

ONTARIO**POWER**
GENERATION

DARLINGTON
REFURBISHMENT
Repowering Ontario

Refurbishment Construction Review Board

April 25 – 29



Orientation & Introduction



Refurbishment Construction Review Board (RCRB)
Schedule
April 25 – 29, 2016

April 25 (DAY 1)	Presenter/Lead	Time
Arrival, Meet & Greet, Coffee	RCRB Members	07:00-07:30
Chairman's address to RCRB Members	Mike Rencheck	07:30-08:00
Pre-Job Brief, Introduction & Introductions	Dietmar Reiner Mike Allen	08:00-08:30
Review of Nuclear Refurbishment Organization	Dietmar Reiner Mike Allen	08:30-09:30
Refurbishment Scope	Karen Fritz	09:30-10:30
Break		10:30-10:45
Refurbishment Scope (Continued)	Karen Fritz	10:45-12:30
Lunch		12:30-13:00
Campus Plan Scope	Dragan Popovic	13:00-14:00
Site and Station Walkdown	Boris Vulcanovic and Dragan Popovic	14:00-17:00
Member Discussion	RCRB Members	17:00-17:30

April 26 (DAY 2)	Presenter/Lead	Time
Arrival/Coffee	RCRB Members	07:00-07:30
Tour of Mock Up	Roy Brown	07:30-09:30
Break		09:30-09:45
Release Quality Estimate (RQE)	Gary Rose	09:45-12:15
Lunch		12:15-12:45
Readiness To Execute (RTE) Plan	Roy Martin	12:45-13:45
Engineering	Gregg McCabe	13:45-14:45
Procurement	Sean Toohey	14:45-15:45
Break		15:45-16:00
Construction and Safety	Ken Hobbs and Bill Owens	16:00-18:00
Member Discussion	RCRB Members	18:00-18:30

April 27 (DAY 3)	Presenter/Lead	Time
Arrival/Coffee	RCRB Members	07:00-07:30
Schedule	Karen Fritz	07:30-10:00
Break		10:00-10:15
Station Integration	Boris Vulcanovic and Steve Gregoris	10:15-11:45
Lunch		11:45-12:15
Managed Systems and Oversight	Dave Stiers	12:15-13:15
Quality	Imtiaz Malek	13:15-14:15
Break		14:15-14:30
Regulatory	Robin Manley	14:30-15:30
Contracts and Contract Management	Doug Semple	15:30-16:30
Mock Up Follow-Up: Tooling and Owner Specified Materials	Roy Brown	16:30-17:30
Member Discussion	RCRB Members	17:30-18:00

April 28 (DAY 4)	Presenter/Lead	Time
Arrival/Coffee	RCRB Members	07:00-07:30
Staffing/Resourcing/On-boarding	Connie Hergert and Nicole Lichowit	07:30-08:30
Risk, Planning & Controls, Reporting	Gary Rose	08:30-10:30
Break (to accommodate Day of Mourning Ceremony)		10:30-11:10
90-Day Lookahead and Closing Comments	Dietmar Reiner and Mike Allen	11:10-11:40
Lunch		11:40-12:15
Round Table Discussion	RCRB Members	12:15-14:30
Exchange with Senior Managers	RCRB Members	14:30-16:30
Meeting with Glenn Jager	RCRB Chair	16:30-17:15

April 29 (DAY 5)	Presenter/Lead	Time
Arrival/Coffee	RCRB Members	07:00-07:30
Exit Meeting	RCRB Members	07:30-09:30

1

2

3

4

5



Refurbishment Construction Review Board (RCRB)
Schedule
April 25 – 29, 2016

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Arrival, Meet & Greet, Coffee	RCRB Members	07:00-07:30
Chairman's address to RCRB Members	Mike Rencheck	07:30-08:00
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Review of Nuclear Refurbishment Organization	Dietmar Reiner Mike Allen	08:30-09:30
Refurbishment Scope	Karen Fritz	09:30-10:30
Break		10:30-10:45
Refurbishment Scope (Continued)	Karen Fritz	10:45-12:30
Lunch		12:30-13:00
Campus Plan Scope	Dragan Popovic	13:00-14:00
Site and Station Walkdown	Boris Vulcanovic and Dragan Popovic	14:00-17:00
Member Discussion	RCRB Members	17:00-17:30

**This document titled “Refurbishment Construction Review Board:
Introduction and Organization” was filed at L-4.3-2 AMPCO-102,
Attachment 1.**



DARLINGTON NUCLEAR REFURBISHMENT PROGRAM

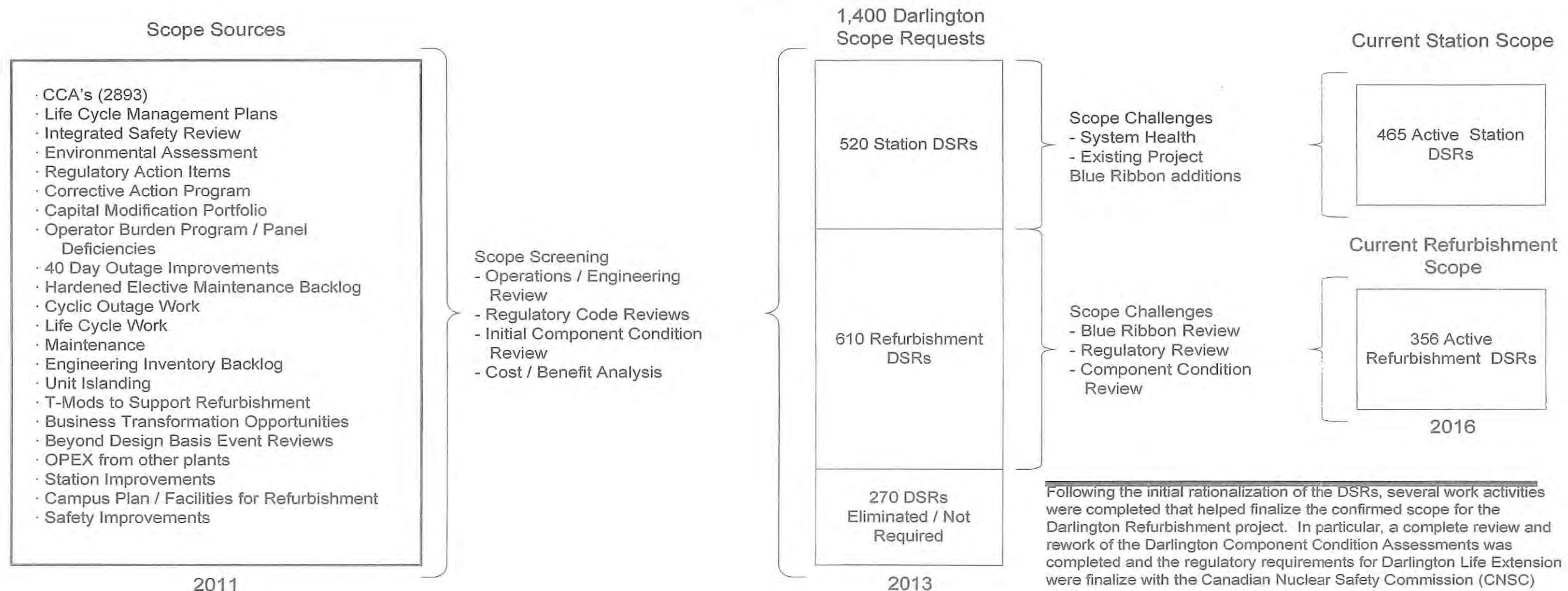
SCOPE SUMMARY

Updated: March 31, 2016

Report Table of Contents

1. Establishing Refurbishment Scope: Overview
2. Darlington Scope Requests (DSR's)
3. Engineering Modifications Summary
4. Integrated Implementation Plan (IIP) Scope
5. Defining Scope Beyond DSR's
6. Master Project List and Scope Definition (*current status)
7. Unit Scope Differences and U2 Refurbishment Equipment Highlight
8. Station System Status and Ownership (*preliminary overview)
9. Major Scope List
10. Project Bundle Scope Summaries (*does not include Functional Bundles)
 - a. DEFUEL
 - b. FUEL HANDLING
 - c. RETUBE AND FEEDER REPLACEMENT
 - d. UNIT ISLANDING
 - e. REFURBISHMENT SUPPORT FACILITIES
 - f. SHUTDOWN, LAYUP AND SERVICES
 - g. BALANCE OF PLANT
 - h. SPECIALIZED PROJECTS
 - i. STEAM GENERATOR
 - j. TURBINE/GENERATOR
 - k. CYCLIC OUTAGE

ESTABLISHING REFURBISHMENT SCOPE: OVERVIEW



Following the initial rationalization of the DSRs, several work activities were completed that helped finalize the confirmed scope for the Darlington Refurbishment project. In particular, a complete review and rework of the Darlington Component Condition Assessments was completed and the regulatory requirements for Darlington Life Extension were finalized with the Canadian Nuclear Safety Commission (CNSC) staff.

All Sources of scope for the Darlington Life Extension were collected and received consideration for inclusion in the Darlington Refurbishment scope of work. Many improvement ideas and suggestions were eliminated directly as being unworkable or uneconomical.

Multiple reviews (both formal and informal) were held to confirm or eliminate scope. Each formal decision was accepted or rejected by the Project Scope Review Board (PSRB). The PSRB was made up of Darlington Site VP, CNE (VP Engineering), and SVP Darlington Refurbishment Project. Each decision presented to the PSRB was preceded by both a Technical Screening Committee and a Finance Screening Committee recommendation.

The PSRB determined that many of the DSRs were part of the normal Station work programs and should not be carried as part of the Darlington Refurbishment scope. Over 45% of the proposed scope was determined to be in this category.

A Darlington Nuclear Refurbishment Scope review panel (Blue Ribbon Task Force) was formed in late 2013 to perform a detailed review of the scope of all DSRs that were intended as Darlington Refurbishment scope. All Blue Ribbon recommendations were processed by the PSRB.

The primary considerations for inclusion in the Refurbishment scope were:

- 1) Required execution of defueled and dewatered conditions,
- 2) Required a unit outage to perform and would take significantly longer than a standard unit outage to complete, and/or
- 3) Substantially safer, lower dose and/or easier if accomplished during the Refurbishment outage, rather than during operation or during a maintenance outage.

DARLINGTON SCOPE REQUESTS (DSRs)

A DSR is used to record scope proposed for execution in preparation for and during the Refurbishment. All DSRs are reviewed, accepted or rejected by the PSRB. Each DSR is tracked to a Work Order(s) once approved in scope.

All scope included in the Darlington Nuclear Refurbishment Program (DNRP) must originate from a DSR. Each project in the DNRP has an 'originating DSR Line Item' to which scope can be traced for each Unit.

The DSR will identify key attributes of the work that can then be recorded in the various electronic sources of scope in order to trace all defined work back to the originating DSR. This is required in order to successfully prove that each DSR has been completed and the scope achieved.

356 DSRs IN SCOPE

One key attribute of a DSR is a 'scope type' that is applied at DSR Scope Approval. The following DSR Types are controlled in the DSR Database:

	DSR SCOPE TYPES
1	Core Scope
2	Performance Improvements
3	Value Enhancing
4	Non-Core Scope

Example of an Approved DSR:

DSR No.: TS0220-3
 Darlington Reactor Regulating:
 Replace Adjuster Absorbers (AA's)

Identification of
 the applicable
 Units

Description of
 the work

Identification of
 DSR Scope Type

Identification of
 IIP commitment

Identification of
 Bundle (BoP)

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Records File Information
Period Life of Project +5
Years

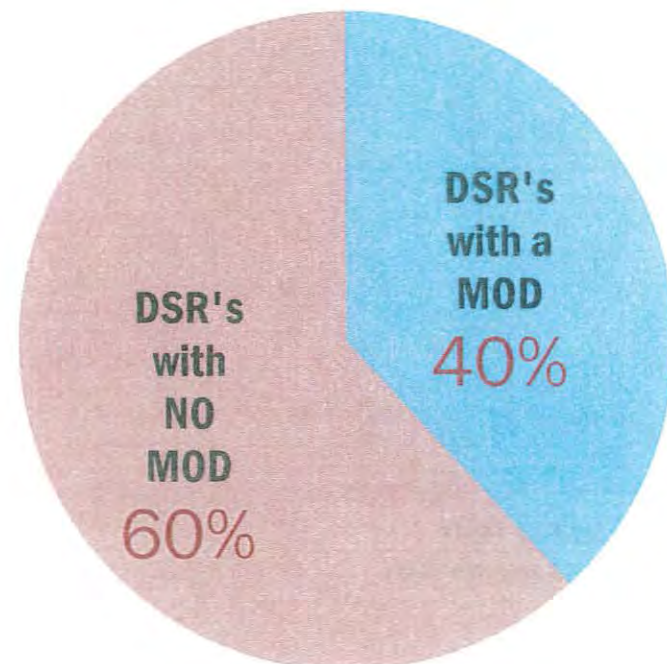
Internal Use Only
DSR Report

DSR:	TS0220-3	Gate:	0	SRB Meeting Date	Wednesday, March 02, 2011
Status:	Approved	Title:	Darlington Reactor Regulating: Replace Adjuster Absorbers (AA's)		
Initiator:	DEBRUIJT	Unit:	1-4	SCI:	63700 (31770, 31780)
Initiators Full Name: TONNIE DEBRUIJN					
Original Description:					
CCA 000402 and 308 items - item 15 Contingency to replace control absorber rods and adjusters if the results of the control absorber reactivity worth assessment to ensure the cadmium sheet will effectively absorb neutrons for extended life is reduced. The four control absorber units have -9.0 mk of reactivity when fully inserted. Ref. AR: 28109158-01. Per approved 2013Q4 SRB DRAS 446: CCA308. Adjusters have been in core with decreased reactivity worth and are subject to replacement in refurbishment. Report NK38-REP-09701-10142 recommended and EDM meeting agreed that AA's will be replaced during Refurbishment. EDM held December 18, 2013, recommended that the DNGS reactors return to a 24 AA configuration of total reactivity worth that does not exceed that of the current configuration (16 in-service AA rods) by more than 1 mk, such that the SRB can make a final decision. Work that has been identified for the project includes: Replacement of all AA's during Refurbishment Outages for all four Darlington reactor units Developing an appropriate strategy to store, transport and deposit the irradiated AA's. For instance, Cooling capacity modification to the IFB. Potential cooling capacity modification to the IFB. AA Holding rack design and fabrication Additional analysis for the new design. Permanent modification if 24 light AAs are used. Associated inspections before or during Refurb outage: (1) To inspect the removed cable for mechanical wear per COG JP 4271 recommendation. (2) To inspect the gap in the Guide Tube locator spring housing between the top of the locator coupling and the rib above for one AA Guide Tube. <u>Per approved DRAS 517 at Q1 2014 SRB:</u> Keep the current core configuration and proceed with 16 AA's like-for-like replacement for <u>Unit 2 only</u> . Decision on Adjuster configuration of 16 like for like or 24 "light" Adjuster Rods for units 1, 3 and 4 to be made by Mark Elliot pending Nuclear Safety Analysis for Shim Operation to optimize shim capabilities (part of SIO410-1 scope). TCD for decision Q3 2014.					
Additional Info:					
Guthrie 5/22/2014					
DRAS 517 approved at Q1 2014 SRB. NK38-LIST-09701-0500363.					
Risk Rank: H25 Contingency: No					
IIP:	No	Scope Type:	CS01	Funding Stream:	Nuclear Refurbishment
Health:	4.04001	Execution Owner:	Guthrie, Scott		
Accountable Organization:					
PSRB Sponsor:	HORST PAETZOLD			Technical Recommended:	Yes
WBS:	52				
Fog:		Fog Desc:			
CCA:		CCA Description:			
Type:	Technical	Cost Element:	Reactor Components		
Not Refurb Reason:		Priority Rank:		<input checked="" type="checkbox"/> Inspection	
Bundle:	BOP			SUB Bundle:	SC
Scope Bucket:	SDS/RRS/DCC Work Defueled			Prereq_Type:	
Hierarchy:	Majo Hierarchy Desc BOP onetime replacement/Inspection				
Refurb Reason					

ENGINEERING MODIFICATIONS

DATA AS OF MARCH 31 2016

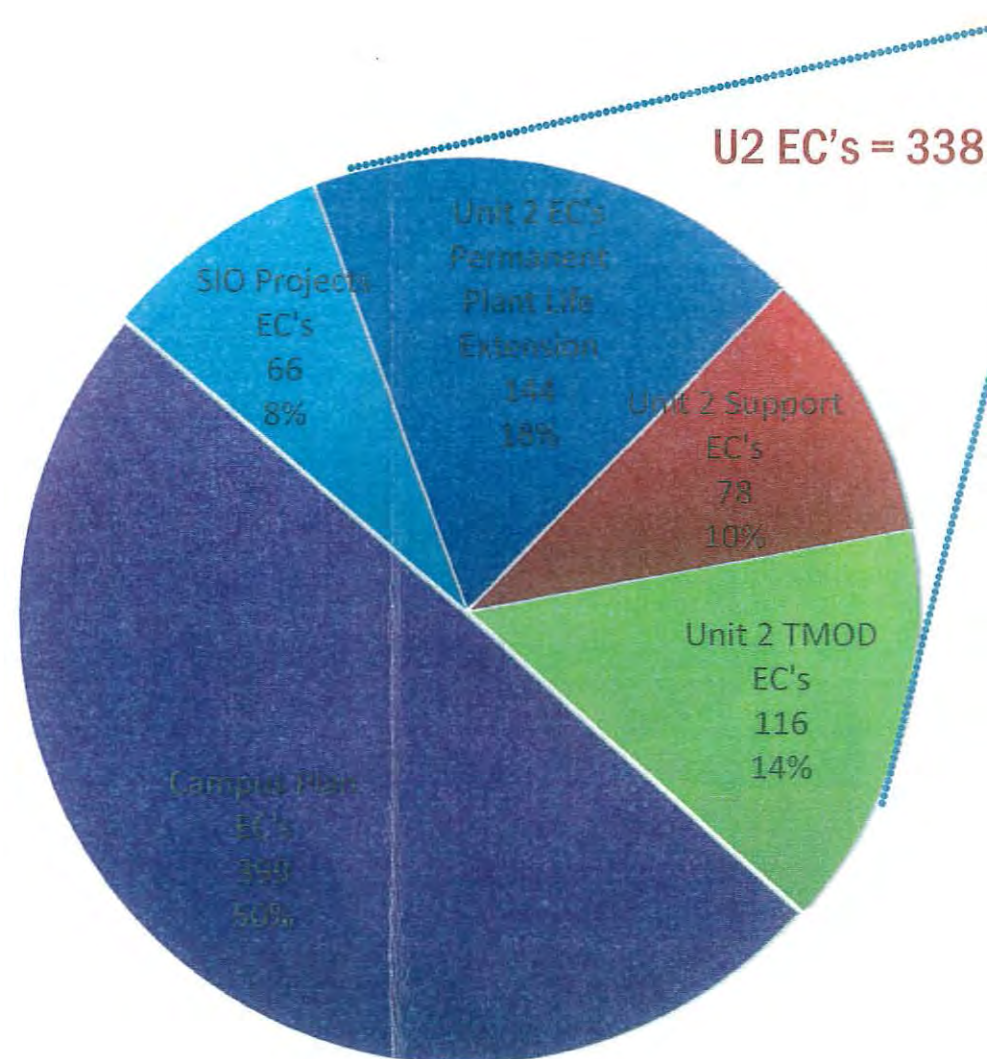
All DSR's are flagged with a modification aspect (Engineering Change) (EC). The seven categories available for flagging are shown in the chart below. Overall, 60% of all approved DSR's do not require any modifications, and 40% are expected to require an engineering modification.



Modification: "Modification refers to a Design Change which affects or alters the design, function, or method of performing the function. Modifications include removal, abandonment, or retirement of already-installed equipment."

Design Change: "Is a change to a final design document that affects a system, structure, component, software, or engineered tool."

In short, a modification alters the design basis. These OPG definitions for any modification envelope the N285.0 definition of a pressure-boundary modification.



Unit 2, SIO and Campus Plan Engineering Changes

Unit 2 Engineering Changes - Will be permanent plant modifications for the extended life of the station

Examples:

- 1) Auxiliary Shutdown Cooling Heat Sink
- 2) Safety System SDS1/SDS2 Computer Upgrades
- 3) Fire Protection Modifications
- 4) Turbine Controls

Unit 2 Support EC's - required for the duration of the Refurbishment outage(s). Not material to extending the life of the station.

Examples:

- 1) Construction of Islanding Barriers
- 2) Lay-up of station systems
- 3) Bulkhead/containment temporary modifications
- 4) Temporary Power

Campus Plan EC's - required as part of the Campus Plan buildings and infrastructure services that support the overall life cycle of Refurbishment.

