN) program for Unit 2. OPG participates in labour market information studies to gain insights into labour market issues, including the identification of skilled craft resource needs using tactics that include both short and long term approaches. There is no significant risks perceived for Unit 2, however there is a risk to future units with the start of the Bruce Power Major Component Replacement program in 2019. Discussions and collaboration with Bruce Power continue and it is expected this risk will be mitigated. The current plans and tactics are being evaluated to ensure integration with the Nuclear fleet to minimize the risks in all support areas. Provisions in trades union agreements also provide for resourcing flexibility, all major unions signed Nuclear Project Agreement (NPA).
4	↑	**First of A Kind/First in A While Work and Processes** A lack of recognition of FOAK/FIAW work and processes during design and execution planning results in installations that do not meet requirements causing rework/delay or degraded production post Refurbishment.	A thorough and in-depth review was completed with Engineering, project teams and various execution and functional groups in the Nuclear Refurbishment and Projects & Modifications organizations to flag FOAK/FIAW risks. A defined set of screening criteria to align with the WANO 2015 SOER report was developed and utilized. Specific mitigation actions are defined for FOAK/FIAW risks, and In-depth challenge/review of risks impact/events along with robust tracking of the mitigation actions are in progress. The initial listing of FOAK/FIAW work and processes review have been completed and this exercise will sustain throughout the refurbishment.

- No change over period
↑ Improvement
↓ Decline

HIGH RISK  LOW RISK

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Darlington Nuclear Refurbishment Program

APPENDIX 17: BUNDLE PERFORMANCE SUMMARY

Bundle Performance in the Four Pillars of Project Excellence -

Period Ending: 30-Sep-2016

BUNDLE PERFORMANCE INDICATORS

Line	Bundle Name	Safety (AIR)	Quality	Cost (CPI)	Schedule (SPI)	Explanatory Notes
1	**Re-tube & Feeder Replacement**	– 0.00	–	– 1.07	↑ 0.99	No safety issues have been identified. Cost performance has remained consistent and schedule performance has improved from 0.94.
2	**Balance of Plant**	– 0.00	↓	↑ 1.01	↑ 0.93	No safety issues have been identified; however, design deficiencies have resulted in numerous Field Initiated Changes and represents a legacy engineering quality issue. Schedule performance is 0.93 and is driven by delays in executing Unit 2 pre-requisite projects. Recovery plans are in place to mitigate the risk to the Unit 2 refurbishment execution schedule.
3	**Steam Generators**	– 0.00	–	– 1.05	↓ 0.89	No safety or quality events have been identified. Schedule performance has decreased due to delays in procurement activities caused by an addition to engineering and testing activities for required parts.
4	**Turbine Generators**	↓ 2.75	–	↑ 1.11	– 1.10	Safety performance has declined as a result of a medically-treated injury on the project. Cost performance and schedule performance are positive. Review is in progress to identify and incorporate lessons learned.
5	**Fuel Handling | Defueling**	– 0.00	–	↓ 0.98	↓ 0.91	No safety or quality events have been identified. Schedule performance has declined as a result of the Powertrack Project where the baseline is pending update to an optimized execution strategy. Baseline will be updated by end of November 2016.

Note: The CPI and SPI calculations exclude project management costs and support tasks which are considered level of effort.

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APPENDIX 18: VENDOR PERFORMANCE SUMMARY

Vendor Performance - Core Refurbishment and Facilities & Infrastructure and Safety Improvement Projects

Period Ending: 30-Sep-2016

VENDOR PERFORMANCE INDICATORS

Line	Vendor Name & Key Scope	Safety	Quality	Cost	Schedule	Relationship	Explanatory Notes
1	[redacted]						
2							
3							
4							
5							

Note: The CPI and SPI calculations exclude project management costs and support tasks which are considered level of effort. The Safety All Injury Rate (AIR) includes