Examples:

- 1) Refurbishment Project Office
- 2) Water and Sewer project
- 3) Retube and Feeder Replacement Island Support Annex

Safety Improvement Opportunities (SIO) Projects

Examples:

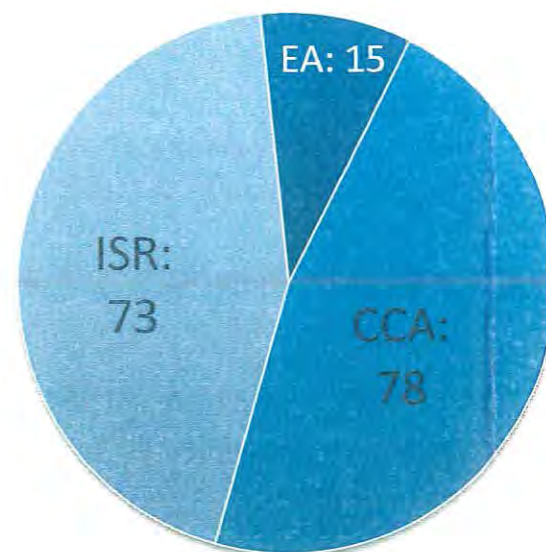
1. Containment Filtered Venting System (CFVS)
2. Powerhouse Steam Venting System (PSVS)
3. Shield Tank Overpressure Protection (STOP)
4. Replacement of Buried Piping (ESW L60)
5. Emergency Power Generator 3 (EPG3)

INTEGRATED IMPLEMENTATION PLAN (IIP) SCOPE

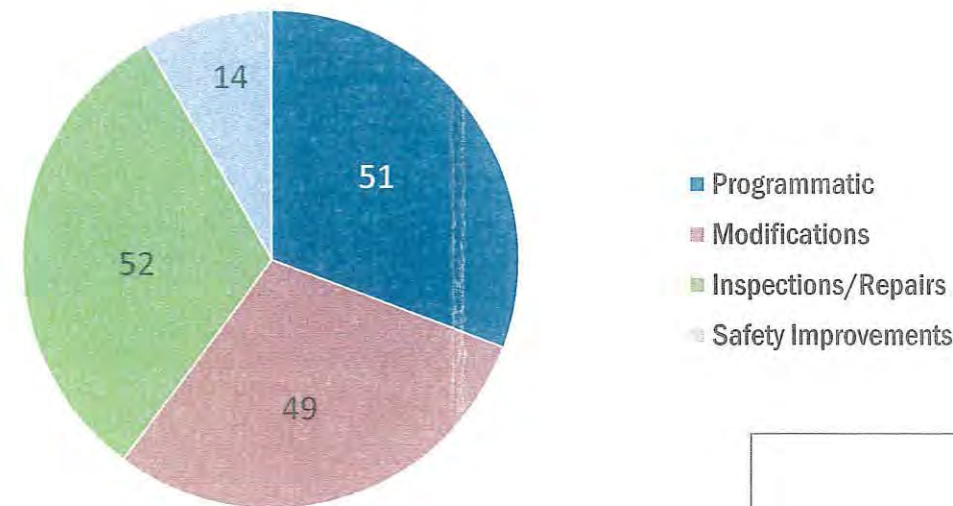
The Integrated Implementation Plan (IIP) was developed per the requirements of RD-360 "Life Extension of Nuclear Power Plants" with 166 line commitments.

IIP Scope consists of 3 primary elements:

- Environmental Assessment Actions (from Environmental Assessment Screening report)
- Integrated Safety Review Gaps (from review to modern codes and standards)
- Component Condition Assessment Actions (inspections, repairs, modifications)



Programmatic:	Procedure Updates & Analysis
Modifications:	Field changes requiring an EC
Inspections/Repairs:	Inspections/repairs in the field
Safety Improvements:	SIOs (EPG3, PSVS, CFVS, STOP, Emergency Water Supply to Heat Transport System (ESW L60 & EHS)), Nuclear Safety Analysis, Modifications as a result of Nuclear Safety Analysis (SDC Pump)

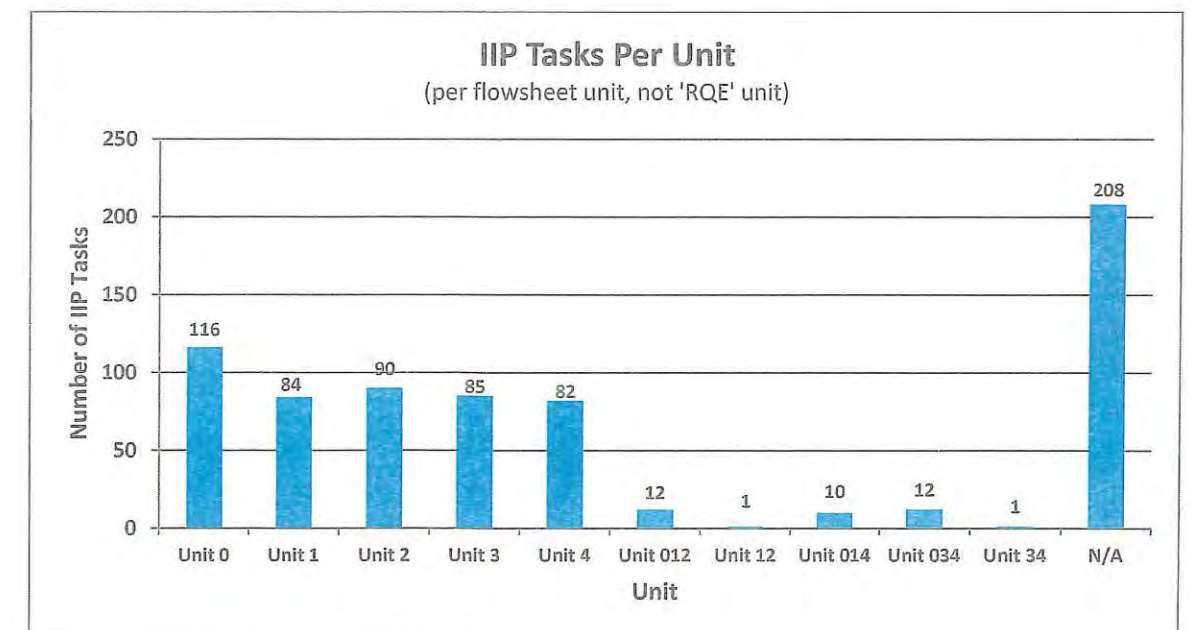


Note:

There are 166 IIP Line items which translates into 701 overall tasks. E.g. A line item is "replace feeders" which has four tasks representing each unit.

To the right is a breakdown of the distribution of tasks through the life cycle of the IIP (2014-2028).

N/A represents programmatic commitments such as procedure updates and analysis.



DEFINING SCOPE BEYOND DSR's

BUNDLES

Following the approval of a DSR, the scope must be further defined. The first step is to assign a DSR to a Bundle grouping. Bundles were created as part of the DNRP to logically group the large volume of work and project management accountability. There are 10 program bundles in the NR Program, 3 additional program bundles funded by AISC. Bundles not only represent scope in the station, but also the support functions.

UNIQUE SCOPES OF WORK

Following the assignment of the DSR to a Bundle, the project team defines the work to be completed. This results in a collection of Unique Scopes of work. There are 123 Unique Scopes of work on the Program. Not all Unique Scopes are executed on every unit, and project numbers are created to define unitization.

PROJECTS

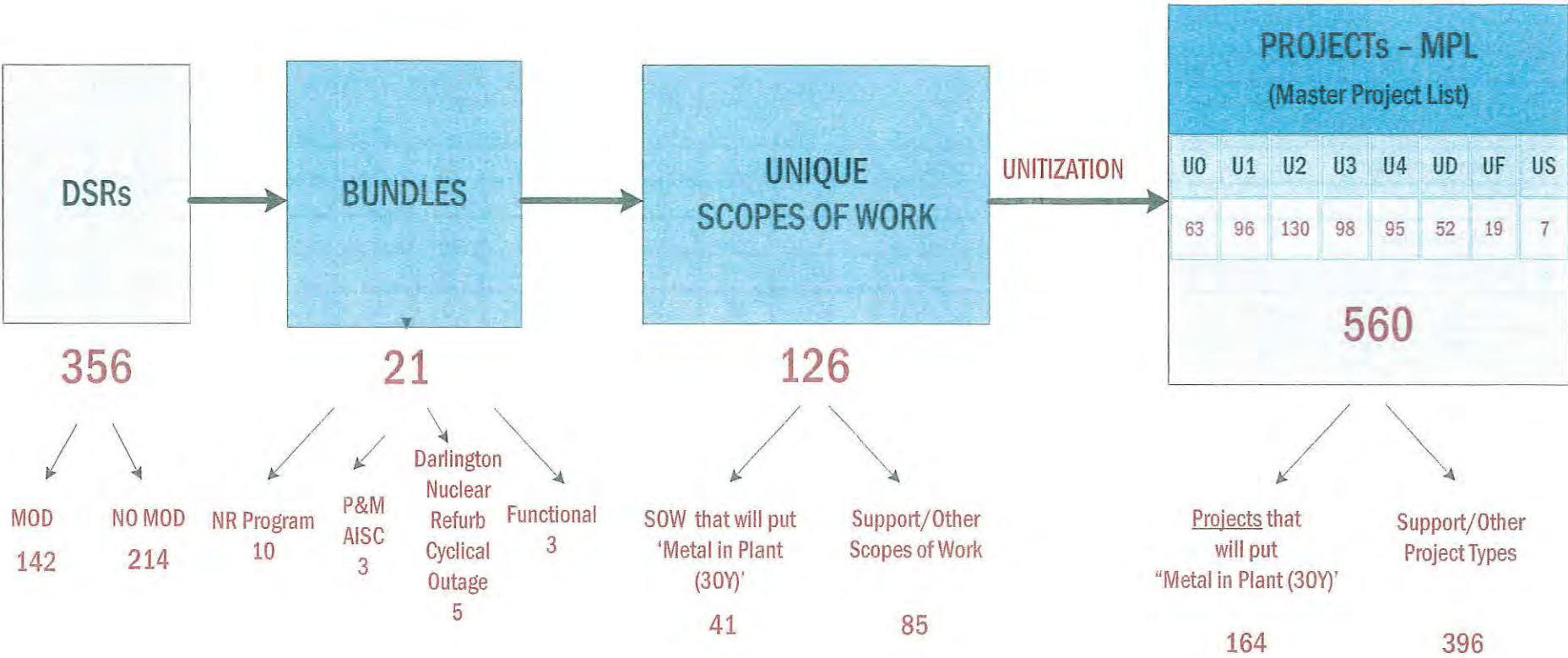
DNRP is a program. The program includes hundreds of projects, for the overall duration of the Refurbishment, for all Units. The unique 'scopes' in each bundle have been defined by a project number for each applicable unit.

UNITIZATION OF WORK

Unitization coding of project numbers in the DNRP must follow the RQE Directive for Unitization. There are eight possible options for Unit coding for project numbers. As a general rule, work is coded to a 'UNIT' when the work is being executed in that Unit Outage with the same number, and will be included in the schedule of that Unit Outage.

UNIT APPLICATION							
UD	U0	U2	U3	U1	U4	UF	US
		X					

- UD
- DEFINITION PHASE - Work is not scheduled as part of any Outage - will be complete in Definition Phase
- U0
- UNIT 0 -Work is common to two or more units and could be executed at various times during refurbishment
- U2
- UNIT 2 - Work will be executed as part of the Unit 2 Outage
- U3
- UNIT 3 - Work will be executed as part of the Unit 3 Outage
- U1
- UNIT 1 - Work will be executed as part of the Unit 1 Outage
- U4
- UNIT 4 - Work will be executed as part of the Unit 4 Outage
- UF
- FACILITIES AND INFRASTRUCTURE (CAMPUS PLAN)
- US
- SAFETY IMPROVEMENT OPPORTUNITY (SIO)



EXAMPLE OF UNITIZATION

UNIQUE SCOPE NAME	PROJECT NAME	Project #	UNIT APPLICATION							
			UD	U0	U2	U3	U1	U4	UF	US
ADJUSTERS	Adjusters	73550			X					
	Adjusters	73551				X				
	Adjusters	73552					X			
	Adjusters	73553						X		
Total project #'s		4								

MASTER PROJECT LIST and SCOPE DEFINITION

There are 21 Bundles in the Program, with 126 Unique Scopes, which translated to 560 Project #'s.
 The following table outlines the Master Bundle List and the number of projects per bundle as of 31st March 2016.

Master Bundle List		Number of DSR's	UNIQUE SCOPES	PROJECT UNIT APPLICATION								Total Project	EC's (U2)	TMOD EC's (U2)	Project EC's (U2)	AS7 Work Orders			Total AS7 Work	Total CWPs
				U0	U1	U2	U3	U4	UD	UF	US					DNRU2	D1621	Other		
PROJECTS - EXECUTION																				
1	Balance of Plant	114	18	2	16	20	16	16	22			92	49	8	12	349	0	815	1164	233
2	Defueling	1	2	3	3	3	3	3	1			16	12	0	2	17	0	16	33	0
3	Fuel Handling	17	4	4	2	2	2	2	2			14	0	0	0	34	0	53	87	34
4	Refurbishment Support Facilities	14	10	2	6	13	6	6	1			34	18	7	4	69	0	10	79	23
5	Retube & Feeder Replacement	19	6	4	2	3	2	2	3			16	21	50	15	245	0	15	260	257
6	Shutdown, Layup and Services	18	15	2	15	22	15	15	1			70	21	22	9	623	31	9	663	48
7	Specialized Projects	8	4	2	4	4	4	4				18	25	0	4	53	0	4	57	0
8	Steam Generator	7	3	3	4	6	4	4	1			22	4	0	3	66	0	5	71	5
9	Turbine Generator	70	4	3	5	7	5	5	2			27	45	3	5	225	113	11	349	259
10	Unit Islanding	22	6	2	5	10	4	4	3			28	26	12	8	27	0	29	56	12
	Bundle Coding Unavailable	7														32	7	1254	1293	
PROJECTS AND MODIFICATIONS																				
11	Facilities & Infrastructure Program (Campus Plan)	21	14			1				18		19	362	21	16	20	0	174	194	0
12	Safety Improvement Opportunity	6	5								6	6	56	6	4	31	0	45	76	0
AISC NR Program																				
13	AISC Projects Executed During NR		1	14								14				46	0	298	344	2
FUNCTIONAL																				
14	Functional Bundle	32	29	16	22	27	25	22	15			127	1	14	0	172	83	21	276	1
15	NR Program	0	2	4	1	1	1	1		1	1	10	0			0	0	0	0	0
16	Waste Disposal	0	1		1	1	1	1	1			5	0			3	0	31	34	0
DARLINGTON OUTAGE																				
17	Balance of Plant	0	0		3	3	3	3				12	0			0	725	14	739	0
18	Cyclical Maintenance	0	1	2	2	2	2	2				10	0			0	7140	67	7207	0
19	Darlington Outage Program Bundle	0	1		1	1	1	1				4	0			0	0	0	0	0
20	Functional Bundle	0	0		3	3	3	3				12	0			0	0	0	0	0
21	Turbine Generator	0	0		1	1	1	1				4	0			0	98	2	100	0
TOTAL		356	126	63	96	130	98	95	52	19	7	560	640	143	82	2,012	8,190	2,873	13,082	874

*Project ECs are used to track documentation and training requirements required to support Engineering Changes being place in service. They are not true modifications.

UNIT SCOPE DIFFERENCES

Scope is Frozen

Scope for the DNRP has been declared 'frozen' at the DSR, Engineering and Work Order level, for all units. Any scope added beyond June 1, 2015, is considered new or changed scope.

Scope Differences

The scope for each unit is not exactly the same. As the first unit of the Refurbishment Outage, Unit 2 is expected to be the most expensive unit, and has more scope than subsequent units. Due to the station configuration and the 'common' requirements of each outage across the station, many EC's and other support scope are only required on Unit 2, and will be in place for the remaining units outage duration.

Replication/Cost note

There are engineering modifications on all Units and the RQE has identified the cost of creating these engineering packages for each unit. The costs per unit are not identical, as much of the work is completed for the first unit on the original engineering package, and then 'replicated' for each subsequent unit, provided the scope is identical

U2 REFURBISHMENT EQUIPMENT HIGHLIGHT

EQUIPMENTS	COUNTS
VALVES	2098
PUMPS	~203
HEAT EXCHANGERS	~68
BREAKERS	123

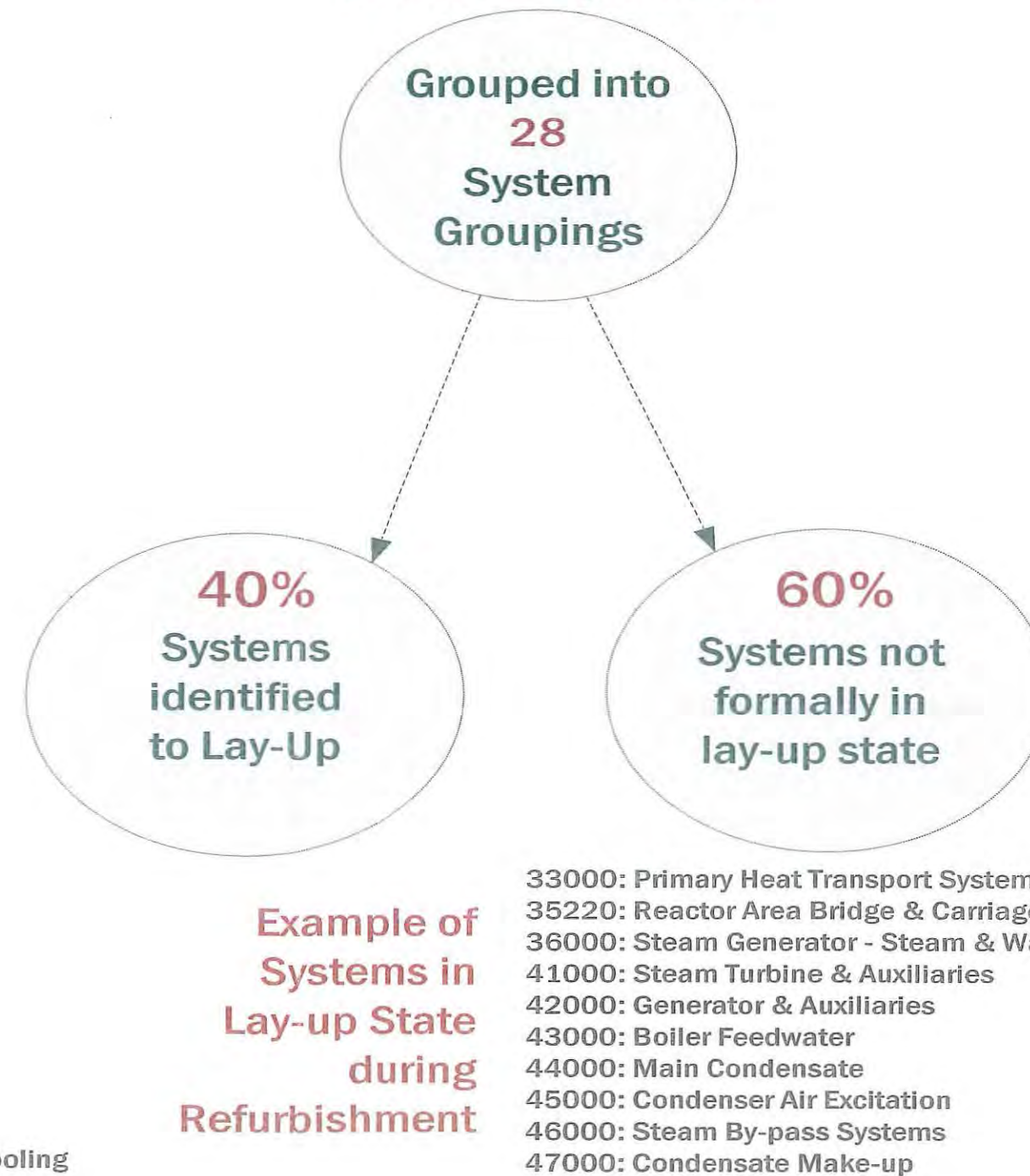
STATION SYSTEMS STATUS AND OWNERSHIP

PLEASE NOTE:
Final RTS Strategy &
Master 'System Grouping'
List is under development,
TCD 31-May-16 (OP2217).