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APPENDIX 19: METRICS LEGEND

Period Ending: 30-Sep-2016

DARLINGTON REFURBISHMENT PROGRAM PERFORMANCE DASHBOARD

METRIC/DESCRIPTION	TARGET	Excellent	Good	Moderate	Poor	↑ – ↓
COST PERFORMANCE INDEX (CPI) Ratio that measures the financial effectiveness. **SCHEDULE PERFORMANCE INDEX (SPI)** Ratio of schedule efficiency to date.	1.00	1.01-1.05	1.06-1.09 0.95-1.00	>1.09 0.91-0.94	<0.91	Managements assessment on the current performance trend. ↑ Performance is IMPROVING – Performance is MAINTAINED ↓ Performance is DECLINING
ALL INJURY RATE (AIR) (# Safety Events/200k hrs worked) Safety events are categorized as the number of fatalities, lost-time injuries, medical treatment injuries and other injuries/illnesses. **The safety statistics include both OPG and contractor performance year-to-date (i.e. reset in January).**	0.24	AIR ≤0.10 AND WP Events = 0	AIR 0.11- 0.24 AND WP Events = 0	AIR 0.25-0.27 OR WP Event = 1	AIR >0.27 OR WP Event ≥2	
# LEVEL 1 WORK PROTECTION EVENTS Count of the number of Level 1 Work Protection Events on DRP over the quarter.	0	AIR is significantly below target AND zero Work Protection Events in the quarter	AIR is at or below target AND zero Work Protection Events in the quarter	AIR is above target within 10% OR 1 Work Protection Event occurred in the quarter	AIR is above target > 10% OR ≥2 high Work Protection Event occurred in the quarter	
# EVENT FREE DAY RESETS (EFDR) The number of Darlington Site Event Free Day Resets that occurred within the quarter as a direct result of work being performed within the Darlington Refurbishment Program. The criteria are aligned to the nuclear industry standards and applied consistently across the sites to allow performance comparisons and benchmarking.	0	BOTH at ZERO	BOTH at ZERO Cumulative # of events for the quarter is 0, however previous performance was moderate or poor OR management assessment on low level trending	EFDR + REG. = 1 Cumulative # of events for the quarter is 1. OR management assessment on low level trending	EFDR + REG. ≥ 2 Cumulative # of events for the quarter is greater than, or equal to 2 OR management assessment on low level trending	
# REGULATORY NON- COMPLIANCE The number of regulatory non-compliance events related to quality that have occurred within the quarter.	0					

FINANCIAL SUMMARY

CURRENT APPROVED RELEASE refers to the total budget of the last release approved by the Board of Directors. The last release was approved by the Board in November 2015, and was to complete the Mobilization Phase.
MOBILIZATION PHASE refers to the work completed Dec 31, 2015 (end of Definition Phase) to October 15, 2016 (Unit 2 Breaker Open).
TOTAL PROGRAM refers to the refurbishment of all 4-units.

METRIC/DESCRIPTION		Excellent	Good	Moderate	Poor	↑ – ↓
LIFE-TO-DATE COST (M$) **ACTUAL** Total Program costs incurred to date against the Approved Release. **PLAN** Planned Program costs to date for the Approved Release. **VARIANCE** Variance of Actual to Plan. ($) indicates underspend vs. plan. **AT COMPLETION OF MOBILIZATION PHASE** **FORECAST** Forecast of total Program costs at the end of Mobilization phase. **PLAN** Planned Program costs at the end of Mobilization phase as per the Approved Release. **VARIANCE** Variance of Forecast to Plan. ($) indicates underspend vs. plan.		Management's assessment based on: Current cost performance; Estimate at Completion; and Contingency allocation.				Managements assessment on the current performance trend. ↑ Performance is IMPROVING – Performance is MAINTAINED ↓ Performance is DECLINING

PROJECT PERFORMANCE INDICATORS AND TRENDS

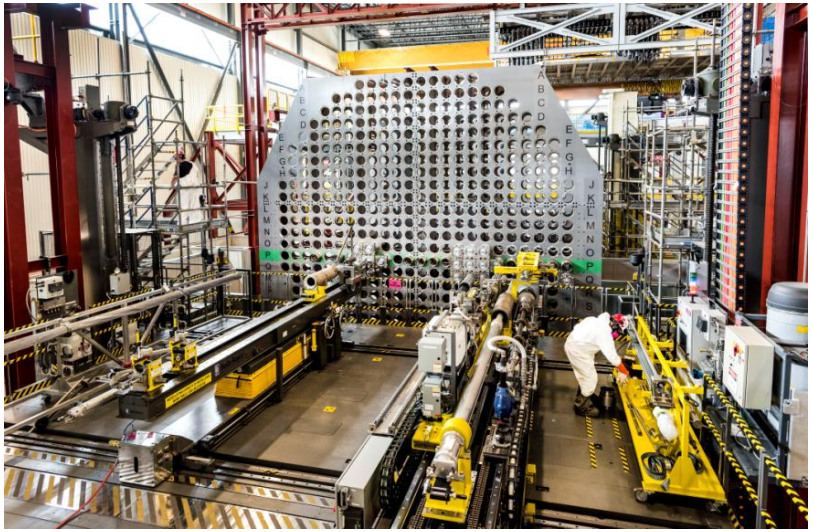
METRIC/DESCRIPTION		Excellent	Good	Moderate	Poor	↑ – ↓
UNIT 2 EXECUTION PROJECTS **PRE-REQUISITE PROJECTS**		Management's assessment of current performance and risk to Unit 2 Refurbishment Execution.				Managements assessment on the current performance trend.

APPENDIX 20: PHOTO CATALOGUE

Period Ending: 30-Sep-2016

PROJECT

Re-tube & Feeder Replacement



Reactor Mock-up

Heavy Water Storage & Drum Handling Facility

Erection of Structural Steel

APPENDIX 20: PHOTO CATALOGUE

Period Ending: 30-Sep-2016

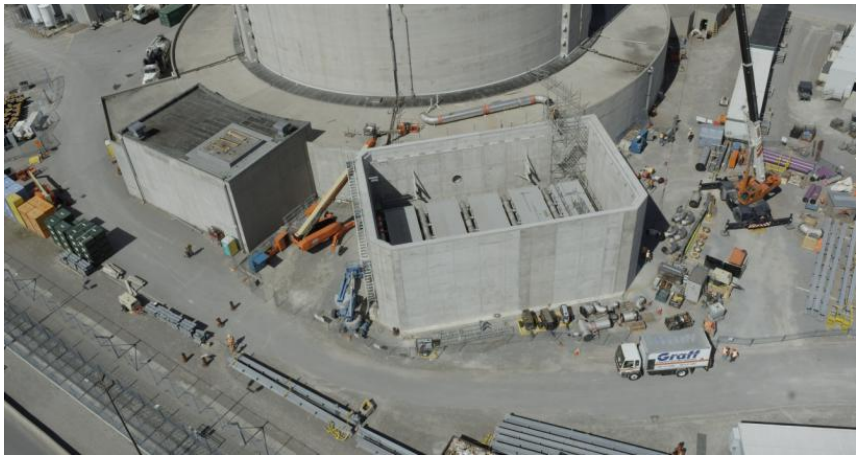
PROJECT

3rd Emergency Power Generator

Completion of Civil Work

Stack Installed

Containment Filtered Vented System



Filter Enclosure

Filters Installed

APPENDIX 20: PHOTO CATALOGUE

Period Ending: 30-Sep-2016

PROJECT

Re-tube Waste Processing Building

Erection of Structural Steel

Re-tube Waste Storage Building
(non-Refurbishment funded)

Building Envelope

Installation of Lighting

Refurbishment Construction Review Board Review (November 29 through December 2, 2016)

Confidential (Commercially sensitive issues are discussed in this document)

Background:

The Refurbishment Construction Review Board (RCRB) conducted a review of the Darlington Refurbishment project from November 28 through December 2, 2016. This report is based on document reviews during the preparation for the review, interviews with Refurbishment personnel, plant walk-downs and observations during four days of the onsite visit.