Refurbishment Master 'System Grouping' List

32000: Moderator & Auxiliaries
34880: Annulus Gas
33000: Primary Heat Transport System
21000: Airlocks and Transfer Chambers
34200: Negative Pressure Containment (NPC)
34300: Emergency Cooling Injection System
63700: RRS
68200: Shutdown System 1 Process
68300: Shutdown System 2 Process
35220: Reactor Area Bridge & Carriage
38300: Vapour Recovery
79700: Active Liquid Waste Collection
51520: Transformers (MOT)
52120: UST
53000: AC Power Generation (i.e. Class IV Power)
36000: Steam Generator - Steam & Water
47000: Condensate Make-up
43000: Boiler Feedwater
44000: Main Condensate
46000: Steam By-pass Systems
41000: Steam Turbine & Auxiliaries
42000: Generator & Auxiliaries
45000: Condenser Air Excitation
72100: LP Service Water
72200: Recirculating Cooling Water
72300: PULS Water
78000: Fire Protection
73720: Reactor Vault and Fuelling Duct Atmosphere Cooling

Station Systems



MAJOR SCOPE LIST

U2 Retube and Feeder Replacement (RFR) Related Work:

- 1. Defuel Entire Reactor Core for RFR Activities
- 2. Drain Entire Heat Transport System (Including Vacuum Dry)
- 3. Drain, Flush and Vacuum Dry Moderator System
- 4. Install Containment Isolation Bulkhead with Radiation Shielding
- 5. Remove Reactor Vault Interferences & Fueling Machine Bridge
- 6. Install Retube Temporary Platform (RTP)
- 7. Remove Reactor Components
 - a. Feeder Cabinet
 - b. Channel Feeder Pipes
 - c. Pressure Tubes
 - d. Calandria Tubes
- 8. Install New Reactor Components (per 7. Above)
- 9. Manually Load Reactor with New Fuel

U2 Refurb Critical Scope (non-RFR) Work (not in order of importance):

- 1. Turbine Generator Major Overhaul
- 2. Primary Side Steam Generator Inspection & Cleaning
- 3. New Emergency Heat Sink Supply (Modification)
- 4. New Auxiliary Shutdown Cooling System
- 5. Replacement of (4) Primary Heat Transport Pump Motors
- 6. Replacement of All Adjuster Rods
- 7. Replacement of All Vertical Flux Detectors
- 8. Replacement of All Horizontal Flux Detectors
- 9. Shutdown System 1 & 2 Trip Computer Replacement
- 10. Liquid Injection Shutdown System Rehabilitation
- 11. Installation of Temporary Fission Chamber for Start-up
- 12. Replacement of Large Portion Powerhouse Upper Level Service Water Pipe Work
- 13. Low Pressure Service Water Outage (LPSW) to Repair LPSW valves
- 14. Rehabilitation of Moderator Isolation Valves while Drained
- 15. Installation of Shield Tank Overpressurization Modification
- 16. Dry Lay-up of Conventional & Nuclear Systems during Refurbishment
- 17. Installation of Steam Generator Secondary Side Access Ports
- 18. Main Output Transformer Drain & Repair of Bushings
- 19. Maintenance & Upgrade of Reactor Vault Cranes
- 20. Major Overhaul of Liquid Zone Control System
- 21. Fueling Machine Power Track Replacement
- 22. Emergency Service Water Piping Replacement and Valve Overhaul
- 23. Reactor Vault Air Conditioning Unit (ACU) Replacement
- 24. Install (960) New Design Fuel Channel Closure Plugs
- 25. Condenser Flex Seal Replacement
- 26. Installation of New Heat Transport Liquid Relief Valves
- 27. Heat Transport Bleed Cooler Inspection
- 28. (2) Moderator Heat Exchanger Inspections
- 29. Inspect & Overhaul of Shutdown Cooling Valves
- 30. Electrical Bus Inspection and Breaker Maintenance
- 31. Perform Periodic Inspection & Flow Accelerate Corrosion Programs
- 32. Emergency Coolant Injection (ECI) Inspection & Maintenance
- 33. Provision of Temporary Power Supplies
- 34. Feeder Scanner Replacement
- 35. Boiler Blowdown Piping Replacement

DARLINGTON NUCLEAR REFURBISHMENT PROGRAM

PROJECT BUNDLE SCOPE SUMMARIES

1. DEFUELING
2. FUEL HANDLING
3. RETUBE AND FEEDER REPLACEMENT
4. UNIT ISLANDING
5. REFURBISHMENT SUPPORT FACILITIES
6. SHUTDOWN, LAYUP AND SERVICES
7. BALANCE OF PLANT
8. SPECIALIZED PROJECTS
9. STEAM GENERATOR
10. TURBINE/GENERATOR
11. CYCLIC OUTAGE

The purpose of the Defueling Project is to safely remove all fuel from each reactor core in a cost effective manner in order to minimize outage duration. Flow Defueling was selected as the preferred method to defuel the reactor and relies on hydraulic drag of primary heat transfer coolant over fuel to “wash” fuel into fueling machine.

Defueling is the first segment on critical path once the Refurbishment breaker is open.

The two major changes related to the project are:

- *Implementation of Universal Carriers (UC), and*
- *The equipment required to defuel an entire reactor*

The UC will be permanently installed on the station fuel handling systems and will allow a Darlington Fueling Machine to fuel and defuel without having to change out the carriers, which is not the case today.

The equipment required to defuel the reactor includes the Dummy Fuel Bundles (DFB), the Flow Restricting Outlet Bundle (FROB), the Fuel Push Tool, (FPT) and includes a software update that is required for all parts of the project as well as modifications to the New Fuel Transfer Mechanism (NFTM) to accommodate the new UC and to facilitate loading of the DFB and FROB.

The Defuel Bundle has 2 Unique Scopes:

- 1. Defueling**
- 2. Defueling- OPG O/S**

DEFUEL

BUNDLE SCOPE SUMMARY

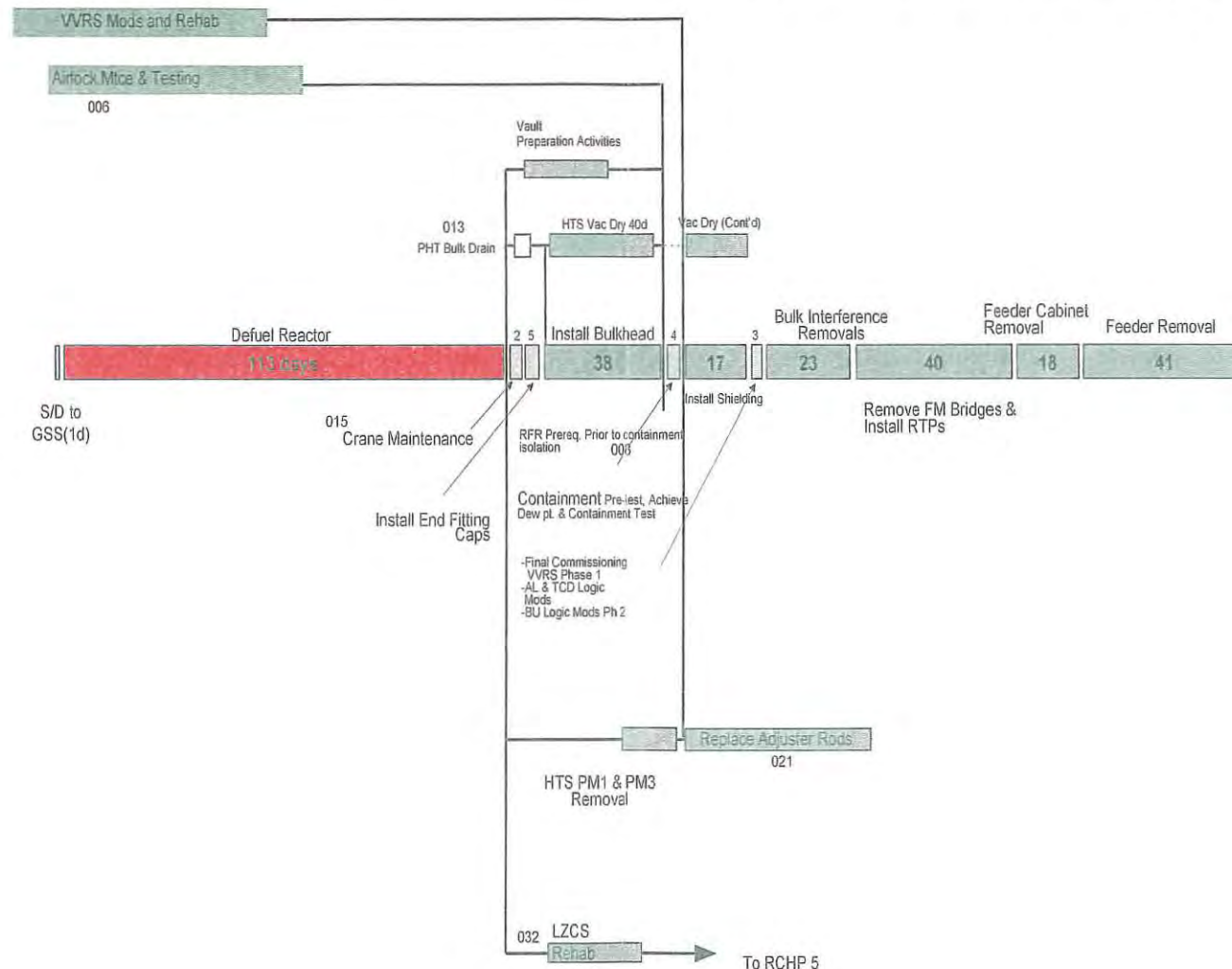
1

DEFUEL

1. Defueling Method - "Flow Defueling" was selected as the preferred method to defuel.

- Relies on hydraulic drag of PHT coolant over fuel to "wash" fuel into fueling machine.
- Uses proven technology OPEX (Bruce A)
- Essentially the same as how DNGS defuels today (operator familiarity)
- Minimizes duration and cost (defuel is critical path activity)
- Nuclear Safety analysis completed in 2012 supports strategy
- Allows all trolleys to either fuel running units or defuel refurbishment units
- Reduces risk of outage delays due to equipment reliability and/or fueling demands on running units
- Project includes support and contingency based on risk evaluation

Unit 2 Refurbishment Outage – DNRU2 - REV A7 - Sept. 21, 2015



Flow Restricting Outlet Bundle (FROB)

The function of the FROB is to mimic the flow resistance of a fuel string and prevent a large scale core bypass of coolant flow once a channel has been defueled.



Dummy Fuel Bundles (DFB)

The function of the DFB is to mimic the mechanical characteristics of existing fuel bundles. In channels where there is limited flow, DFBs will be used in a process called push defueling.



Dummy Bundle Push Tool/Fuel Push Tool

The FPT works in conjunction with DFBs to safely remove fuel from channels where the coolant flow is too low to allow for flow defueling of bundle pairs.



Universal Carriers

UCs allow for flexibility for either fueling or defueling the reactor units without the need to swap carriers. Darlington currently uses two sets of carriers and switches between fueling carriers for fueling and outage defuel carriers for defueling.



The Fuel Handling (FH) Bundle exists to improve FH reliability through inspections and replacement of critical components during Refurbishment. The DNGS FH System loads ~20,000 fuel bundles/year and must remain reliable. The system is a trolley-based system, to allow flexibility in fueling and is not dedicated to each unit (i.e. Pickering).

- The FH system must be reliable in order to meet schedule and performance commitments for Refurbishment and other running units.
- Following the Retube activities, the FH equipment must be returned to the station in a condition suitable for operation to extended end of life.

The FH Bundle includes the following Unique Scopes:

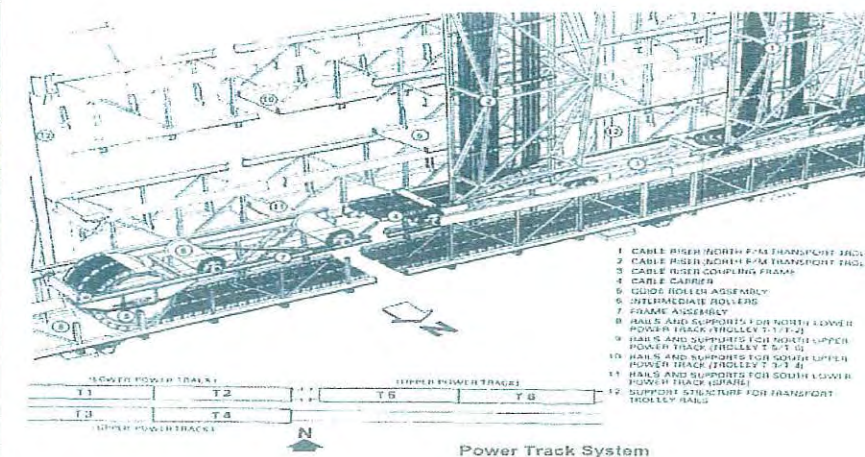
1. Powertrack Refurbishment
2. Irradiated Fuel Bay Heat Exchanger Replacement
3. Reactor Area Bridge & Carriage Refurbishment
4. Fuel Handling - OPG O/S

F U E L

H A N D L I N G

BUNDLE SCOPE SUMMARY

2



FUEL HANDLING

3 OF 4 UNIQUE SCOPES

1. POWERTRACK

The FH system at Darlington performs routine online fueling operations using fueling machines mounted on trolleys. The Powertrack (P/T) provides a flexible avenue for power, control and signal cables to be connected to the trolleys from the Central Service Area. One of the major activities in the DNRP is to refurbish the three existing Powertracks, to ensure the continued operation of the FH system to the end of station life.

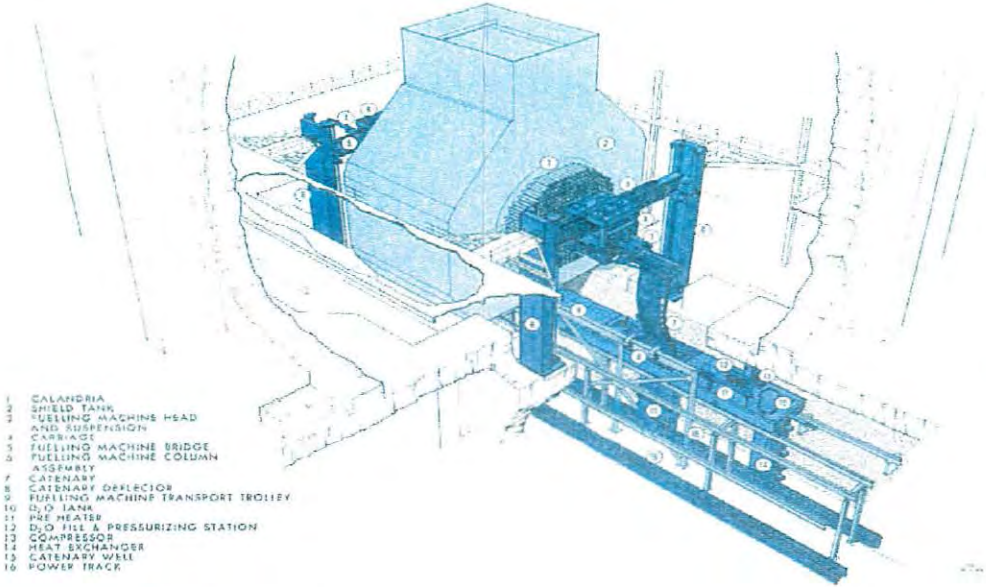
Refurbishment scope is to refurbish T34 (in 2017) and T12 (in 2018) during Unit 2 Refurbishment and T56 during Unit 3 Refurbishment (in 2020). This is to be done with the support of an external contractor, who will be responsible for the Procurement and Construction (PC) of the components for the Powertrack. This is a "like for like" replacement, no modification scope is required. The scope of work requires the replacement of the following components:

- A. Powertrack chain
- B. Powertrack support rollers including shafts and wheels, end drums including shafts
- C. Powertrack power, control and CCTV cables

THIS COMMON SYSTEM
SCOPE WILL BE
EXECUTED DURING
U2 + U3 OUTAGES

This is a non-critical path activity however integration with Station refueling program is fundamental in successful implementation of this project.

THIS SCOPE WILL BE
EXECUTED ON
U2, U3, U1, U4



3. IRRADIATED FUEL BAY HEAT EXCHANGER REPLACEMENT (COMPLETE)

The Darlington Irradiated Fuel Bay system is comprised of eight Heat Exchangers (HX) and the corresponding piping equipment; at each side of the Station there is one IF Storage (main) and one IF Reception (small) bays for a total of four bays. Every Storage bay has 2 x 100% duty HX's and every reception bay has 2 x 100 % duty HX's for a total of eight HX's. Existing equipment performance did not satisfy the design basis and could not meet anticipated needs of the DNRP during core defueling.

The decision was to perform a "like for like" replacement of "plate packs" for all eight IF bay HX's prior to 2015 in order to restore cooling capacity and mitigate margin management issue. This pre-requisite Refurbishment project was completed by an external contractor in June 2015.

THIS COMMON SYSTEM
SCOPE
HAS BEEN EXECUTED
AS A PRE-REQUISITE TO
THE U2 OUTAGE

2. REACTOR AREA (RA) BRIDGE AND CARRIAGE REFURBISHMENT

RA Bridge assembly supports a Fueling Machine Carriage which accepts the FM head and suspension from the Transport Trolley in the duct and supports them while in the reactor vault. Vertical motion provided by the Bridge (course Y), along with horizontal motion (course X) provided by the Carriage, position the FM head at any channel such that refueling can be accomplished. The RA Bridge assembly consists of a bridge beam supported between two elevators which travel up and down via a ballscrew/jack system on two fixed columns. Two bridges are provided for each reactor and are located adjacent to and parallel with the reactor face.

Refurbishment scope is to replace a number of major components on the RA Bridge and Carriage. The RFR contractor informed OPG of their intention to remove the RA Bridge and Carriage during their execution of the RFR project. Based on this intent, OPG directed the contractor to plan for and perform the installation of the required new components for RA Bridge and Carriage as described in NK38-SOW-35000-10000, R3. All replacement components shall be classified as "free issue" from OPG and they are "like for like", with no modifications envisioned. RA Bridge and Carriage project is a critical path activity and will be repeated on every Darlington Unit, with the RA Bridge removal.

The Retube and Feeder Replacement (RFR) Project includes full engineering, procurement and construction services for:

- 1. Replacement or inspection of components;*
- 2. Replacement of fuel channels, feeders and supporting hardware and associated parts;*
- 3. Internal inspection of calandria vessels;*
- 4. Development of tooling and systems to perform replacement and inspection tasks; and*
- 5. Fuel channel and feeder mock-ups in the Darlington Energy Complex (DEC) for tool testing and training.*

The Retube and Feeder Replacement Bundle includes 6 Scopes in two phases:

- 1. RFR - Retube Waste Processing Building (RWPB)**
- 2. RFR - Retube Waste Processing Building (RWPB) - OPG O/S**
- 3. RFR Project Bundle - Major Retubing - Execution Phase**
- 4. RFR Project Bundle - Major Retubing - Execution Phase - OPG O/S**
- 5. RFR Project Bundle - Major Retubing - Definition Phase**
- 6. RFR Project Bundle - Major Retubing - Definition Phase - OPG O/S**

R E T U B E

3

A N D F E E D E R R E P L A C E M E N T

B U N D L E S C O P E S U M M A R Y

RETUBE and FEEDER REPLACEMENT

3 OF 6 UNIQUE SCOPES

THE CONSTRUCTION OF THE
MOCK UP IS COMPLETE

1. RFR DEFINITION PHASE

MOCKUP: In order to prepare and train for the Retube and Feeder Replacement (RFR) project, particularly for the first Unit, the RFR team constructed a full scale fuel channel mock-up area with the following:

- Fuel channel arrays
- Feeder section with headers
- Fueling machine bridge
- Airlock mock-up
- Additional mock-ups

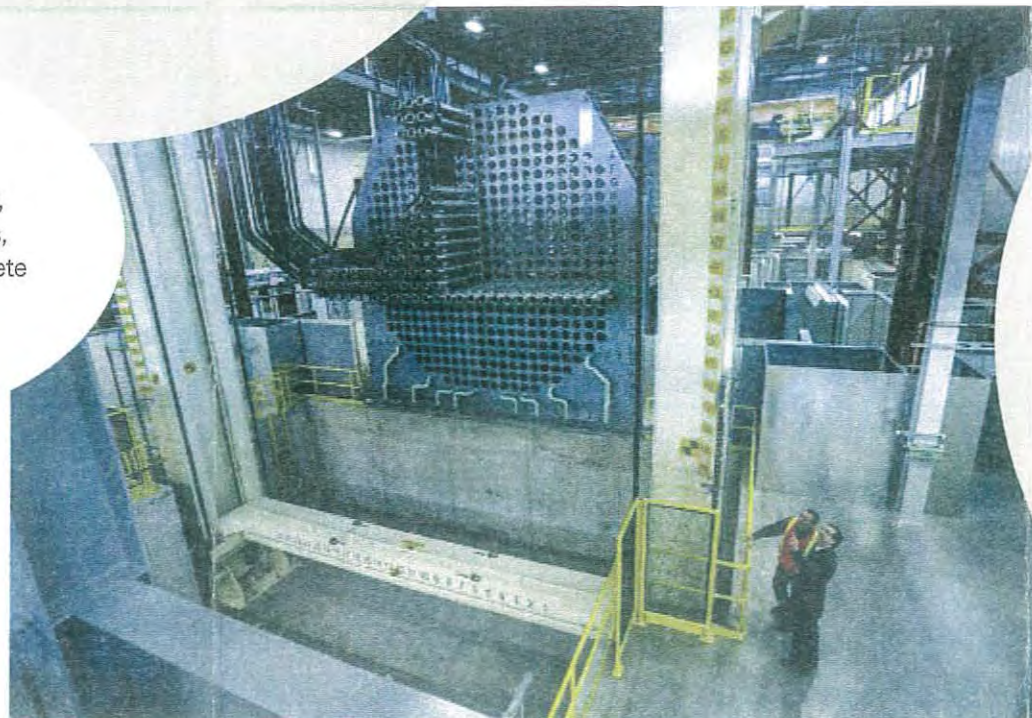
TOOLING: This scope includes the design, engineering, construction, completion and testing of the tooling (removal, installation, inspection, contingency and other tooling as described in the Tooling Design Requirements document) on the mock-ups.

Mods Engineering, Procurement, Execution Planning:

This scope includes the engineering of station Mods, procurement of reactor components for Unit 2, and preparation of execution documentation such as construction work packages.

Tooling engineering complete, prototype tool manufacturing, testing and integration with mock-up complete, production tool manufacturing in progress

Mods engineering substantially completed, procurement in progress, execution planning complete



THIS SCOPE WILL BE
EXECUTED DURING
U2, U1, U3, U4 OUTAGES

3. EXECUTION PHASE

The RFR is core scope that supports the primary reason for executing a refurbishment outage at Darlington.

The scope includes the retube of 480 pressure tubes and calandria tubes and the replacement of all feeder piping.

Major activities:

- New pressure tubes
- New calandria tubes
- New end fittings
- Fabrication and installation of new feeders

Part of the RFR project includes a significant number of engineering changes to perform vault preparation, including restoration of the vault after Retube has been completed

2. RETUBE WASTE PROCESSING BUILDING

The project includes the design, construction and commissioning of a Retube Waste Processing Building (RWPB). The RWPB will house the volume reduction tooling system and process the intermediate-level refurbishment waste, as well as accommodate all DNRP low level waste container shipments per the current Waste Management Plan.

Used reactor components will also be delivered from the outage unit to the RWPB in appropriately shielded flasks.

*** Caissions complete, Pilecap work in progress*

THIS BUILDING IS A **PRE-REQUISITE** TO
THE U2 OUTAGE

The Islanding Project (IP) will create a safe, precise work area that is separated from the operating plant through a system of physical barriers and controls. Once separated, the IP's goal will be to maximize the ability of OPG and contract staff to perform work safely and efficiently on the unit that is being refurbished while minimizing the impact on the operating units.