The RCRB provides a report of its activities to the Senior Vice President Nuclear Projects which includes both observations and recommendations to improve performance. In addition to the report, a number of briefings to Senior OPG and Refurbishment Executives occurred on the RCRB findings.

The RCRB team consisted of the following members:

External members:

Ken Ellis (acting Chairman)
Drew Fetters
Britt McKinney
Ike Zeringue

Internal member:
Paul Pasquet

The RCRB would like to recognize the excellent support provided by Jennifer Vulanovic and Irena Doslo, their preparation and hard work enabled the RCRB to productively conduct this review.

The RCRB has made a limited number of key recommendations which the project needs to address with priority. The recommendations have been flagged and although no “formal” action plans are being requested, the RCRB will expect a formal briefing during the next visit to outline what actions have taken to address the identified issues.

Executive Summary:

The success of this project is in large part defined by the ability to achieve the published schedule. It is critical that the project leadership reinforce the need for Schedule Adherence which is not being adequately achieved at this point. Doing the right work, which starts on time, and finishes it on time with requisite Safety and Quality, must be the theme and content of management actions and communications. The Project leadership must focus their attention to ensure that both behaviours and results support this approach. This will require both an understanding of why the schedule is not adhered to and taking corrective actions to address the condition. The RCRB believes that field observation and coaching by the leadership team will assist in obtaining an understanding of the challenges and issues faced by field personnel.

Positive Observations

a) Fuel Handling Performance and Refurbishment based modifications to support Defueling of Unit 2

   Fuel Handling Performance (both fuel handing equipment and the staff) has been positive and event free. It has created the opportunity for the critical path to be advanced approximately 20 days from the base line schedule. This has been as a result of good collaboration between the Refurbishment team and the plant. The RCRB suggests making prompt decisions in advancing the schedule to take full advantage of schedule gains when they occur.

b) On boarding / Security Clearances / Recruitment

   Considerable progress has been made in recruiting the necessary people to support the project (approximately 200 people have been hired since staffing levels were reviewed in April by the RCRB). In addition there is good communication and prioritization of needs between the refurbishment staffing manager, security and the P&C (People and Culture) Recruitment team. The time to hire “current security cleared” augmented staff has been reduced to approximately 23 days. The overall On-boarding process is now more efficient. However a recent self-assessment has identified a number of program improvements associated with plant access and job specific training programs that should be implemented. These improvements have an owner and are progressing. The Refurbishment leadership team should continue to monitor the progress of these improvements.

c) Initial Islanding of the unit is adequate

The initial islanding efforts are viewed as achieving the initial goals of the project. The Unit 2 Refurbishment boundary points, perimeter barriers and ingress/egress routes have been established. The Islanding CBTs are relevant and raise general awareness of the unique conditions within the Refurbishment unit. It is expected that once all the Unit 2 systems required to support the operating units is finalized, additional work will be required to better refine the Unit 2 islanding requirements.

Recommendations and Key Observations

a) Work Execution

The RCRB considers the ability to execute the base line schedule the key issue that the project must address. Outlined below are a number of metrics which show the required volume of work which is not getting executed:

- Work week T-0 activity schedule completions are approximately 53% with a downward trend since breaker open.
- The activity work survival between T-2 and T-0 is approximately 50%.
- The project has completed approximately 55% of the scheduled activities when compared against the baseline schedule since breaker open.

In addition to this, a number of behaviours were noted that do not support completion of the approved schedule. Vendors are pulling non-scheduled work into the work week as opposed to adhering to the T-0 schedule. The RCRB observed that little effort is devoted to determining why schedule adherence is low, for example, why the work was not ready to execute. This is contributing to schedule adherence being well below target in the T-0 window. In addition, the SPI metric is providing an incomplete picture of schedule execution performance due to the amount of non-scheduled work that is being moved in the T-0 work weeks. At both schedule and metric review meetings the RCRB observed that the majority of the discussion was focused and making schedule changes to support execution shortfalls, versus what steps are being taken to adhere to the schedule. In addition, project management is not consistently holding the vendors to account for not adhering to the committed schedule.

Recommendation #1

(Note: The recommendation is very similar to the recommendation included in Appendix #1).

The RCRB recommends that action is taken to both understand why the desired task/work off rate is not being achieved and take the required actions to ensure this work is completed as scheduled.

The project currently carries out a "metrics / performance" review meeting but not a "T+1" type meeting to identify, understand and rectify the issues preventing the required work from being executed as scheduled. For example, in discussions with execution staff, it was apparent that for some work, the work instructions were handed to the craft during the execution week. This limits the ability to walk the work down and set the execution groups up for success. A detailed understanding of these challenges, along with corrective actions, is required in order to improve the schedule completion rate. Schedule adherence and the actions to improve performance needs to be a priority for the Leadership team.

b) Schedule Stability

There have been 540,692 hours added to the project and 278,238 hours removed for a net change of 262,454 hours since breaker open. Stated differently, 10% of the original U2 total hours has been added in the first 6 weeks. It is acknowledged a significant component of this issue was the one time inadvertent addition and removal of a large block of work. The fact this occurred supports the need for additional controls associated with changes to the schedule. Not only does this cause significant schedule 'churn', but these additions could impact project duration. Assuming the 20,000 hour per week work-off rate, if uncorrected, the extra 262,454 hours this represents 13 weeks of additional trades effort.

Based on meeting observations and a review of project metrics, there is a lack of controls associated with the vendors (and for OPG assigned work) adding hours to their projects or changing the start and finish dates to their work. It is strongly recommended that only OPG be authorized to make changes to the schedule. An example of a method (note, this is a suggestion only) to address schedule changes would be to first have the Project Manager review/accept/reject all recommended changes. These would then be forwarded to the Schedule Group, who would run them on the parallel schedule for impact. If the impact was not significant, they would be approved. If there was an impact to project duration or logic ties, then that change would be forwarded to the SVP of Refurbishment for approval. If approved, then the currently approved schedule would be updated.

Causes and Contributors

There are a number of improvements that can be made to improve project performance:

i. Transition to a more disciplined execution mode has not yet occurred (missed start and completion dates along with inconsistent demonstrated accountability by Project Managers and Vendors). Project Managers and Directors are not overtly driving their projects during project meetings. Work Management staff to their credit are attempting to fill the gap in this area.
ii. Some of the decision making is not being done in a manner which supports the project schedule. An example is a 'zero leakage' valve was specified for replacement in the Vault Vapor Recovery System (VVRS). A new technical specification called for "zero leakage" and the Vendor was attempting to purchase such a valve. It became apparent that a potential equivalent valve used in the same system was in inventory but did not have the "zero leakage" classification however no prompt decision making occurred to allow the work to proceed. As a result of this and other delays, this work has become near critical path.
iii. Time management within the project organization, which applies to OPG staff and the requirements OPG places on its Vendors, needs to transition to more of an 'execution focus.' Meetings need to be concise, focused on accountability and accomplishing work on time, along with being able to tactically and strategically look ahead. In addition, routine meetings are being used to make decisions. It appears there is an excessive number of meetings, many of which are attended by people who may be adding limited value.