The IP can be broken down into the following principle elements:

- *Establishing barriers and access control around the Refurbishment Island to keep Refurbishment station staff from entering operating unit areas and to keep workers from entering Refurbishment work areas.*
- *Isolating the Refurbishment unit reactor vault from station containment once the irradiated fuel has been removed from the core (commonly referred to as "installing the bulkhead"). This will allow both airlock doors to be opened to facilitate worker and material transfer into/from the vault which will significantly improve RFR worker efficiency. Bulkhead installation is the single largest element of the IP.*
- *Establishing terminal points on station systems to allow them to be isolated from the operating units to the maximum extent possible. Where necessary, modifications will be installed, either in planned outages that precede the Refurbishment outage (preferred) or at the start of the Refurbishment outage.*

The IP Bundle includes 6 Unique Scopes:

- 1. Bulkhead and Containment Isolations**
- 2. Barriers**
- 3. Islanding Pre-Refurbishment Projects**
- 4. Button Up Modifications**
- 5. Airlocks**
- 6. Islanding - OPG O/S**

ISLANDING

4

BUNDLE SCOPE SUMMARY

ISLANDING

6 UNIQUE SCOPES

1. BULKHEAD AND CONTAINMENT ISOLATIONS

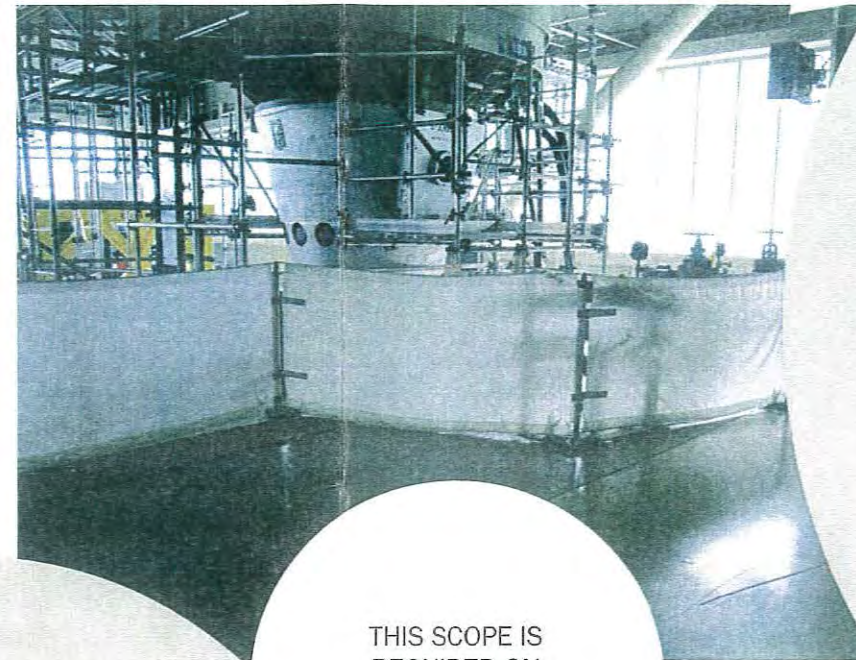
This scope is being executed by the JV/RFR vendor but is part of the IP.

The outage unit vault will be isolated from containment through the installation of a bulkhead and other containment sealing provisions. This modification will enable:

1. Safety of Refurbishment unit workers
2. Productivity and outage efficiencies
3. Decrease in impediments to operating units (i.e. fueling)



THIS SCOPE IS
REQUIRED ON
U2, U3, U1, U4



THIS SCOPE IS
REQUIRED ON
U2, U3, U1, U4

2. CONSTRUCTION ISLAND BARRIERS

Islanding barriers will provide separation of the Islanded unit from the operating units. These barriers will enable the construction island to be created and will separate the Refurbishment staff from the Operating Unit staff. This will minimize the impact of Refurbishment on Darlington Operating Units.

Scope includes construction and personnel barriers, marked pathways and signage required to establish the construction island.

This work will include outside pathways.

3. ISLANDING PRE-REFURBISHMENT PROJECTS

- A. **Negative Pressure Containment** - *This modification is required to maintain Post Accident Monitoring (PAMs) capability for containment pressure when Unit 2 is isolated from containment. The modification also replicates key Unit 2 loops (EFADS pressure monitoring and pressure transmitter used for in-service containment leak rate testing CLRT) to Unit 3.*
- B. **D2O Management Modifications** - *This work is required to ensure that the over-pressure protection is available at all times during station operation for the station D2O transfer headers. Currently, the common headers are protected from overpressure by relief valves located on Unit 2. When Unit 2 is isolated for outage work, it will become unavailable for overpressure protection.*
- C. **EQ of 5/6 CB4** - *Original logic design allows only one LPSW pump to restart on restoration of CLIII power from the standby generators following a loss of CLIV power. For 5CB4/6CB4, this modification will allow credit of all four Service System Transformers to be a source of power to supply the inter station transfer bus.*

THIS SCOPE IS ALL
REQUIRED AS A PRE-
REQUISITE TO
UNIT 2 OUTAGE

OTHER MINOR SCOPES IN THIS BUNDLE

4. AIRLOCKS (one-time procedural change, will support all units)

Modification is required to enable both sets of airlock doors and transfer chamber doors to be open at the same time. Opening of airlocks and transfer doors in support of free movement of materials and equipment, once containment bulkhead is installed.

5. BUTTON UP MODIFICATIONS (applies to all four units)

Modifications in the form of inhibiting the automatic button-up signal from the Outage Unit are required for work protection reasons, and work execution support.

6. LPSW BOOSTER PUMP (one-time procedural change, will support all units)

Island the Refurbishment units to address required Nuclear Safety and Operational support credits to the running units (including EQ-SLOD) by adding operational margin to booster pump set points and address NR configuration resulting from NR unit LPSW pump house outage.

Refurbishment Support Facilities (RSF) is a bundle of work that is required to support the Refurbishment scope and staff in and around the station. It includes common areas such as shops and storage, Washrooms, and offices for refurbishment workers

The RSF Bundle includes 10 Unique Scopes:

1. Collaborative Front-End Planning (RSF)
2. Contaminated Shops & Scaffold Storage
3. Decontamination Tool S107 Upgrades
4. Holt Road Services Projects
5. Radiation Protection and Teledosimetry Facility
6. Shops & Work Areas
7. Turbine Auxiliary Building West Elevation Elevator
8. Washrooms
9. Work Control Area
10. Refurb Support Facilities - OPG O/S

REFURBISHMENT SUPPORT FACILITIES

BUNDLE SCOPE SUMMARY

5

REFURBISHMENT SUPPORT FACILITIES

2 OF 10 UNIQUE SCOPES

1. SHOPS & WORK AREAS

To facilitate Refurbishment activities, a number of dedicated temporary shops, work areas and facilities have been identified by OPG to improve workflow. These facilities will be located in the Turbine Building (TB) on elev. 100.000m – area south of the condensers. These modifications will facilitate the organization, storage and staging of work by vendors participating in the Refurbishment as well as for OPG staff providing project direction.

This project includes the following facilities:

- *Control Maintenance Shop in the TB on elev. 100.000m – area south of the condensers*
- *Mechanical Maintenance fitting/ Machine Shop in the TB on elev. 100.000m – area south of the condensers*
- *Civil Maintenance Shop in the TB on elev. 100.000m – area south of the condensers*
- *Clean Scaffold Material Storage Area in the TB on elev. 100.000m – area south of the condensers*
- *Safe Work Area Depot in the TB on elev. 100.000m – area south of the condensers*

THIS SCOPE IS
REQUIRED ON
U2, U3, U1, U4

2. CONTAMINATED SHOPS & SCAFFOLD STORAGE

The hot shop/ contaminated machine shop, with the contaminated scaffold storage area in the Reactor Auxiliary Building are identified to facilitate work on contaminated components, tooling or materials in support of critical path work. This project is to construct a three-bay consolidated grouping of the hot shop/ contaminated machine shop, with the contaminated scaffold storage area nearby at the south end of the 87.7m elevation of the Reactor Auxiliary Building, rooms R-017 and R-018.

The areas will contain machines, equipment, radiation monitors, bins and storage areas, and various services with appropriate active ventilations. The areas will be enclosed with partitions to facilitate radiation protection controls. The overflow areas will be designated for contaminated scaffold storage since additional space may be needed based on operating experience. These areas will be shared by multiple contractors and vendors as well as OPG staff.

THIS SCOPE IS
REQUIRED ON
U2, U3, U1, U4

The Shutdown, Layup and Services (SDLU) Project will require establishing specific conditions for the shutdown of the Darlington units and layup of the units' systems to maintain a protected environment until the systems are returned to service following Refurbishment activities. Provision of those services to support field work execution are:

- *Upgrades (modifications) to breathing air and service air systems to support vault work and other field execution activities*
- *Power supply/ distribution requirements, Alternative cooling water supply, and associated modifications to support Refurbishment work execution needs (those that are not already provided by the individual projects)*

The SDLU Bundle includes 15 Unique Scopes:

1. Breathing Air Capacity Enhancement
2. Condenser Circulating Water
3. Contingent D2O Storage
4. Collaborative Front-End Planning
5. Cranes Maintenance
6. Dry Air Provision to Nuclear Side Systems
7. Dry Air Provision to Conventional Side Systems
8. Moderator Flush
9. Monitoring of Permanent Station System Components and Equipment
10. Monitoring of Temporary Equipment and Laid Up Systems
11. PHT Drain Modification
12. Service Air Capacity Enhancement
13. SG Secondary Side & System Generator Emergency Cooling System (SGECS) Layup
14. Temporary Power
15. SDLU Systems Shutdown - OPG O/S

SHUTDOWN, LAYUP AND SERVICES

BUNDLE SCOPE SUMMARY

6

SHUTDOWN LAYUP AND SERVICES

2 of 15 UNIQUE SCOPES

1. MONITORING OF PERMANENT STATION SYSTEM COMPONENTS AND EQUIPMENT

To support refurbishment activities, the monitoring and maintenance of permanent station system components and equipment will be undertaken by the SDLU project. Activities involve layup of station equipment and components as well as recurring preventative maintenance work such as rotating pumps, motors, fans, stroking valves, taking oil samples, corrosion protection and restoration prior to RTS, etc. This will ensure that all permanent station system equipment/components are in their proper layup conditions throughout the duration of the Refurbishment.

THIS SCOPE IS
REQUIRED ON
U2, U3, U1, U4

The SDLU Project has developed operational lay-up plans to support an outage that is longer than normal at DNGS. The project developed the plans to help visualize taking the existing plant from its current operating state to the desired laid up state, as per input from Engineering, Operations and supporting organizations. These plans were used as a reference to develop the detailed designs for each system to be laid up. The Layup project Bundle is accountable to implement the resulting modifications via separate work plans to place the station into the optimal laid up state for Refurbishment and maintenance work.

Layup modifications and work plans are managed by the SDLU Bundle Director, and will be supported by permit strategies, engineering modification, and ongoing maintenance support. Temporary modification will be removed at the end of the Refurbishment outages.

2. STEAM GENERATOR SECONDARY SIDE & SYSTEM GENERATOR EMERGENCY COOLING SYSTEM (SGECS) LAYUP

This project involves placing the SG Secondary Side (SGSS) and SG Emergency Cooling System (SGECS) in the appropriate lay-up states to support execution of the Refurbishment project. Chemically treated water will be pumped via wet recirculation skids through the SGSS as well as the Second Stage Reheat Drains and Inter Unit Feedwater Tie. In addition, pressure monitoring devices will be installed at various locations across the system for monitoring of the flow. Lastly, a nitrogen blanket will be applied to the SGECS tank and at the top of the SGs (steam drum, above the water level), up to the main steam piping. To prevent the nitrogen from flowing into the secondary side steam circuits, flow stopping devices will be installed upstream of the boiler stop valves.

THIS SCOPE IS
REQUIRED ON
U2, U3, U1, U4

Lay-up Plans

NR Lay-up (33100) - System Lay-up Plan - Heat Transport And Auxiliaries	NK38-PLAN-09701-10087
System Lay-up Plan - Moderator Systems	NK38-PLAN-09701-10088
System Lay-up Plan - Turbine Systems	NK38-PLAN-09701-10091
System Lay-up Plan - Generator Systems	NK38-PLAN-09701-10092
System Lay-up Plan - Secondary Side Steam And Water Systems	NK38-PLAN-09701-10089
Service Water Systems Lay-up	NK38-PLAN-09701-10094
System Lay-up Plan - Negative Pressure Containment	NK38-PLAN-09701-10128

The Balance of Plant (BoP) Bundle includes systems in five distinct areas. Those systems are: Safety and Control Systems, Primary Side and Reactor Component Systems, Secondary Side, Ancillary Systems, Common Systems and Special Programs. The BoP Bundle will perform work on more systems than any other bundle, and has more equipment and components than any other bundle.

Balance of Plant contains modifications and a large number of non-modification scopes of work (like for like replacements).

The Balance of Plant Bundle includes 17 Unique Scopes:

1. Adjusters
2. Auxiliary Shutdown Cooling System Heat Sink
3. BoP Scope Definition Legacy Work
4. Containment
5. Emergency Heat Sink
6. Electrical Rehab and Preventative Maintenance
7. Emergency Service Water Line 15
8. Fire Protection
9. Fission Chambers
10. Primary Heat Transport & Auxiliaries
11. Regulating Flux Detectors
12. Service Water (Stoppie Plug)
13. SHIM Operations
14. Unique Components
15. Low Pressure Service Water Alternate Cooling Supply
16. Valve Rehab and Preventative Maintenance
17. Balance Of Plant - OPG O/S

BALANCE OF PLANT

BUNDLE SCOPE SUMMARY

7

BALANCE OF PLANT

3 OF 17 UNIQUE SCOPES

Adjusters

The Scope

The scope of this work is a like-for-like replacement of the 16 adjuster rod assemblies (i.e., rod, cables and pins to drive mechanism attachment components) currently in core at DNRS (see below for a specific list of component Cat IDs). This project is part of the core scope initiative DSR TS0220-3. The scope does not include the 8 adjuster rods currently locked out of core but does include transportation and storage of the irradiated adjusters in the Wet Cask Handling Bay (WCHB).

Each Adjuster Absorber (AA) consists of stainless steel flexible cable, flange, nuts and washers, support rod, cotter pins, tube and either steel or titanium center rod. The flexible cable that “hangs” an adjuster rod, will be detached from the drive mechanism and used to hoist the element into the RM flask for transport to the WCHB located in the WFFAA.

Associated with the adjuster assembly are an upper and a lower shield plugs. The upper shield plug can be removed as the AA is being transferred to the flask. The lower shield plug will need to remain with the AA as it is being transported to the WCHB (it cannot be easily separated from the assembly). In order to reuse the lower shield plug, it will need to be separated from the AA in the WCHB. New lower shield plugs will be installed in Unit 2 in order to allow activation decay time for those that have been removed. Recycled lower shield plugs will be installed in the remaining units.

THIS SCOPE IS
REQUIRED ON
U2, U3, U1, U4

THIS SCOPE IS
REQUIRED ON
U2, U3, U1, U4

Valve Rehabilitation

The Scope

The Balance of Plant (BOP) Valve Rehabilitation Project Strategies apply to 11 valve groups (328 valves total) within the Primary Heat Transport, Shutdown Cooling, Moderator, Low Pressure Service Water and Compressed Air systems. The scope is to address known or anticipated deficiencies to the existing station valves (both nuclear and conventional), of which the scope includes inspections, overhaul, repack, and replacements.

Two of the valve groups (Moderator Main Isolators and Service Water Isolation Valves) are required to be replaced. Where the opportunity exists, a blended strategy will be used to perform replacement on the first refurbishment unit and overhauls/swaps on the remaining 3 units.

THIS SCOPE IS
REQUIRED ON
U2, U3, U1, U4

Valves – PM/CM

Valve preventive maintenance and a portion of the corrective repair maintenance items have been included in BoP Bundle. Valve preventive maintenance includes items such as: Motor Operated valve testing or (MOVATS), Air operated valve testing known as (FLOWSCAN), and valve overhauls. This Scope of work will be done in conjunction with the Valve Rehabilitation scope. This scope includes over 650 individual work items in numerous systems throughout the plant.

Auxiliary ShutDown Cooling Heat Sink

The Scope

This modification consists of installation of the two new auxiliary shutdown cooling pumps considered as backup pumps (forced flow capability) which will be used as heat sink during unit outages, i.e., low pressure and low temperature conditions, to remove decay heat 24 hours after reactor shutdown and maintain HT temperature below 90°C. The new pumps are not required for cool down or for accident heat sink. The new Auxiliary Shutdown Cooling (ASDC) pumps and their support services (power, pump cooling, etc.) are independent, diverse (to the extent practicable), and physically separate from the existing SDC pumps.

THIS SCOPE IS
REQUIRED ON
U2, U3, U1, U4

The Specialized Projects Bundle includes 4 Unique
Scopes:

1. SDS Computers
2. Vault Coolers
3. SDS Computers - OPG O/S
4. Vault Coolers - OPG O/S

SPECIALIZED PROJECTS

BUNDLE SCOPE SUMMARY

8

SPECIALIZED PROJECTS

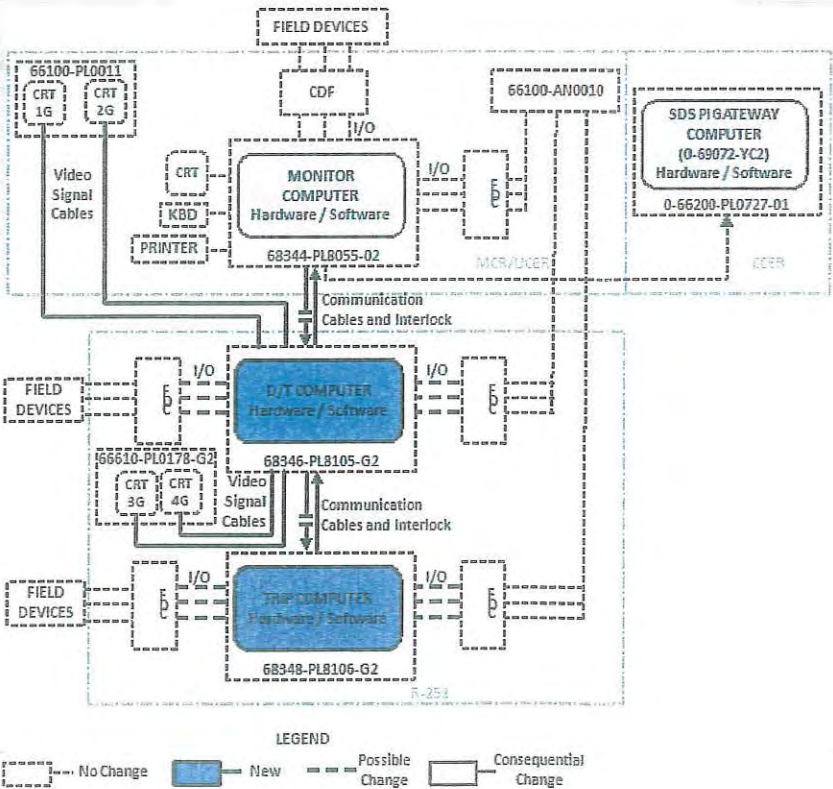
2 OF 4 UNIQUE SCOPES

1. SDS COMPUTERS

The Darlington Shutdown System (SDS) computers comprise a network of 14 computers per reactor unit connected to one Shutdown System Monitor Computer (SSMC) that is common to all four reactor units.

- Replace the obsolete SDS1 & SDS2 Trip Computers to improve reliability and plant safety.
- Replace the obsolete SDS1 & SDS2 Display / Test Computers to improve reliability and plant safety.
- Produce licensable computer Hardware & Software.
- Assess and resolve operational issues where practical.
- Provide sufficient spare parts and major components as required
- Procure the hardware for all 4 units together to ensure consistent revisions of components

THIS SCOPE IS
REQUIRED ON
U2, U3, U1, U4

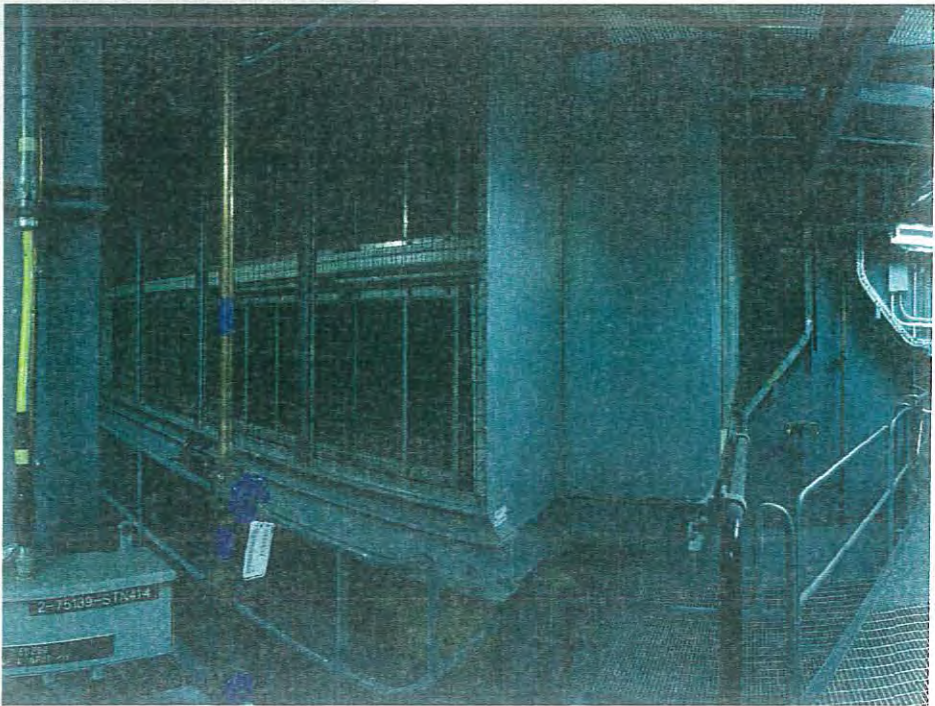


2. VAULT COOLERS

THIS SCOPE IS
REQUIRED ON
U2, U3, U1, U4

The scope of work for the Vault Cooler Refurbishment is:

1. A like-for-like replacement of the Vault Cooler coils as there is no economically viable alternative that will return a noticeable improvement in vault temperatures.
2. A like-for-like replacement of the Vault Cooler fan motors.