Recommendation #2

The RCRB recommends that actions be taken to improve schedule stability.

i. As discussed above, controls need to be implemented to prevent unapproved or uncontrolled changes to the daily schedule or Level 1 schedule.
ii. In order to achieve schedule stability, the scheduled work needs to be ready to execute when required. For example, as discussed above, the quality of the work instructions are inconsistent and are being modified in the week before or week of execution. This limits the ability to walk down the work prior to execution. Consequently, there is a higher probability the work will be moved due to execution challenges. The project is attempting to get all work ready four weeks prior to execution. This is a notable goal

but may be difficult to achieve and will likely require incremental resources to achieve. The RCRB suggests the project ensure all work is ready two weeks prior to execution and ensure a graded approach to readiness prior to the work ready milestone (such as parts available/ engineering complete, etc.).

iii. The performance metrics associated with each Vendor and support group (OPG etc) is reviewed periodically to ensure they are playing their role in improving schedule stability.

iv. There are many different groups that need to play a role to support work execution. There needs to be a clear message that groups must support each other and when they do not, this needs to be identified to ensure the correct amount of support is obtained.

c) Tailored Project Reporting

A pyramidal system of metrics, scorecards and performance indicators is needed to effectively manage a project of this complexity. Quarterly reports of high level metrics and performance indicators are provided to the Board of Directors, and starting December monthly reports will be provided to the Board of Directors and the DRC (Darlington Refurbishment Review Committee). There is a large amount of lower level metrics generated, so much so that key trends may be lost in the volume. What is missing are the "aligned intermediate levels" between these two sets of metrics. As an example, "T-0" Schedule Completion and "T-2 to T-0" survivability should be selected as an intermediate level metrics. Another missing management tool is the absence of individual department "score cards" which drive both accountability and behaviour. It is acknowledged that work is underway in producing these intermediate levels. The absence of these intermediate level metrics and scorecards makes it difficult for the organization to manage the project.

Recommendation #3

(Reference recommendation #3, Appendix #1)

While the project does have a large number of metrics, they do not consistently provide a clear picture of project health for the project leadership. A "pyramidal system" of metrics, performance indicators, and individual department scorecards is needed to effectively manage a project of this complexity.

Other Observations

1. Sense of Urgency

The project needs to articulate and enforce what success looks like associated with accountability. Management behaviour when schedule expectations are missed requires improvement. The prevailing 'discussion' at meetings is focused on the new completion date , with little to no discussion as to why the original date was missed, nor does a healthy sense of urgency appear. In short, both the management team and the contract partners need to make it uncomfortable for those who do not deliver on their commitments, and offer support wherever they can to get the commitments back on track.

2. [redacted]

[redacted]

3. Valves

This is a 'critical activity' for the project. In the project, there are essentially two valve groups, one for valve replacements and one to perform periodic maintenance. The RCRB has yet to review the full scope of this work with all the owners. Project OPEX is that the valve program is the "Achilles heel" of most refurbishments and needs considerable oversight. The RCRB has yet to observe this and consequently this will be a focus area for a future RCRB visit.

4. Safety performance

Over a number of weeks prior to the review, several safety events have occurred at the DN site involving supplemental workers. During the review week a Station/Refurbishment stand down occurred to review these events with staff. In addition during the review week a significant work protection event and a serious personnel injury occurred. The RCRB noted during field tours a number of PPE non-compliances and a failure to tie off an impact wrench when working at heights. In our collective experience the main contributor for such performance is lack of communication and enforcement of expectations.

5. Monitoring of Boiler Chemistry

Since the unit was shutdown there have been challenges with boiler chemistry such as difficulties in maintaining chemistry within the administrative limits. Part of the issue appears to be after the installation of the boiler recirculating skid hoses which are adding sulphates to the boiler necessitating frequent boiler draining/refilling. During the morning meetings there was a lack of urgency to resolve the chemistry issue and it was the Outage director who spoke up to bring resolution to the issue versus someone from Operations/Maintenance. Based on PN RTS

operating experience, monitoring the boiler layup chemistry (and other system chemistry specs) was an issue and follow-up on chemistry issues needs to be closely monitored.

6. RTS group/Document closure

The project has formed a 'Closure Group' to ensure that all supporting paperwork is in order to support the efficient turnover of systems and equipment back to the Operating authority. The plan is comprehensive and relies on a computer program for tracking of key and supporting documents. This group is integrated into the Return to Service (RTS) function and is required to support the availability for service (AFS) process, prepare operations turnover plans and Level 2 Logic Diagrams, as well as review construction completion documents (CCD).