The SG Project scope of work has been generated from the SG Life Cycle Management Plan ("LCMP") and the Component Condition Assessment ("CCA") program undertaken by Ontario Power Generation ("OPG") in order to identify elements of the SG and other Heat Exchangers which require inspection, maintenance and/or modifications in order to support the extension of Darlington's operating life.

The Steam Generator Bundle includes 3 Unique Scope:

- 1. Steam Generators
- 2. SG Primary Side Layup Tooling
- 3. Steam Generators - OPG O/S

STEAM GENERATOR

BUNDLE SCOPE SUMMARY

9

STEAM GENERATORS



1. STEAM GENERATORS

The SG project has been broken down into separate elements of the work to be performed throughout Refurbishment based on the requirements identified in the Steam Generator LCMP.

- 1. Primary Side Cleaning (PSC) – is a mechanical cleaning of magnetite from the inner diameter of the SG tubes.*
- 2. Secondary Side Cleaning (Waterlancing) - is the cleaning of the outer diameter of tubes and tubesheet with a combination of high pressure lancing and low pressure/annulus flushing with visual inspections of the tubesheet area.*
- 3. Access Port Installation - allows additional visual inspection locations of SG internals during and post refurbishment. The ports are also required to provide future ability to clean the upper support plates and preheater region through waterlancing or future chemical cleaning, access for foreign material retrieval, and remote inspection of U bend region and upper supports.*
- 4. Inspection and Repair - is required per the SG LCMP. This work includes tube plugging.*
- 5. Divider Plate Inspections, Boiler Open/Close, and Inspection Support - Primary Side Divider Plate Leakage Measurements using Acoustic Leakage Inspection System will be undertaken during the refurbishment outages to compare measurements conducted in previous outages.*
- 6. Bleed Cooler Inspection and Bundle Replacement - The Darlington bleed coolers have never been inspected due to insufficient recall time. In accordance with the Component Condition Assessment (CCA), wall thickness measurements will be taken. Based on the results, tube plugging may be required. Bleed Cooler bundle replacement is contingent on the results of the initial inspection.*
- 7. Pressurizer Inspection and Contingent Sludge Removal. - The CCA identified a risk of sludge build up inside the pressurizer of all 4 units. Inspections were completed on all 4 units in 2014, no sludge removal is required.*

THIS SCOPE IS
REQUIRED ON
U2, U3, U1, U4

The Turbine Generator Project is one of the major projects under the Darlington Nuclear Refurbishment Program.

The Turbine Generator sets, auxiliaries, and controls are highly specialized equipment designed and supplied as an integrated system for the Darlington station.

The project is utilizing two vendors to perform the scope: GE (formerly Alstom) as the Engineering Services and Equipment Supply (ESES) and SNC Lavalin/Aecon(JV). The JV will provide the integration & field execution of the entire project scope, including the equipment supplied from the ESES (as described above). This will include the Engineering Change Control related work, limited procurement, as well as field execution

The Turbine Generator Bundle includes 3 Unique Scopes:

1. Turbine / Generators
2. Turbine Generator & Auxiliaries Layup
3. Turbine / Generator - OPG O/S

TURBINE GENERATOR

BUNDLE SCOPE SUMMARY

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TURBINE/GENERATOR

The scope can be broken down in the following elements:

1. TURBINE + AUXILIARIES

- 1. Complete disassembly, inspection, and reassembly of LP and HP turbines and auxiliaries.
- 2. Long Lead & Maintenance Spares: for the assembly/ disassembly of the Steam Turbines and auxiliaries.
- 3. Installation of Erosion Protection Rings on blade carriers of LP-turbines to address erosion-corrosion.
- 4. Inspect and repair condenser struts, as required

2. GENERATOR + AUXILIARIES

- 1. Generator inspection/ repair/ maintenance.
- 2. New Generator Mid section: The new generator midsection will be provided for U3 with the dimensions of the stator casing are identical to the original design, enabling old components (end shields, end covers, etc.) to be reused
- 3. Stator rewind and Generator Spare: Stator rewind will occur on U3 stator to be installed on U4, and the U4 stator will be rewound and become a station spare.
- 4. Generator Auxiliaries: Replacement of Stator Cooling Water, Hydrogen Cooling, and Seal Oil skids and integration with Turbine Controls.

Scope Differences T/G Unit over Unit

THE TURBINE GENERATOR U2 OUTAGE IS A MAINTENANCE OUTAGE (including turbine blade inspections (phase array).

Unit 2 Turbine does not include any modifications in the field – it is a 'maintenance' outage only. However, there are 3 EC's to install a Maintenance Simulator, to support Training and Testing of the controls system for future units.

- 1) Master Engineering Change 133398: MAINTENANCE SIMULATOR 1/2/3/4-64000 - MASTER- STEAM TURBINE ELECTRONIC CONTROLS UPGRADE (Project 31539 DSR#SI0010)

3. MOISTURE SEPARATOR REHEATER (MSR)

- 1. Inspect and repair moisture pre-separators
- 2. Inspect / repair all internal components of the MSR vessel
- 3. Inspect and refurbish / replace selected MSR MOV's, as required

THE TURBINE GENERATOR U3 OUTAGE INCLUDES:

- 1) MAINTENANCE (SIMILAR TO UNIT 2)
- 2) MODIFICATIONS (CONTROLS/SKID)
- 3) STATOR SCOPE

THE TURBINE GENERATOR U1 OUTAGE INCLUDES:

- 1) MAINTENANCE (SIMILAR TO UNIT 2)
- 2) MODIFICATIONS (CONTROLS/SKID)

THE TURBINE GENERATOR U4 OUTAGE INCLUDES:

- 1) MAINTENANCE (SIMILAR TO UNIT 2)
- 2) MODIFICATIONS (CONTROLS/SKID)
- 3) STATOR SCOPE

4. STEAM TURBINE/GENERATOR ELECTRONIC CONTROLS

- 1. The Turbine control equipment will be composed of 14 new control panels to be installed in the MOCPER room. These panels include the turbine control and protection system, the Turbine Supervisory System and Human Machine Interface. The hydraulic controls will be upgraded with new servomotor controls and new EHCs. A new 2 out of 3 trip block will enhance the reliability of the turbine control. The TSS system will require new field sensors and probes as it interfaces with the new 2 out of 3 trip block. The old mechanical over-speed system will be replaced by an electronic over-speed detection system.
- 2. The Excitation control equipment will be composed of 10 new control panel cubicles to be installed in the Excitation room. This panel include the Main Excitation control panels, the power rectifier, field breaker, de-excitation control cubicles and a human machine interface.
- 3. The scope includes modification to the Main Control Room. The alterations in the MCR include changes to the DCC software, push buttons, annunciation windows and alarms.

Refurbishment is accountable to complete all maintenance required on each station unit during the time period of refurbishment on each unit.

This work is referred to as 'cyclic' work. As there are four refurbishment outages, there will be cyclic work required (preventative maintenance, station shutdown state backlog) that Refurbishment is required to execute during the time period of each ~3-year outage.

CYCLICAL

SCOPE SUMMARY

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CYCLICAL U 2 (D 1 6 2 1)

The cyclic outage is referred to as D1621. The cyclic outage must include all the work that the station would normally execute during a planned outage at the Darlington Station during the Unit's normal cyclic outage timeframe (as per the station outage plan). The outage primarily includes Preventative Maintenance work orders, but also includes station backlog.

WO Type	WO TYPE DESCRIPTION	COUNT	% of TOTAL WO Scope
CC	CORRECTIVE CRITICAL	8	0.10%
CL	CORRECTIVE LOW CONSEQUENCE	25	0.30%
CN	CORRECTIVE NON CRITICAL	5	0.06%
DC	DEFICIENT CRITICAL	150	1.83%
DL	DEFICIENT LOW CONSEQUENCE	118	1.44%
DN	DEFICIENT NON CRITICAL	57	0.70%
OA	OTHER MAINT, CORRECTIVE ACTIONS, INSPECTIONS	1212	14.79%
OB	OTHER MAINT, UNDEFINED OM	9	0.11%
OD	OTHER MAINT, DESIGN ENHANCEMENTS	17	0.21%
OP	OTHER MAINT, PRE-OUTAGE ACTIVITIES	2	0.02%
OR	OTHER MAINT, EQUIP REFURBISHMENTS	20	0.24%
PM	PREVENTIVE MAINTENANCE (SYSTEM ASSIGN)	6566	80.16%
SU	SUPPLEMENTAL (SUPPORT WORK ORDER - SYSTEM ASSIGN)	3	0.04%
Total Work Orders in the Cyclic Outage		8,190	

June 2012

ONTARIO**POWER**
GENERATION



DNGS REFURBISHMENT

Integrated Work Flow Analysis



Submitted by:



DILLON
CONSULTING

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DNGS REFURBISHMENT

Integrated Work Flow Analysis

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DNGS REFURBISHMENT – INTEGRATED WORK FLOW ANALYSIS

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EXECUTIVE SUMMARY

OPG Project Charter Document #D-PCH-09701-10015 "Facilities for DNGS Nuclear Refurbishment Balance of Plant and Fuel Handling Activities" identified several of the shop facilities and work spaces that are required to support the Refurbishment Project. The Charter also requested that "a work flow analysis for all facilities must be done to determine the correct size of each facility, as well as to ensure the facilities have the right equipment necessary". The intent of this report is to document the efforts undertaken by OPG to complete a work flow analysis as required for the Refurbishment Project.

A work flow analysis is described as "a day in the life" of a Refurbishment worker. A typical day for a construction worker would have them driving to work, parking, proceeding through a series of buildings, obtaining tooling, obtaining Radiation Protection dosimetry, obtaining material & supplies from laydown spaces and obtaining Work Protection to execute work tasks in the most efficient and cost effective manner. The work flow of the worker includes travel times for showering, lunches, staging for "jumps" and general movement of people through the Refurbishment work site.

It was not the intent of the Work Flow Analysis Team to develop an all encompassing site layout plan of all Project and Contractor space and facilities needs for the Refurbishment Project since several significant contracts for the Project have not been let and some Project variables and strategies have not been determined at this early stage of the Project (4.5 years prior to Project start).

Actions and recommendations are made in this report to help the Refurbishment Project Management Team develop some strategies and come to an agreement on a consolidated site space Campus Plan inside the protected area including the DNGS Refurbishment Powerhouse Island to complement the existing Refurbishment Site Campus Plan.

To advance the analysis of work flow for the Project, OPG arranged a series of meetings with Vendors between April 17, 2012 and April 26, 2012 to discuss work flow elements that would be prominent during the Refurbishment Project. Work flows were categorized into the following four areas: Personnel Flow, Shops and Work Spaces, Material Flow and Site Construction and Infrastructure (Site Layout). To facilitate this analysis, an assumption was made that the existing estimates for the number of Refurbishment Project staff and added construction work force were correct.

During the discussions several ideas and strategies were discussed and developed as actions or recommendations through the body of this report. All actions are intended to be addressed; recommendations are put forward for further review and discussion. Thorough review and careful disposition of the items in this report will enable the Darlington Refurbishment Management Team to develop a comprehensive and consolidated Refurbishment Site Campus Plan.

The report provides some key recommendations that were intended to significantly improve work flows on the DNGS Refurbishment Project and also to realize efficiencies in the following areas:

- The Work Flow Analysis Team concluded that the representation of scope from the Darlington Scope Request Database reflected approximately 60% of the scope the Vendors executed during the Pickering 'A' Restart Balance of Plant scope. This rationalization produced a re-estimated field shop footprint reduction that is relative to the team's scope estimate. The field shops were proposed to be in the Refurbishment Island based on this conclusion. The risk of this conclusion is that the Project is still developing and in the early planning phase; therefore, supporting contingencies have been recommended for review to support this conclusion (i.e., Vendor off site services/BTU Plant Footprint Unit #4/Pipe Fabrication Shop & R&FR Annex).
- Refurbishment site material flow can be significantly improved with pre-inspection/clearance of shipments at an off-site location. Additionally, adding a delivery truck staging lane at the ASB will allow pre-cleared shipments to be delivered expeditiously and de-packaging of materials off site utilizing totes, where possible, will assist with security screening and reduce waste. An entry vestibule is recommended at the Unit #1 west roll-up door to support the material flow initiative. The recommendations identified will result in Project production efficiencies and cost savings.
- Utilizing the existing DNGS field OCC office on the 115 metre elevation for the centralized Work Control Area for all Refurbishment units will considerably reduce costs of Infrastructure during the Refurbishment Project. This area is close to the existing Master Control Room (MCR) and is central to all Refurbishment units.
- Trailer installation south of the Refurbishment units will improve work flow and site efficiencies (R&FR Staging/RCC/RP RAD Office/Work Protection/Washrooms).
- Integration of key consistent RPT staff and supervisors within the Vendor's workforce will considerably improve construction worker productivity.
- Vendors should be contracted to provide their own tool supply, storage and calibrated tooling. Contract strategy recommendations are made to assist the Management Team in making a decision regarding a bias for this decision. The strategy chosen directly affects the availability of Project space and could involve significant infrastructure costs adding space footprints for a Tool Crib and M&TE lab for calibrated tooling. Decisions in this area would be important to the consolidated site Campus Plan.
- A bulk storage pad has been recommended for the Project for storage of approximately 20 Land/Sea containers in the Protected Area. This recommendation is made based on OPEX from various utilities currently involved in Nuclear Refurbishments.

The report reviews the various work flows explored during the Work Flow Analysis Team meetings, the methodology around the assumptions, how the Work Flow Analysis Team arrived at the key efficiencies, actions and recommendations that will lead to developing a comprehensive and coordinated site Campus Plan that includes inside the Refurbishment Island space.

1.0 INTRODUCTION/BACKGROUND

Reactor units at the Darlington Nuclear Generating Station (DNGS) are approaching their predicted end of service life, and require significant refurbishment in order to extend their production life. The Darlington Refurbishment Project (the Project) is being undertaken to refurbish these reactors. The Project requires a number of dedicated staff and facilities to support the various work activities.

A project charter document (Document #D-PCH-09701-10015) was prepared in 2011 to identify the in-plant facilities needed for the Project. This report addresses the workflow analysis required in the project Charter using input from the Vendors. The report is intended to support the right-sizing of the Refurbishment support Shops and Work Spaces.

In addition to identifying the need and potential locations for in-plant shops and work spaces associated with Refurbishment activities, this report identifies the various worker (work group) flows that would be involved in the Refurbishment, as well as the flow of materials needed to carry out Refurbishment work.

Lastly, a review of the site layout was undertaken to confirm that the workers, facilities and flow of materials do not present conflicts, while at the same time striving to maximize any work and material flow efficiencies.

Section 2 explores the approach that was undertaken in developing the material for this report.

2.0 APPROACH

The approach used to develop an understanding for the various components of work involved in the Project involved a series of team meetings with staff from both OPG (Projects & Modifications Campus Plan, Retube & Feeder Replacement Project, Construction Projects, CMO / Facility Projects, Operations & Maintenance) and various Construction and Engineering Services Vendors (Aecon, Black & McDonald, E.S. Fox under a Master Services Agreement with OPG) between April 17, 2012 and April 26, 2012. The meetings were facilitated by Dillon Consulting Limited.

Separate breakout meetings were dedicated to various broad topics. The first meeting focused on personnel flow (identifying various work groups and mapping out their movements on site). The second meeting detailed the various in plant shops and work spaces that would be needed by workers on the Project. The third meeting explored material flow, and reviewed ways in which materials related to the Project would arrive on site and be processed. The fourth meeting reviewed the layout of the site and the planned construction activities to determine whether the findings of the previous three meetings formed a cohesive work flow environment.

Each of the meeting topics (Personnel Flow, Shops and Work Spaces, Material Flow, and Site Layout) is described further in Sections 3 through 6.

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3.0 PERSONNEL FLOW

Summary

For the Project it is important to understand the flow of workers from the parking lot to the work face so that travel times (and consequently labour costs) can be minimized to the greatest extent possible. A total of seven (7) different worker groups were identified to determine travel requirements by workers associated with the Project.

By analyzing personnel flow, the following could be achieved:

- **Shops and work spaces can be better positioned/located to promote efficient work flow.** This would enable workers to be reasonably close to the facilities needed to perform their work, and thus cutting down on travel times and loss of productivity.
- **Workers would have close access to PPE, tools, instructions and supervisory staff.** Similar to shops and work spaces, this would ensure workers do not have to travel far to obtain the necessary equipment, tools, instructions and ability to ask task-related questions of supervisors in a timely manner.
- **Indirect travel through buildings would be minimized.** This would ensure smooth flows of people through the site, to and from buildings, and provide direct and simple travel routes.
- **The ability to keep work groups together.** This would prevent workers from straying off intended travel paths.
- **Radiation incidents can be minimized.** Through careful planning of travel flow, appropriate monitoring stations can be implemented at key locations to address the flow of refurbishment workers and to reduce high risk areas for contamination control to ALARA (as low as reasonably achievable).
- **Improvement in worker productivity.** By coordinating and planning travel routes as well as shops and work spaces, workers will be less frustrated since efforts have been made to make the work day stream lined from a travel perspective. Consequently, this should have a positive effect on productivity and efficiency.

Introduction

Discussions concerning personnel flow identified the following work groups associated with the Project:

- Retube and Feeder Replacement (R&FR) workers
- Balance of Plant, Radiation workers
- Balance of Plant, Conventional (Non-Rad) workers
- Turbine Generator workers
- Steam Generator workers
- Fuel Handling workers
- Refurbishment Maintenance workers

For each of these work groups, the intent was to identify the "day-in-the-life" work flow of these specific workers. In other words, how does this worker get to the site, where does the worker go when on site (to change clothes, get work assignments, receive pre-job briefings, go to lunch, etc.), and how does this worker leave the site. The following subsections outline the specific "movements" anticipated for each work group.

Section 3.1 outlines the assumptions that were used during meeting discussions to help develop worker flowpaths. Sections 3.2 through 3.8 identify the work flows for each worker group. Radiation Protection considerations for refurbishment are highlighted in Section 3.9. A study of walking times associated with travelling between various locations on-site and within the protected area at the DNGS Refurbishment site is discussed in Section 3.10.

3.1 Personnel Work Flow Assumptions

A total of six assumptions guided the discussion of personnel work flow for the Project.

Assumption #1

Existing Refurbishment staff numbers are assumed to be accurate for the analysis undertaken in the Work Flow Analysis report. A more defined scope of work is required for OPG to finalize the actual Project construction staff numbers.

The DNGS Refurbishment – Infrastructure Summary Report identified that an additional 1,200 workers will be on-site during the Project. These numbers can have an impact on: the number of parking spaces required (which need to be located to the west and northwest of the WSOB); the number of lockers needed in the WSOB change room; the use of PPE path ways where needed or applicable; the number of hand & foot monitors to reduce travel time delays for workers between zones; the number of work spaces (offices); and lunch room capacities.

Assumption #2

Staffing requirements for Darlington New Nuclear build construction labour has the potential to cause labour and schedule conflicts during the 10-year life of the Project. It is assumed that the New Nuclear build labour analysis is outside the scope of this report.

Given that the construction industry workforce is a finite number, there is the potential that the Project and the New Nuclear Build Project may be in direct competition for the same construction workers during the life of the Project.

Assumption #3

Existing space for Vendors will be available in the WSOB/RIA for general foremen, front line managers and key staff required in the operating island. Pre-job briefings for construction staff will take place at the work site location.

The six contractor trailers illustrated on the campus plan outside the WSOB will be required for Administrative purposes. The space associated with these trailers will be maintained on the campus plan for the Vendors and contingency contract purposes.

Assumption #4

Based on current staff assumptions, additional washroom facilities will be required during the Project.

These washrooms are needed to meet Ministry of Labour requirements, as well as to minimize the distances travelled by workers to utilize a washroom. If the distance to get to a washroom is significant, it can increase the amount of downtime for workers resulting in a loss of productivity.

Assumption #5

Access and pathways to washroom facilities will be given priority over pathways for laydown space for material/equipment and material handling efficiencies.

This assumption sacrifices material handling flow and laydown space in favour of personnel flow to and from the washrooms.

Assumption #6

Accommodations (serviced areas) for six contractor trailers outside the WSOB will be added.

The six contractor trailers are currently needed, but the space will be reserved and optimized with the Vendors and used as required for contingency needs in the future.

Note:

Applicable to the life of the Project, flows of people, materials and equipment will transfer starting with Unit #2 and then moving through Unit #1, Unit #3 and finally Unit #4. It is intended through this report that although the initial intent of optimizing the work flow analysis is initially focused on Unit #2 to start, the progression to Unit 1, 3 and 4 will be a natural progression as the Project moves from unit to unit over the life of the Refurbishment schedules.

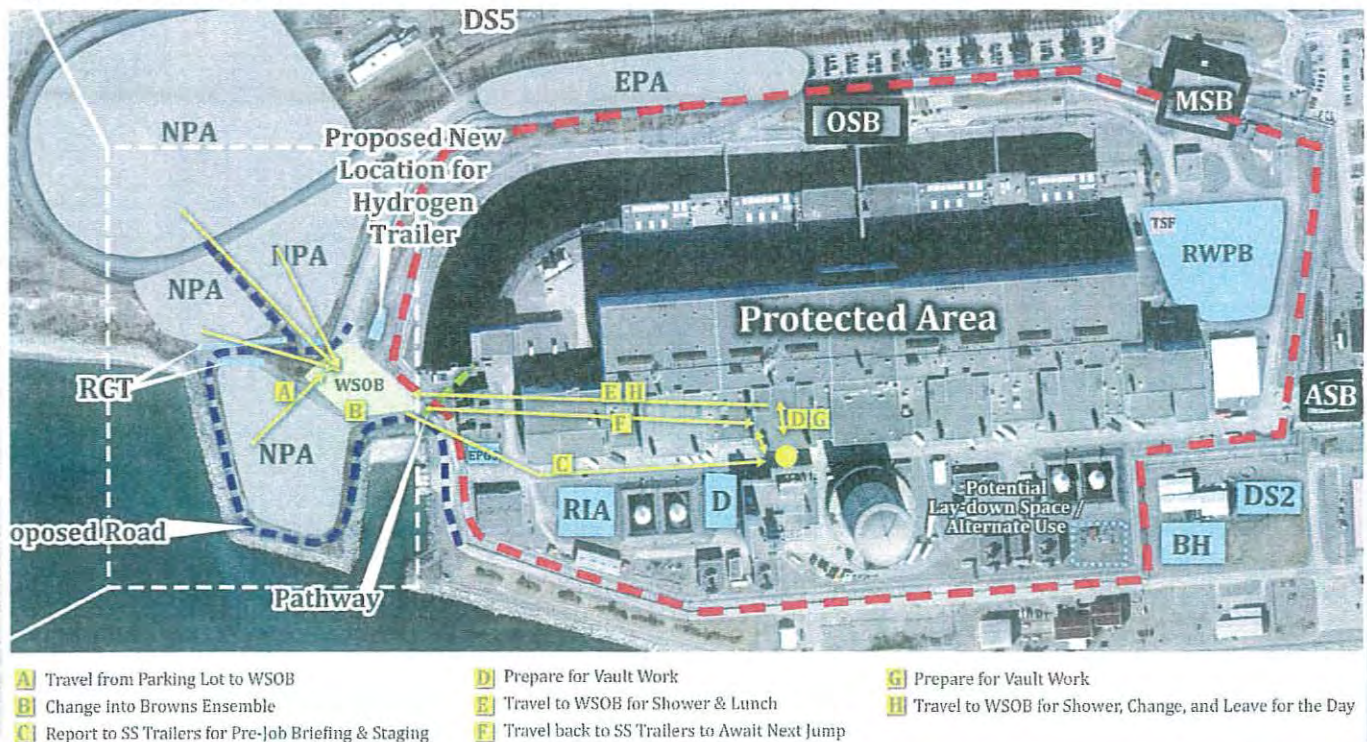
3.2 Retube and Feeder Replacement (R&FR) Workers

The following text describes the steps taken by R&FR workers during a typical day.

- (1) Enter the DNGS property via Park Road.
- (2) Park vehicle in one of the proposed parking lots located to the west of the proposed West Security Office Building (WSOB).
- (3) Enter the WSOB.
- (4) Drop off lunch in the lunchroom located in the WSOB.
- (5) Use the Change room in the WSOB to get changed into "browns" ensemble.
- (6) Workers will "badge in" prior to leaving the WSOB.
- (7) Report to the RIA or trailers located on the south side of the reactor building for a pre-job briefing.
- (8) Obtain any specialty tools from tool cribs and/or job boxes.
- (9) Prepare for vault work.
- (10) Personnel staging will occur outside the Air Lock or in trailers located outside the powerhouse along the south side wall (SS trailers).
- (11) Plastic suits will be obtained near the vault.
- (12) Following a shift (or vault "jump"), workers will proceed back to the SS trailers.
- (13) At lunch time, workers will proceed to the change room in the WSOB to shower before having lunch. Lunch will occur in the lunchroom located in the WSOB.
- (14) Following lunch, workers will go back to the SS trailers to await their next "jump".
- (15) Following the workers last "jump", they will proceed back to the WSOB to shower and change before leaving at the end of their shift.

The general flow of these movements is illustrated in *Figure 1*.

Figure 1 - R & FR Worker Flow



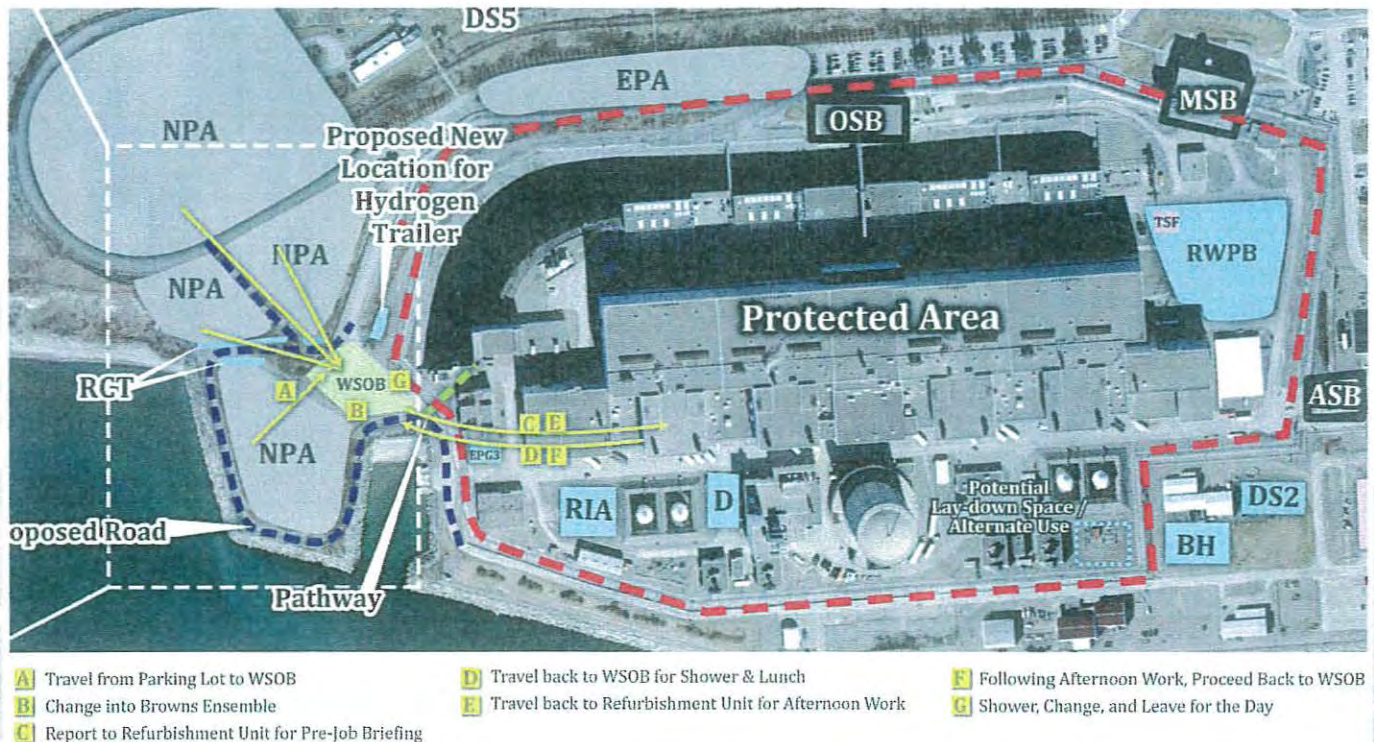
3.3 Balance of Plant (BoP) Workers Performing Radiation Work

The following text describes the steps taken by BoP Rad workers during a typical day.

- (1) Enter the DNGS property via Park Road.
- (2) Park vehicle in one of the proposed parking lots located to the west of the proposed West Security Office Building (WSOB).
- (3) Enter the WSOB.
- (4) Drop off lunch in the lunchroom located in the WSOB.
- (5) Use the change room in the WSOB to get changed into "browns" ensemble.
- (6) Workers will "badge in" prior to leaving the WSOB.
- (7) Use the designated pathway from the WSOB to the Unit #1 west entrance.
- (8) Report straight to the agreed reporting location in the unit being refurbished for a pre-job briefing.
- (9) At lunch time, workers will proceed to the change room in the WSOB to shower before going to have lunch. Lunch will occur in the lunchroom located in the WSOB.
- (10) Following lunch, workers will change back to browns prior to going back to the unit to resume work.
- (11) Following afternoon work, they will proceed back to the WSOB to shower and change before leaving at the end of their shift.

The general flow of these movements is illustrated in **Figure 2**.

Figure 2 - Balance of Plant RAD Worker Flow



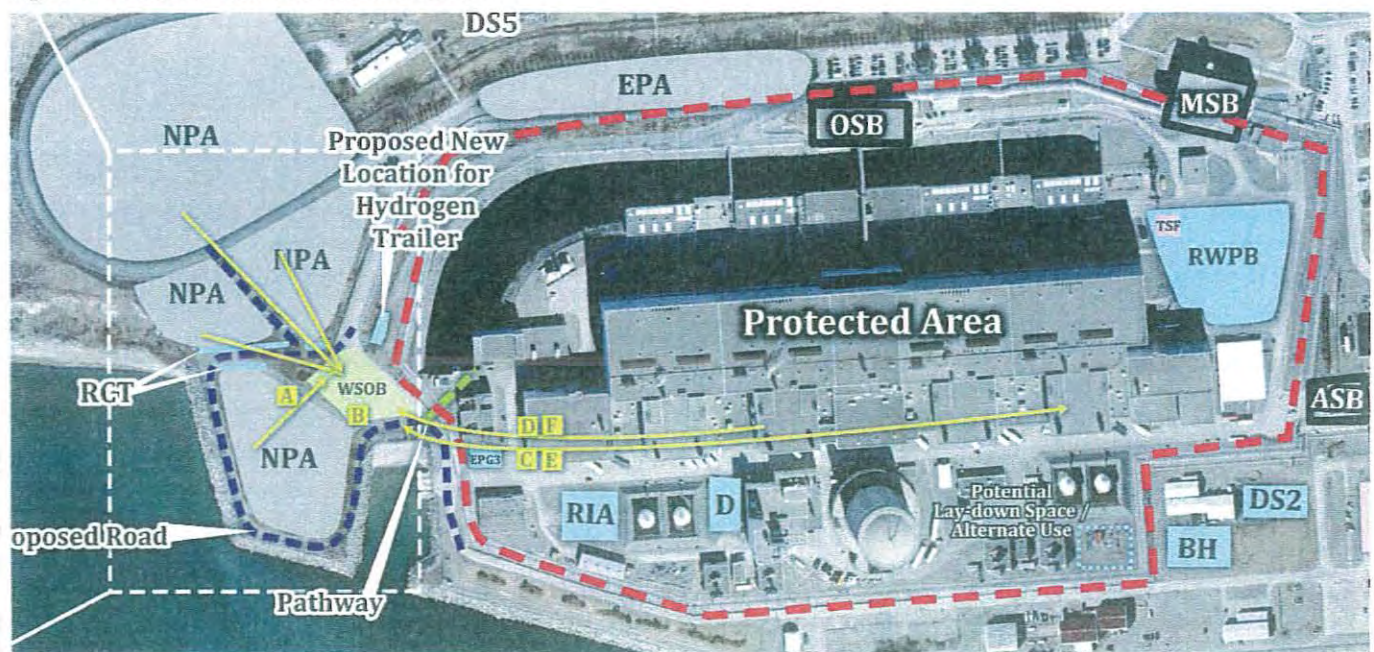
3.4 Balance of Plant (BoP) Workers Performing Conventional (Non-Radiation) Work

The following text describes the steps taken by BoP Non-Rad workers during a typical day.

- (1) Enter the DNGS property via Park Road.
- (2) Park vehicle in one of the proposed parking lots located to the west of the proposed West Security Office Building (WSOB).
- (3) Enter the WSOB.
- (4) Drop off lunch in the lunchroom located in the WSOB.
- (5) Workers will "badge in" prior to leaving the WSOB.
- (6) Report straight to the unit being refurbished for a pre-job briefing.
- (7) At lunch time, workers will proceed to the WSOB to eat lunch in the WSOB lunchroom.
- (8) Following lunch, workers will go back to the unit to resume work.
- (9) Following afternoon work, they will proceed back to the WSOB to leave for the day.

The general flow of these movements is illustrated in *Figure 3*.

Figure 3 - Balance of Plant Non-RAD Worker Flow



- | | |
|--|---|
| A Travel from Parking Lot to WSOB | D Travel back to WSOB for Lunch |
| B Drop off Lunch in WSOB Lunch Room | E Travel back to Refurbishment Unit for Afternoon Work |
| C Report to Refurbishment Unit for Pre-job Briefing | E Following Afternoon Work, Proceed Back to WSOB and Leave for the Day |

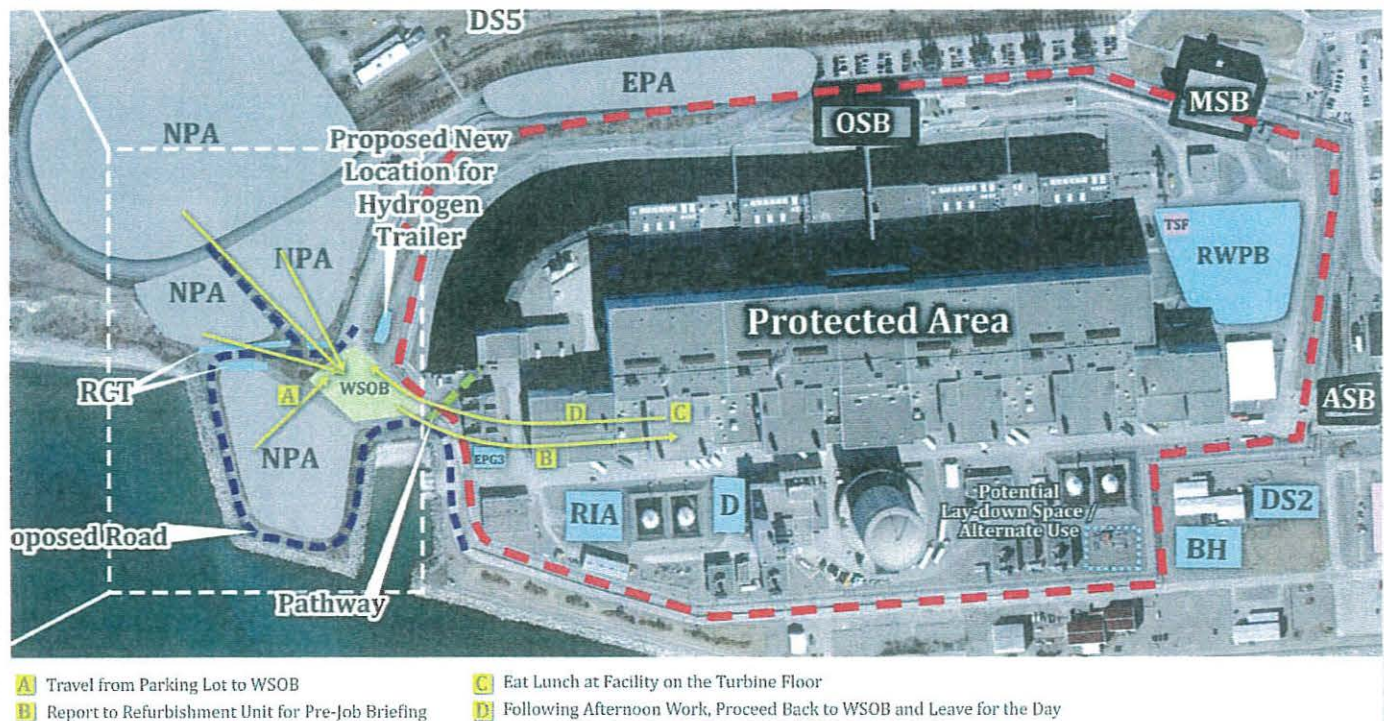
3.5 Turbine Generator Workers

The following text describes the steps taken by turbine generator workers during a typical day.

- (1) Enter the DNGS property via Park Road.
- (2) Park vehicle in one of the proposed parking lots located to the west of the proposed West Security Office Building (WSOB).
- (3) Enter the WSOB.
- (4) Workers will "badge in" prior to leaving the WSOB.
- (5) Using the Project constructed west end construction elevator, workers will report to the unit being refurbished for a pre-job briefing at the work face.
- (6) At lunch time, workers will eat lunch at a newly established facility located on the turbine floor (a PPE free and/or RP approved food acceptable corridor will be required for workers to bring lunches from the West gate).
- (7) Following afternoon work, they will proceed back to the WSOB to leave for the day.

The general flow of these movements is illustrated in *Figure 4*.

Figure 4 - Turbine Worker Flow



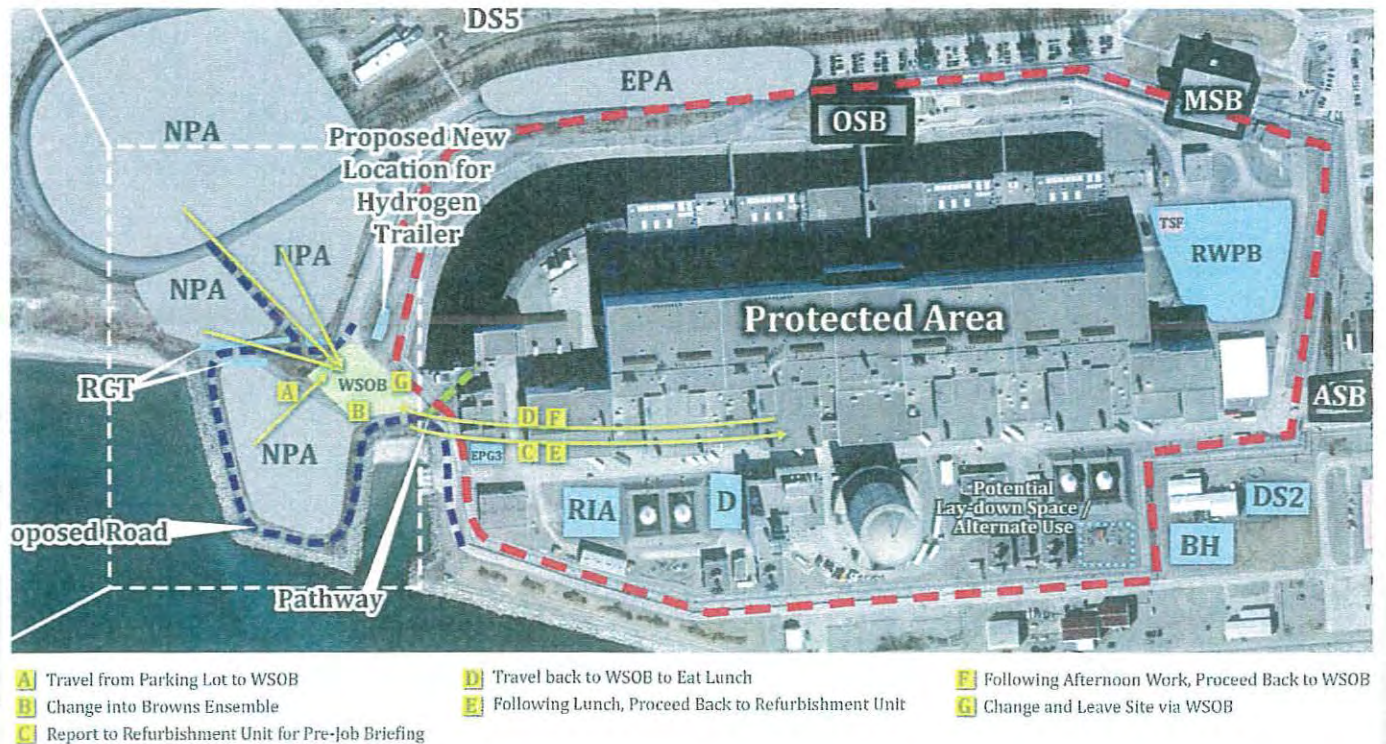
3.6 Steam Generator Workers

The following text describes the steps taken by steam generator workers during a typical day.

- (1) Enter the DNGS property via Park Road.
- (2) Park vehicle in one of the proposed parking lots located to the west of the proposed West Security Office Building (WSOB).
- (3) Enter the WSOB.
- (4) Change into "browns" ensemble in WSOB change room.
- (5) Workers will "badge in" prior to leaving the WSOB.
- (6) Report straight to the unit being refurbished for a pre-job briefing at the work face.
- (7) At lunch time, workers will travel back to the WSOB to eat lunch in the building lunch room.
- (8) Following lunch, they will proceed back to the unit for afternoon work.
- (9) Following afternoon work, they will proceed back to the WSOB and stop to change in the change room. Once changed, they will exit via the WSOB and leave for the day.

The general flow of these movements is illustrated in *Figure 5*.