The Level 2 Logic Diagrams are a key aspect of RTS, and set the stage for the logic to return the plant equipment and systems to operation as well as setting up the closure process for success. These documents are targeted to be completed in June 2017. Efforts need to be expended to get these done as soon as possible in order to support the overall RTS process. The Level 2 Logic Diagrams efforts should be complete by now, but are not. These Level 2 logic diagrams will require operations review to ensure they are accurate. The RCRB is concerned with the availability of key operations personnel to manage getting work ready for execution, preparing commissioning plans, complete return to service activities and concurrently review the Level 2 logic diagrams.

7. Scaffolding

The Site should strongly consider the consolidation of scaffolding construction into a single group. This should eliminate variations in quality, avoidance of use by groups that did not build them, and aid in readiness for work, as well as removal when the work is complete. It should reduce the need for some scaffolding storage areas.

8. Project Effectiveness (Construction Switch)

The project has undertaken a number of initiatives to improve the efficiency of getting work executed. There are 16 different initiatives planned (in addition the vendors were asked to provide suggested efficiency improvement ideas). The plan has owner and target completion dates. To date a limited number of initiatives have been actually implemented. The focus areas appear to be appropriate but it is too early to assess progress on effectiveness of the program. This will need to be an ongoing initiative since the RCRB and the project staff believe opportunities to gain efficiency will continue to be identified as the Refurbishment project continues to ramp up its workforce and activities.

9. Field Services

The implementation of the field services engineering group is a recent initiative that is proving to be effective. Processes are flow charted, expectations are defined and metrics are in place. The field services group appears to be headed in the correct direction.

10. Presentation of Performance Metrics

The following are some suggestions on standardizing and improving the presentation of the metrics which are generated for the project;

- Each chart to have a legend which explains every bar colour and trend lines
- Each graph to have arrows indicating 1) Better than target or 2) Worse than target
- Each graph to have a box detailing the definition of metric
- Each graph to show the target performance
- Each graph to have a brief explanation as to what the current performance shortfall implications are (if applicable) and a few key corrective actions (who, what when) to address shortfall (if applicable)

Appendix 1

Recommendations from the July 18 - 22, 2016 RCRB Review

Recommendation #1

The RCRB recommends that action is taken to both understand why the desired task/work off rate is not being achieved and take the required actions to ensure this work is completed as scheduled.

This recommendation is still open

Recommendation #2

It is the RCRB experience that some form of "close out group" needs to be created to ensure that the close out of construction work is done correctly and timely. In addition a return to service group needs to expeditiously complete both the conceptual and detailed planning associated with returning of laid up / operating and modification systems and components to service. This activity needs to be monitored and tracked by the Refurbishment management team.

Progress has been made in addressing this recommendation. This recommendation will be reassessed during the next RCRB review.

Recommendation #3

While the project does have a large number of metrics, they do not consistently provide integrated picture of project health. The metrics identify individual project performance but do not adequate portray the integrated project execution and status. A "pyramidal system" of metrics and performance indicators is needed to effectively manage a project of this complexity. There are a sufficient number of metrics generated; they need to be strategically applied to allow management to focus on the problem areas.

This recommendation remains open. In this report the recommendation specifically targets a particular focus area for the project to address.

Recommendation # 4

With the reactor defueled and the unit separated from containment there exists an opportunity to enhance efficiency by streamlining various work processes so only those activities that truly add value (be it from a safety / quality / schedule or cost perspective) are in effect.

Progress has been made in addressing this recommendation. This recommendation will be reassessed during the next RCRB review.

Recommendation # 5

The level of accountability and understanding of what accountability means needs to be improved on the project. This includes a common understanding by both OPG and the contract partners of what it means to by an accountable organization. The RCRB is not suggesting that a management style be implemented that is inconsistent with the culture of OPG. For a project with multiple contractors, a number of different types of contacts and a large number of interface points between OPG and its Vendors, it is very important that all people involved are truly ready to execute their work as scheduled.