Figure 5 - Steam Generator Worker Flow



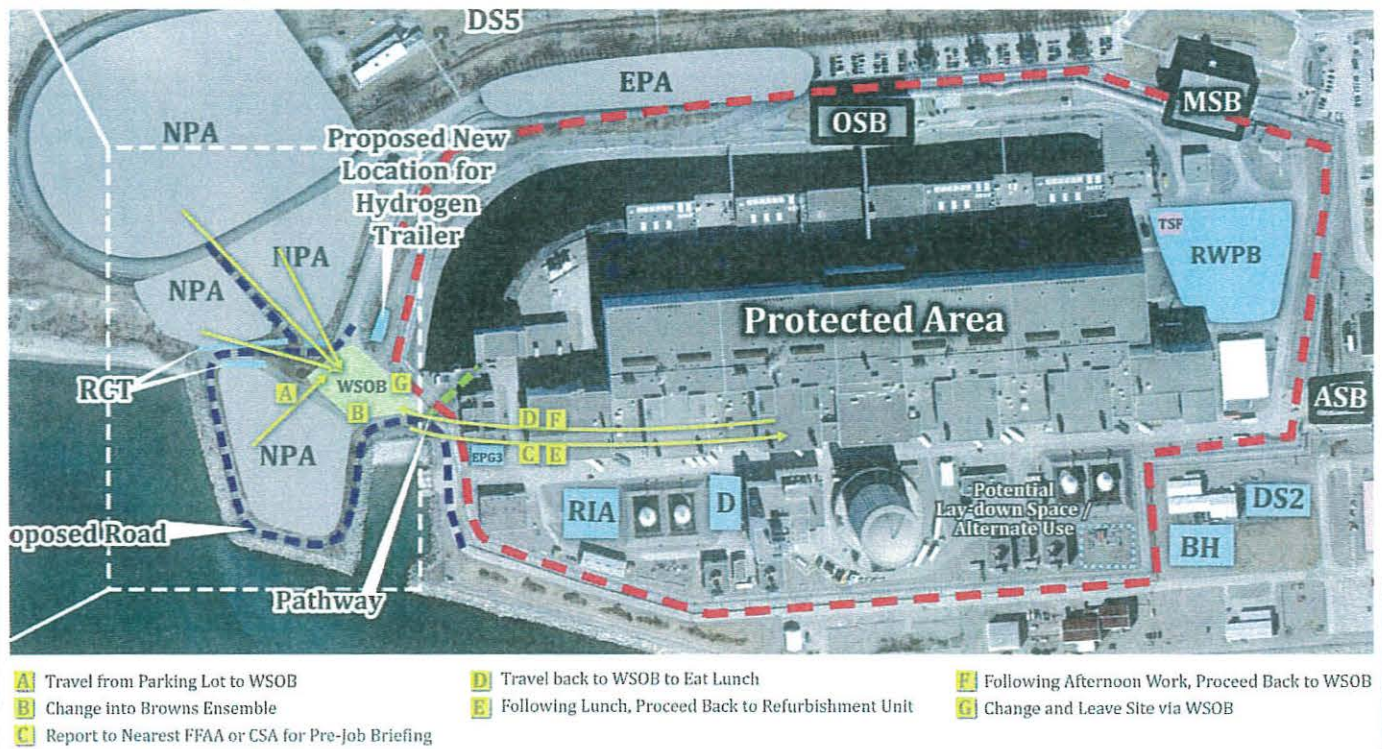
3.7 Fuel Handling Workers

The following text describes the steps taken by fuel handling workers during a typical day.

- (1) Enter the DNGS property via Park Road.
- (2) Park vehicle in one of the proposed parking lots located to the west of the proposed West Security Office Building (WSOB).
- (3) Enter the WSOB.
- (4) Change into "browns" ensemble in the WSOB change room.
- (5) Workers will "badge in" prior to leaving the WSOB.
- (6) Report to the nearest Fueling Facility (FFAA) or Central Service Area (CSA) for a pre-job briefing.
- (7) At lunch time, workers will travel back to the WSOB to eat lunch within the lunch room.
- (8) Following lunch, they will proceed back to the work face for afternoon work.
- (9) Following afternoon work, they will proceed back to the WSOB and stop to change in the change room. Once changed, they will exit via the WSOB and leave for the day.

The general flow of these movements is illustrated in *Figure 6*.

Figure 6 - Fuel Handling Worker Flow



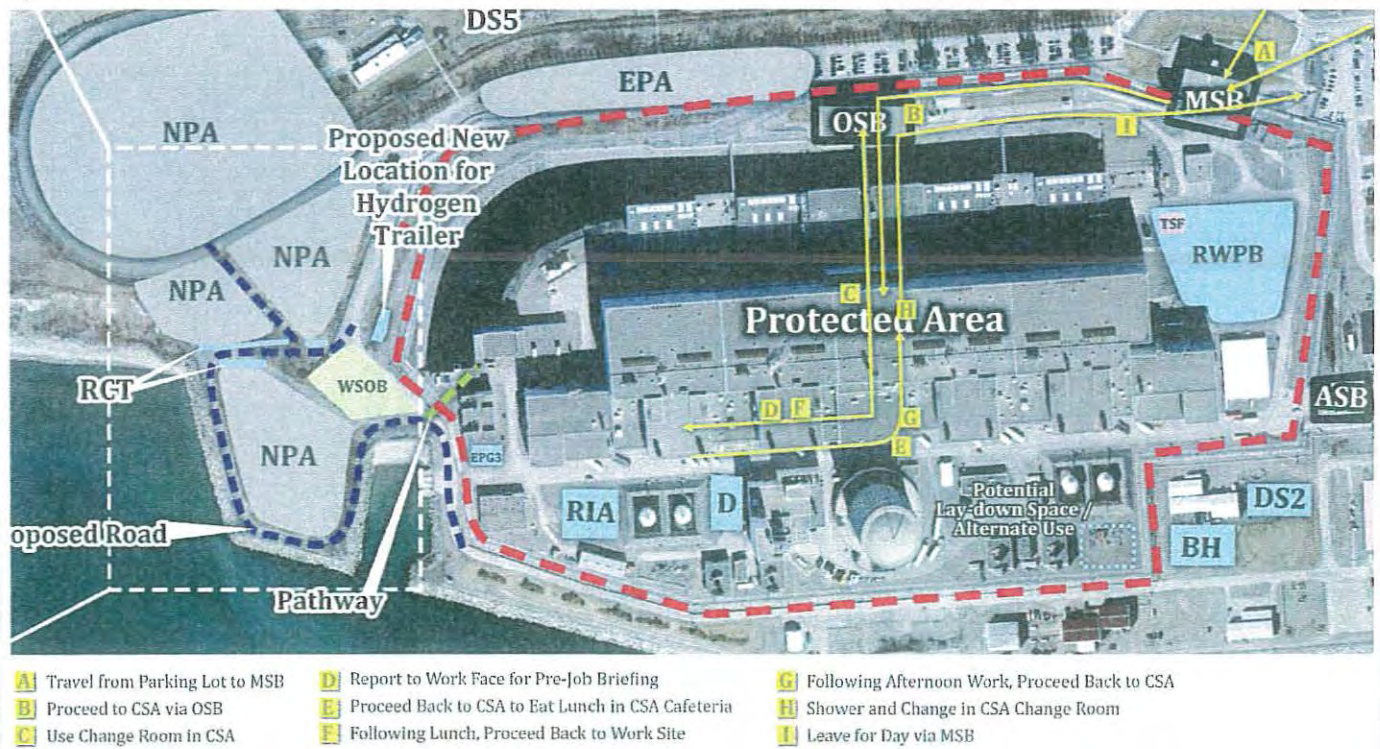
3.8 Refurbishment Maintenance Workers

Refurbishment maintenance workers are existing maintenance workers at the DNGS site that are re-assigned to the Project. Today, these workers:

- (1) Arrive at the site via Holt Road.
- (2) They park their vehicle in one of the parking lots located to the north, northeast or west of the Main Security Building (MSB). Worker parking ID tags are to be consistent with Project parking identification decisions.
- (3) They enter via the Main Security Building.
- (4) They proceed to the Central Service Area (CSA) via the Operations Support Services Building (OSB) to utilize the change room.
- (5) Report to the work face for a pre-job briefing.
- (6) At lunch time, they eat in the cafeteria located in the CSA.
- (7) Following lunch, they proceed back to the work site.
- (8) At the end of the work day, they travel back to the CSA to shower and change. Once completed, they leave via the MSB.

This existing routine will be maintained for work on the Project. The general flow of these movements is illustrated in **Figure 7**.

Figure 7 - Refurbishment Maintenance Worker Flow



3.9 Radiation Protection Issues for Workers

During the team meetings, discussions were held with staff from the Radiation Protection Office. Radiation Protection Office staff had the following comments/issues related to personnel who will be involved in the Project:

- Radiation Protection is working to phase out Hand and Foot (H&F) monitors (as budget permits) in favour of Whole Body monitors.
- WB Monitors are installed south of the reactor area due to multi-zone change (from Zone 3 to an unzoned area).
- H&F monitors are currently positioned at the north due to a single zone change (from Zone 3 to Zone 2).
- Radiation Protection intends to position Whole Body Monitors (WBM) at vault exits and Zone 3 boundaries.
- The distribution of EPDs is most effective from a central location
- EPD's could be issued in the Refurbishment Island Annex, at the Radiation Protection Office, or by Radiation Protection Technicians "Greenmen" on behalf of their crews on a daily basis.
- A significant additional supply of Radiation Protection Technicians will be augmented into the Radiation Protection Department.
- Radiation Protection support needs to come from a central group under the direction of the Refurbishment organization.
- OPG will maintain a direct line of accountability for Radiation Protection services.
- The preferred arrangement for Vendor success is for Radiation Protection staff to be embedded in the Vendor's crews, while still reporting to OPG Radiation Protection for daily Pre-Job Briefings (PJB's), updates and direction
- Radiation Protection is committed to provide sufficient quantity and quality of staff for effective Radiation Protection support during the Refurbishment.
- Outage Radiation Protection and dosimetry stations are usually located on the 107.5 metre elevation across from Air Lock 2

3.10 Walk Time for Workers

To enable the team to gain a better understanding of travel time devoted to workers walking between various locations on-site, the time required to walk between representative destinations was recorded. Calculations were then performed to estimate the annual time and cost associated with travel between the WSOB, RIA and Units 1 through 4. Table 1 summarizes the difference in time and costs associated with having R&FR workers staged in the RIA versus staging in trailers along the south side wall of the powerhouse (as shown in *Figure 8*). Calculations were performed for refurbishment on Unit #2.

Table 1 – Difference in Annual Costs for Staging Areas

Entry Point	Staging Area	Unit	Daily walking time per worker	Cost per 70 person crew x 200 working days	Cost Savings
WSOB	RIA	2	52 minutes	\$918,000	\$0
WSOB	Trailers	2	37 minutes	\$656,000	\$262,000

As shown in Table 1, there are significant annual time savings in having R&FR workers stage in trailers positioned along the south side powerhouse wall rather than at the RIA building. Additionally, the south side trailers would reduce the need to travel to the RIA (R&FR Annex) building for clarification of work activities and people staging. As the Refurbishment transfers from unit to unit over the life of the Project, cost savings are realized as the staging trailers are re-locatable and the RIA (R&FR Annex) is not.

Further evaluation revealed that time efficiencies are possible if a Radiation Protection office is located in a trailer on the south side of the powerhouse wall, south of the unit being refurbished. Similarly, an R&FR command centre (RCC) could be located in a trailer in the same vicinity. This would reduce the number of staff in the RIA building and improve worker productivity & efficiencies.

As the Project progresses to the east (i.e., towards units 3 and 4), there is some merit, from a time and cost savings perspective, to have some dedicated work groups utilize the Auxiliary Security Building (ASB) to access the protected area. Table 2 summarizes a time and cost comparison of utilizing the WSOB versus the ASB for entry when working on units 1 and 4.

Table 2 – Difference in Annual Costs for an ASB Entry for BoP Workers

Entry Point	Unit	Daily walking time per worker	Cost per 150 person crew x 200 working days	Cost Savings
WSOB	4	42 minutes	\$1,593,000	\$0
ASB	4	18 minutes	\$675,000	\$918,000
WSOB	1	20 minutes	\$757,000	\$0
ASB	1	41 minutes	\$1,560,000	-\$803,000

East of the protected area, there is minimal parking (or space to create additional parking) available to accommodate Refurbishment workers. Additionally, by bringing some Refurbishment workers in through the ASB, there is the potential for complications related to mixing Refurbishment workers with regular plant workers in the east change room. This may negate any time and cost savings associated with utilizing the ASB for a dedicated crew of workers during Refurbishment on Units 3 and 4. Also, space limitations and construction of additional parking negated any potential cost savings. As a result, no further discussion was pursued concerning the use of the ASB by Refurbishment workers.

It was determined that adequate space would be available within the WSOB for general foremen (GFs) and front line managers (FLMs), such that contractor trailers positioned outside the WSOB would be necessary for Administration purposes only. This would minimize travel times between GFs/FLMs and trades staff, since there would be no need to enter/exit through security checkpoints in the WSOB to facilitate meetings between staff. Since pre-job briefings are likely to occur at the work face, the need for these contractor trailers is reduced to administration and initial check in. The locations for the contractor trailers will be retained, and serviced pads provided for contingency use in case the need for this space increases in the future.



FIGURE 8 – Potential Trailer Locations South of Powerhouse

3.11 Personnel Flow Actions and Recommendations

Table A1 summarizes the actions and recommendations resulting from the discussion on personnel flow for the Project. The proposed issue owners can also be found in this table, located in Appendix A.

3.11.1 Personnel Flow Actions

The following 11 actions resulted from the discussion concerning personnel flow. An Action refers to activities assigned to individuals to be completed as part of the Refurbishment Project.

Action #1:

The Turbine Project needs to determine the location and timing of space requirements in the Turbine Hall.

There is a need to understand what space is available for personnel flow in the turbine hall as opposed to space that is dedicated to shops, work spaces and/or storage. Additionally, space requirements on the non-Refurbishment units also need to be understood.

Action #2:

A turbine lunch room needs to be built on the turbine floor on the 115 metre elevation to take advantage of work flow efficiencies. (Utilization of this facility by Balance of Plant workers during off hours / backshifts needs to be evaluated.)

Rather than have turbine generator workers eat lunch in the WSOB lunch room, there is a benefit to having them eat lunch at a location on the turbine floor. This would place less pressure on the WSOB lunch room for space as fewer refurbishment workers would be directed there to eat lunch. This would also benefit turbine worker productivity as there would be less travel between the lunch area and the work location.

Action #3:

A Building Trades Union (BTU) personnel/equipment elevator (including an operating teamster) needs to be installed and dedicated to construction staff working on the Turbine Project on the conventional side of the plant to benefit work flow efficiencies. A direct access route is needed from the WSOB to the turbine work location for BTU staff working in street clothing.

Having a dedicated elevator will enable the efficient movement of personnel and material/equipment related to turbine work directly to the work face.

Action #4:

A BTU personnel/equipment elevator (including an operating teamster) needs to be installed and dedicated to construction staff working on the Balance of Plant project on the south side of the plant at the reactor building hoistway to benefit from the work flow efficiencies.

This will enable the efficient movement of BTU construction staff to and from radiation work locations in the south reactor building.

Action #5:

Washroom facilities need to be added to support the R&FR and Balance of Plant radiation construction staff from Vendors from the site south entrance.

Given the number of additional workers on site for the Project, additional washrooms are required to serve radiation workers. To reduce travel times from work location to the washrooms, they should be located close to radiation work near the south side point of entrance to the reactor building.

Action #6:

Washroom facilities need to be added to support the Turbine and Balance of Plant non-radiation construction staff from Vendors from the site north entrance.

Given the number of additional workers on site for the Project, additional washrooms are required to serve non-radiation workers. To reduce travel times from work location to the washrooms, they should be located closer to the north side point of entrance.

Action #7:

Radiation/Emergency/Fire Assembly and Accounting areas need to be clearly designated on the Island plan.

In the event of an emergency or similar situation whereby an accurate accounting of workers on site needs to be taken, a formal meeting or assembly place needs to be designated on the island plan. An accounting and Assembly supervisor needs to be established for this initiative.

Action #8:

Develop a plan to add hand and foot monitors to the Refurbishment site where needed. The correct number of hand and foot monitors required to enter the powerhouse and adequately exit the powerhouse needs to be determined.

Given that many Refurbishment Project workers will travel back and forth from the powerhouse to the WSOB (to enter/exit the protected area, as well as eat lunch in the WSOB lunch room), there will be a need to create a vestibule near the roll up door on the west side of the powerhouse. Space in this area will need to be set aside for a sufficient number of radiation monitors to minimize travel time delays for workers.

Action #9:

Confirm all proposed zoning changes with the Manager of Radiation Protection for "Go / No Go" decisions currently under consideration.

Any zoning changes being proposed on-site would impact the number of monitors (hand and foot, and whole body) that need to be located on the Project. Consequently, any zoning changes have a direct impact on worker travel times on-site.

Action #10:

Station site space needs to be available for BTU construction staff hard hats / gloves and other personal protective equipment (e.g., harnesses, etc.).

There is a need to create "PPE-free" walkways on-site so that workers do not always have to wear PPE when walking to the work site. In order to accomplish this, there needs to be space set aside on-site to store PPE (hard hats, gloves, etc.) for approximately 650+ workers. Additionally, this will alleviate potential bottlenecks and time loss at the west exit stations due to PPE that needs to pass through SAM prior to WSOB storage.

Action #11:

An alternate snow removal and dumping area plan needs to be considered to alleviate parking supply constraints (e.g., DNGS soccer fields, off-site), since available WSOB area parking can be reduced by 20% during the winter due to snow storage.

During the wintertime, parking lots can effectively "lose" spaces due to snow storage. This loss of spaces can be as much as 20%. A 20% reduction in the effective parking supply may result in some refurbishment workers not finding a parking space, or result in extra long search times for a parking space. Either of these situations could mean that some workers would be late in showing up for work. By designating an "off-site" space for snow storage, the potential for effective parking supply reductions during the wintertime is minimized.

Action #12:

Station Operations and Maintenance input is needed into the Refurbishment Project at some frequency to alleviate organizational stresses (coordination, communication and alignment between the Refurbishment Project and Site Representatives).

Lines of communication need to be maintained during the Project so that refurbishment work and general operating plant work can co-exist. Regular discussions/meetings between Refurbishment O&M and site will alleviate organizational stresses.

3.11.2 Personnel Flow Recommendations

The following 19 recommendations resulted from the discussion regarding personnel flow. These Recommendations are activities assigned to individuals to be evaluated for execution or for disposition with reasons for not proceeding as part of the Refurbishment Project. Actions may result from these evaluations.

Recommendation #1:

The DNGS Information Center should be used for Vendor training during the Refurbishment Project for makeup, re-qualification, computer-based training (CBT) or specific OPG auditorium training to improve work flow efficiencies. (This initiative is exclusive of initial/general training.)

All refurbishment workers will be trained initially at an off-site location. Prior to going through the WSOB, Vendor workers can complete specific computer-based training, and any re-qualification training at a central location outside of the protected area. This enables training activities to not interfere with other work tasks inside the protected area.

Recommendation #2:

The DNGS Information Center should be utilized for Vendor issuance of TLD's & Initial-Final Whole Body Monitoring (WBM) to improve work flow efficiencies. This initiative would include the evaluation of the benefits of installing a Whole Body Monitor in this location.

TLD's need to be issued to Vendor workers. As well, workers must undergo initial and final whole body monitoring to determine any changes in radiation levels from working at the DNGS site. Rather than dedicate space inside the protected area for these functions, these activities can take place outside of the protected area to help free up space inside the protected area for other activities. It also is more logical to have initial and final whole body monitoring of a peaking work force done outside the protected area, since the final monitoring is typically the last thing a worker would do before leaving the DNGS site on his/her last day of work.

Recommendation #3:

Reactor building vault contamination reduction may allow for easier access by BTU trades staff, improving work flow efficiencies. An evaluation should be made to determine if the reactor building can be "browns free" following the Calandria Tube (CT) removal.

By having the reactor building "browns free" after the calandria tubes are removed, there is an opportunity to reduce the amount of protective clothing (browns) that must be worn by some work groups (primarily R&FR workers) resulting in productivity improvements and Project laundry cost savings.

Recommendation #4:

Need to evaluate the issuance of EPD's from a central radiation office location near the south reactor building staff deployment area with a bias to deploy EPD's to construction work locations as needed to improve efficiencies. The issuance of EPD's at the RIA building should also be considered by Radiation Protection as part of this initiative.

Rather than having workers stand in one line to receive EPD's at a central location removed from the work location, there is the potential to have them distributed by green men to Vendor work crews at work site locations. This would reduce wait times and increase the amount of available time for workers to be productive.

Recommendation #5:

Need to evaluate how Radiation Protection personnel can be integrated with vendor workers to improve work flow efficiencies for BTU construction staff.

Rather than have Vendor workers rely on the daily supply of existing OPG green men, OPG should hire additional green men and second them into Vendor work teams. This integration of green men would improve work flow efficiencies as Vendor workers get to know who the dedicated green men are that they need to go to for issues related to Radiation Protection on their particular scope of work.

Recommendation #6:

Vendors recommended that the preferred location for the Radiation Protection Control Office is in (2) trailers (Double Wide) located near the R&FR staging area south of the reactor building air lock.

To enable Radiation Protection staff to be closer to the vault work locations, there are benefits to have the Radiation Protection Control Office situated in a trailer located just south of the reactor building air lock. This would minimize employee downtime, as the travel distance and time between work locations and the radiation protection control office is minimized. It would also centralize the RP Office with the R&FR Control Center (RCC).

Recommendation #7:

Vendors recommended that the preferred staging area for R&FR workers is in (2) trailers (Double Wide) located south of the reactor building air lock. An alternate R&FR worker staging/jump & benches area located outside the reactor building containment air lock is also required. Vendors also recommended the R&FR Command Center be located in one (1) trailer positioned south of the reactor building.