This recommendation is still open. There are pockets where the behaviours have improved but the results (example schedule adherence) are not at a point where this recommendation can be closed.

Refurbishment Construction Review Board Review (February 6-7, 2017)
Confidential

Background:

The Refurbishment Construction Review Board (RCRB) conducted a brief follow-up assessment of the Darlington Refurbishment project on February 6th and 7th 2017. The intent of this assessment was to status the implementation of the recommendations from the previous RCRB report. The RCRB provides a report of its activities to the Senior Vice President Nuclear Projects which includes both observations and recommendations to improve performance

The RCRB team consisted of the following members:

External members:
Ken Ellis (acting Chairman)
Drew Fetters (unable to participate in this assessment)
Britt McKinney
Ike Zeringue
Internal member:
Paul Pasquet

The RCRB would like to recognize the support provided by Irena Doslo.

Outlined below the RCRB has commented on the status of recommendations made in the previous report. The RCRB will expect a formal briefing during the next visit to outline the progress made to address the issues identified in this review.

Recommendations made in the previous RCRB review:

Recommendation #1

The RCRB recommends that action is taken to both understand why the desired task/work off rate is not being achieved and take the required actions to ensure work is completed as scheduled. Schedule adherence and the actions to improve this performance needs to be a priority for the Leadership team.

Recommendation #2

The RCRB recommends that actions be taken to improve schedule stability. In order to achieve schedule stability, the scheduled work needs to be ready to execute when required.

Recommendation #3

While the project does have a large number of metrics, they do not consistently provide a clear picture of project health for the project leadership. A "pyramidal system" of metrics, performance indicators, and individual department scorecards is needed to effectively manage a project of this complexity.

Recommendation Status

1. The project's most important focus area remains to improve schedule compliance at T-0 which includes completing the required work that supports the project schedule. As it currently exists today, the project is starting to build a bow wave of work. In addition, the float associated with a number of bundles of work is being used up, such that these bundles have the potential to impact the project's critical path.

   T-0 task completion as planned for the last 10 weeks is under 60%. Contributors to this issue are:
   a. The Weekly Performance Review Meeting (T+1) is not effective in identifying the reasons for not getting the work done, and in implementing the actions needed to improve performance. While this may be done on an intuitive basis, a rigorous approach has not been taken to implement corrective actions to address the issue.
   b. Work packages are not consistently ready to be worked at T-2, and sometimes at execution week. Package readiness is not being verified prior to being given to the craft on a consistent basis.
   c. Based on limited interviews, a common theme is parts are not being staged for the craft and work instructions are incomplete or inadequate.
   d. The RCRB recommends a dedicated effort focused on ensuring work packages can be implemented, where the general foreman verifies and signs off on the readiness. This may require augmented and/or dedicated resources.
   e. The RCRB recommends that an achievable but challenging yearend target for T-0 completion rate be set which includes interim targets. This will allow the organization to monitor and track performance improvement.

2. Scope Stability has improved from 25% to 40%. By having controls at T-2, there is a better opportunity for work package readiness to improve. We recommend that a future date be set to freeze scope at T-2, to allow the organization to prepare for this change.

Schedule compliance and stability need to be reflected in the Top 10 Refurbishment project priority list. This will provide visibility for the issue and allow staff to work to address the issue and see the progress being made.

Additional Observations:

1. A reconciliation was completed to address the changes in labour hours from Sept. 16 to Oct. 15. (Specifically identifying the cyclical outage work and AISC projects work which does not impact the total cost envelope of the project. This work will still need to be scheduled and monitored to ensure it does not have an impact on the project's schedule).

2. Some improvement has been noted in the refocus and accountabilities of the Project Manager. The RCRB was impressed by the Turbine Generator Project Manager's team and with the vendor relationship.

Other

[redacted]

ATTACHMENT 'B'

Confidential, Unredacted Documents