Rather than have R&FR workers stage only in the RIA building, it would reduce travel time to have them stage in a double wide trailer located just south of the reactor building air lock closer to the work face. Some space could also be set aside just outside the air lock for putting on "plastics" and to conduct final briefings before entering the vault.

Recommendation #8:

To maintain continuity of work and to optimize the BTU labour within the vendor workforce, a review is recommended which looks at potential economies of scale & scheduling window opportunities to reduce labour issues while executing Balance of Plant activities during normal Station Outages (i.e., BOP = JOB JAR in specified windows).

Since BTU labour may be at a premium during cyclical outages, there may be benefits in coordinating various activities to take advantage of available labour and not have to train additional workers for short duration peaks to ensure a cohesive supply of trained labour forces during this period and to manage labour costs to the Project.

Recommendation #9:

Worker efficiency gains can be realized through utilizing electronic sign-on for Work Authorization & Work Protection. It is further recommended that an evaluation be completed on the use of video communication in specific areas for work flow efficiencies where deemed appropriate.

This would minimize line-ups to access a centralized sign-on location to receive work for the day, greatly benefitting work flow. Employee travel time savings between work locations and the sign on location would also be achieved. This initiative would also support the recommendation to centralize the Work Control Area near the existing DNGS site Main Control Room (MCR).

Recommendation #10:

Designated walkways are recommended to improve work flow efficiencies through the Powerhouse to/from the RIA building & WSOB to reduce monitoring and wait times.

These designated walkways would enable refurbishment workers to travel separately from plant workers, to maximize work face travel route efficiencies, and minimize monitoring and down time.

Recommendation #11:

Need to evaluate designating space for both Visitor & "Kiss & Ride" parking during DNGS Refurbishment near the WSOB entrance on the campus plan (i.e., need to address parking requirements for meeting attendees / external guests and construction worker drop off).

Designating space for visitor parking near the WSOB entrance would address the need for parking related to meeting attendees and external guests. It would also cut down on travel times to access the WSOB for workers who routinely get "dropped off at work" or attend meetings. This initiative would require designated parking spaces closer to the WSOB for this purpose. Lack of available parking for meeting attendees and guests may translate into lack of attendance by key guests to important meetings in some cases due to inconvenient access and travel arrangements not conducive to busy schedules.

Recommendation #12:

Recommend that parking for the Refurbishment Project will be first come, first served in the lots to the west and northwest of the WSOB. It is further recommended that specific colour parking tags for Refurbishment Vendors and staff be issued (to identify all staff directly linked to Refurbishment).

This will enable refurbishment workers to have a dedicated parking tag at the DNGS site. A first come, first served approach is the most cost-effective way to address parking since workers will eventually learn what spaces are typically available when they arrive at the site. Given this learned behaviour, the implementation of sophisticated parking monitoring systems is not required and will reduce Project costs.

Recommendation #13:

For work flow efficiency reasons, it is recommended that a no smoking policy on site (no smoking areas) be evaluated. Negotiations and policy strategy are to be determined.

This would eliminate downtime during a work shift by not having workers travel to designated smoking sites for a "smoke break".

Recommendation #14:

For work flow efficiency reasons, it is recommended that a review be undertaken of the site shower policy for construction staff, amend/negotiate changes as needed. (Showering is mandatory for all radiation work. For all other types of work, showering would be done on the employee's own time).

For non-radiation workers, this would mean that workers could choose whether or not to shower prior to leaving work for the day. If many non-radiation workers end up choosing not to shower at the DNGS site, this may impact the number of showers required in the WSOB change room / locker room. It would also potentially increase productivity as non-radiation workers wouldn't be able to incorporate showering into their on-site "paid time".

Recommendation #15:

For work flow efficiency reasons, it is recommended that an evaluation be undertaken to assess the potential for a "no blues / dress ensemble" policy for non-radiation work on Turbine and Balance of Plant work projects. Instead, work would be executed in street clothing.

By not requiring non-radiation workers to change into a "blues ensemble", workers could report directly to the work site, and not incorporate changing of clothing into their site "paid time".

Recommendation #16:

For work flow efficiency reasons, it is recommended that an evaluation be undertaken of the need for OPG to provide Balance of Plant / Turbine BTU construction staff with fire retardant safety personal protective equipment (Blues/Greens). If provided by OPG, laundering should fall under the accountability of Vendors. OPG would not be accountable once provision is complete.

This is an item for negotiation between OPG and Vendors.

Recommendation #17:

For work flow efficiency reasons, it is recommended that an evaluation be undertaken regarding the provision of winter parkas/coats where coats are not provided by OPG. Construction worker coats are brought into the station from the WSOB & hung in a job site work box (Knack Box – work site field office).

This is an item for negotiation between OPG and Vendors.

Recommendation #18:

For work flow efficiency reasons, it is recommended that an evaluation be undertaken to review and validate the use of Security Access data for accounting/assembly information, brassing & Island entry and exit. It is expected that labour negotiations are needed to support this initiative.

As a potential “one stop shop” means of accounting for staff on-site, OPG should explore the use of security access cards. This is an item for negotiation between OPG and Vendors.

Recommendation #19:

For work flow efficiency reasons, it is recommended that an evaluation be undertaken regarding staggered start times and lunch times for Vendors on the Refurbishment Project. Also shift coverage terms & conditions should be reviewed/negotiated as part of this initiative.

Given that the WSOB lunch room has a fixed capacity, consideration needs to be given to staggering start times and lunch times for Project workers. This would enable work crews to be “kept together” during a work day with a more co-ordinated approach to use of the lunch & locker facility on the Project. A common lunch time has the potential to create bottlenecks and lead to less productive afternoon crews. Shift coverage terms and conditions should be completed as part of this initiative to adequately plan for use of facilities in concert with the agreed shift schedules.

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4.0 SHOPS & WORK SPACES

Summary

For the Project it is important to understand the various shops and work spaces required so that Project work can be carried out as efficiently as possible.

The shops and work spaces exercise focused on:

- **Determining Shop and Work Space Requirements.** This involved taking the Project Charter findings and refining it based on discussions with Vendors. The need for certain shops and work spaces was rationalized, as well as the actual size to perform the work envisioned.
- **Determining Optimal Locations for Shops and Work Spaces.** Based on the proximity of work and personnel flow routes, potential locations for shops and work spaces were identified. Given the overall space constraints on the DNGS site as a whole, it was felt that the proposed locations best meets the needs of the workers.
- **Determining the Need for New Shops and Work Spaces.** The Project Charter did not identify all of the shops and/or work spaces required for the Project. Meeting discussions identified some new shops and work spaces to accommodate contractor's requirements. As well, discussions explored the potential to share space and facilities to realize potential cost saving benefits. Actions and recommendations were made to address a more consolidated site space plan.

Introduction

To confirm the space requirements for various tasks associated with the Project, a number of in-plant shops and work spaces were identified in the Charter (D-PCH-09701-10015), along with estimates of size requirements (where possible) and preferred locations. The following shops and work spaces were discussed:

- Mechanical Maintenance Shop
- Control Maintenance and Electrical Shop
- Valve Shop
- Civil Maintenance Shop
- Hot Shop
- Clean & Contaminated Scaffolding
- Work Control & Permit Preparation
- Radiation Protection Office / Teledosimetry
- First Aid Station
- Safe Work Area Depot
- Waste Handling and Collection Area

The Charter also listed other office areas as contingency space. Site office locations are now confirmed to be accounted for in the DEC (Darlington Energy Center), WSOB (West Security Office Building), and the RIA (Refurbishment Annex Building), and with the exception of Section 7.0 Conclusions, they will not be discussed further in this report.

Section 4.1 outlines some of the main assumptions that were used in determining the shops and work spaces required, and their sizes, for the Project. The following subsections detail the findings of the discussions regarding the specific shops and work spaces. Many of these shops and work spaces were identified in the Project Charter. As part of this exercise, there was a need to undertake a critical review of the shops and work spaces as identified in the Project Charter to challenge the need for any additional permanent shops, given the limited amount of space on the DNGS site. There are other construction support shops and work spaces that were not specified in the Project Charter. These shops and work spaces are identified in Section 4.14.

4.1 Shops & Work Spaces Assumptions

A total of four assumptions guided the discussion on shops & work spaces for the Project.

Assumption #1

The DNGS Refurbishment DSR (Darlington Scope Request) list was presented by the Refurbishment Maintenance Manager to the Vendors to allow the team to review the scope of work in relation to shop requirements. The team concluded that the scope conservatively represents 60% of the Pickering Nuclear Generating Station RTS Balance of Plant Scope (DNGS EQ Project complete/stronger PM program/fewer valves per system).

The Project Charter directs OPG to build new shops for the Project. The Project Charter provided initial estimates on the size of shops required for the Project. Through team meetings with the Vendors, it was estimated that the Balance of Plant work was not as significant as originally estimated in the Project Charter. Therefore, the Vendors believe that smaller sized shops could be adequate. Given that space is limited both in the plant and within the protected area, the assumption was made that a smaller shop footprint would be sufficient for the Balance of Plant work if the appropriate risk recommendations around BTU existing facilities are accepted to support this plan.

Assumption #2

Previous Refurbishment/Maintenance Manager negotiations concluded that existing PWU Maintenance shops are required by Station Maintenance staff.

This means that PWU maintenance shops cannot be used for Project work, and that separate facilities will be required for the Project.

Assumption #3

Previous Refurbishment/Maintenance Manager negotiations concluded that existing PWU Maintenance shops will be utilized for specialty purposes only (RV's/Lapping/Other). An existing service level agreement (SLA) is in effect between the Site Maintenance and Refurbishment Maintenance Managers, and will remain in effect.

Specialty RV reconditioning and valve lapping work can be managed within the existing SLA's and be performed in existing shops during Refurbishment. Given the level of effort, cost and equipment required to duplicate these facilities it may be determined this is the most efficient and economical decision in some cases.

Assumption #4

Since existing non-specialty PWU Maintenance Facilities are not available for Refurbishment as per the service level agreement (SLA), the DSR process is utilized for all additional requirements.

The normal DSR process utilized by OPG Refurbishment to summarize a problem and put forward a solution for consideration will be used to address any additional installations required for Project-related non-specialty maintenance facilities.

The Mechanical Maintenance Shop is an area that is separate from station facilities and will be a central shop area for all project activities. This shop will include office space for Mechanical Maintenance supervisors, as well as work stations for staff reporting on work progress. The shop equipment will include lathes, drill presses, work benches and hoists. The Project Charter (Document #D-PCH-09701-10015) identified an area of 9,100 ft² of space for this mechanical shop and further proposed it be located in the R&FR Waste Reduction Facility. This facility was proposed as a new building by the R&FR Project for an exclusive Project purpose and is not proposed to include shop space, as a result, no further strategy for shops involving the Waste Reduction Facility will be made in this report. Meeting discussions identified a need of 5,000 ft² for the mechanical shop, based on the reduced scope of equipment component reconditioning required.

An alternative approach to reduce space requirements is for the Vendors to send the majority of parts & equipment off-site to Vendor's shops, other facilities outside the Protected Area, or OEM (Original Equipment Manufacturer) facilities. Space in the East Complex Mechanical Fabrication and Machine Shop and existing BTU work areas on Unit #4 in the DNGS site operating island are recommended to be retained to support this initiative.

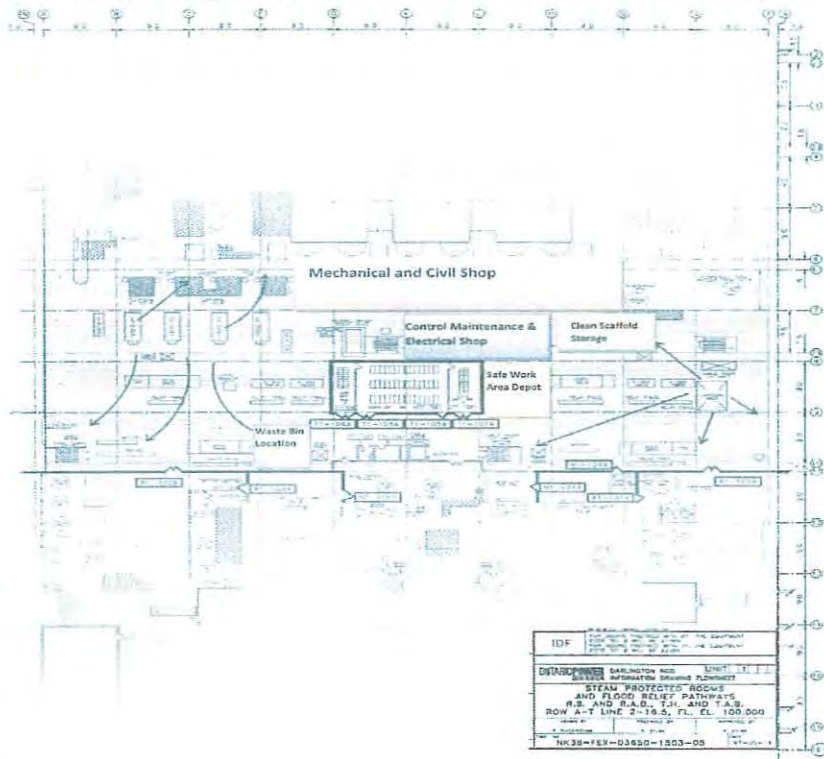


FIGURE 9 – Mechanical and Civil Maintenance Shop

4.3 Valve Shop

The Valve Shop will provide control and mechanical equipment maintenance support for testing and reconditioning of valves using Viper, Flowsan and Kalsi equipment. The Project Charter (Document #D-PCH-09701-10015) identified an area of 5,000 ft² of space for the Valve Shop.

A potential location providing 1,300 ft² for the valve shop is located on the 115 metre elevation in Unit #1 and Unit #3 only between columns A8 and C9, as illustrated in **Figure 10**. The Steam and Water sampling (SAWS) room occupies this location in Unit #2 and Unit#4. The area would be regarded as extended Refurbishment facilities for the Refurbishment Unit pair (Unit #1 and Unit #2). Valve maintenance on potentially contaminated equipment would be performed in the Hot Shop and Decontamination Facility location.

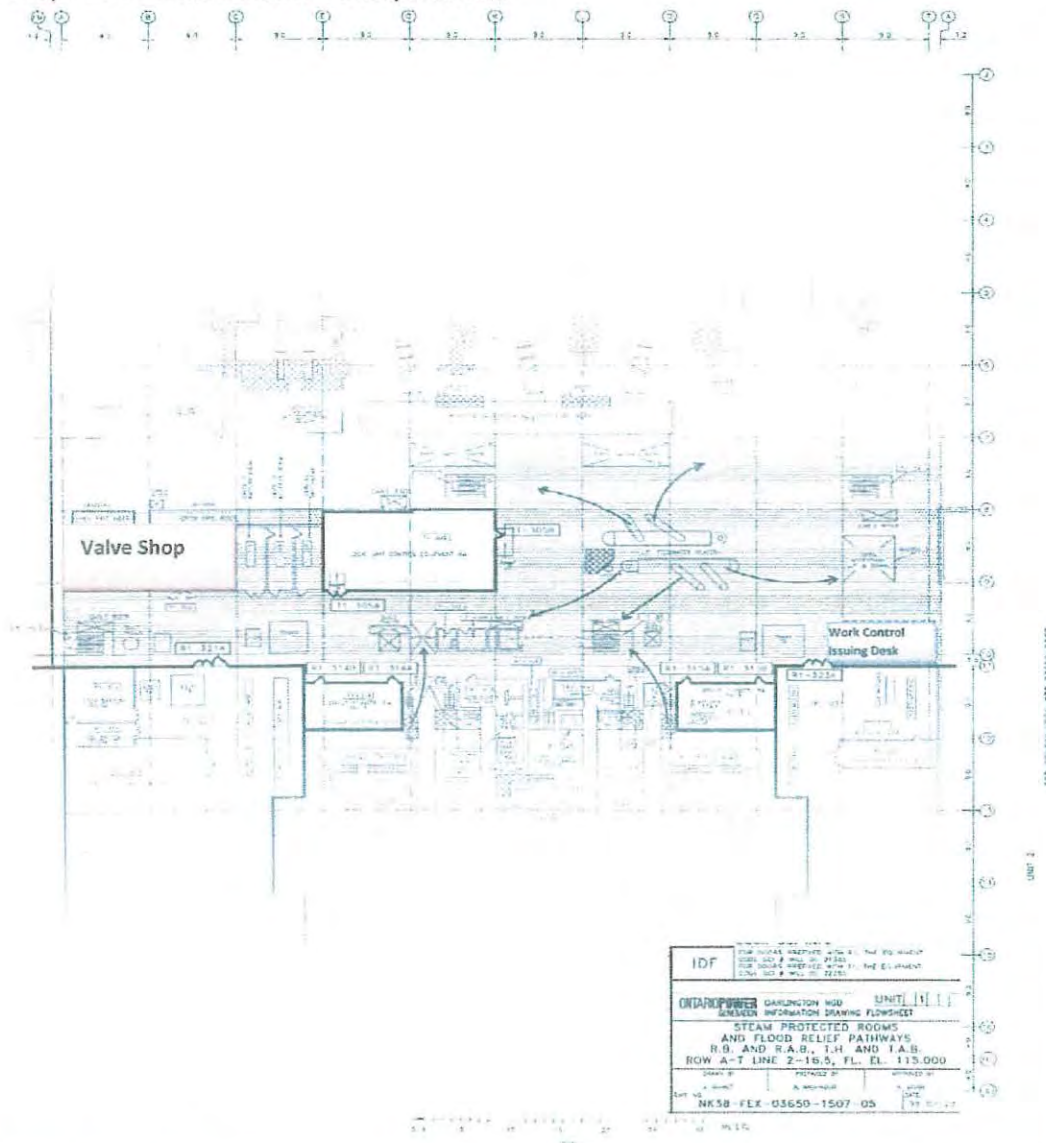


FIGURE 10 – Valve Shop

4.4 Control Maintenance and Electrical Shop

The Control Maintenance and Electrical Shop requires space for conduit tube bending, power pack repair, electrical testing and an instrument bench area. The approximate size required for the Electrical Shop is 1,200 ft².

A potential location for the control maintenance and electrical shop is on the 100 metre elevation, between columns K7 -O8, providing 1,450 ft² as illustrated in **Figure 11**. This location must be negotiated with Station personnel pertaining to the planning of facility unit pairs as this location is presently used for TWE vehicle parking on Unit#3.

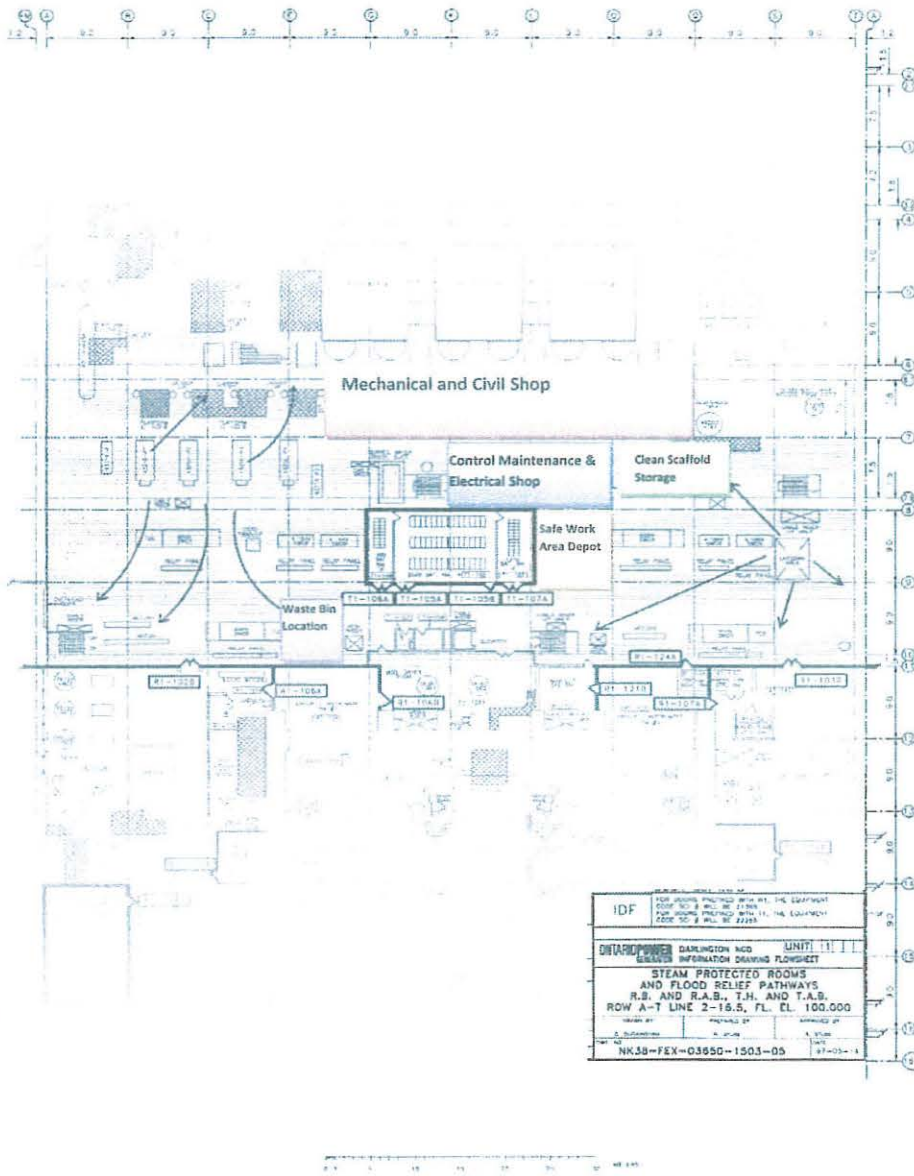


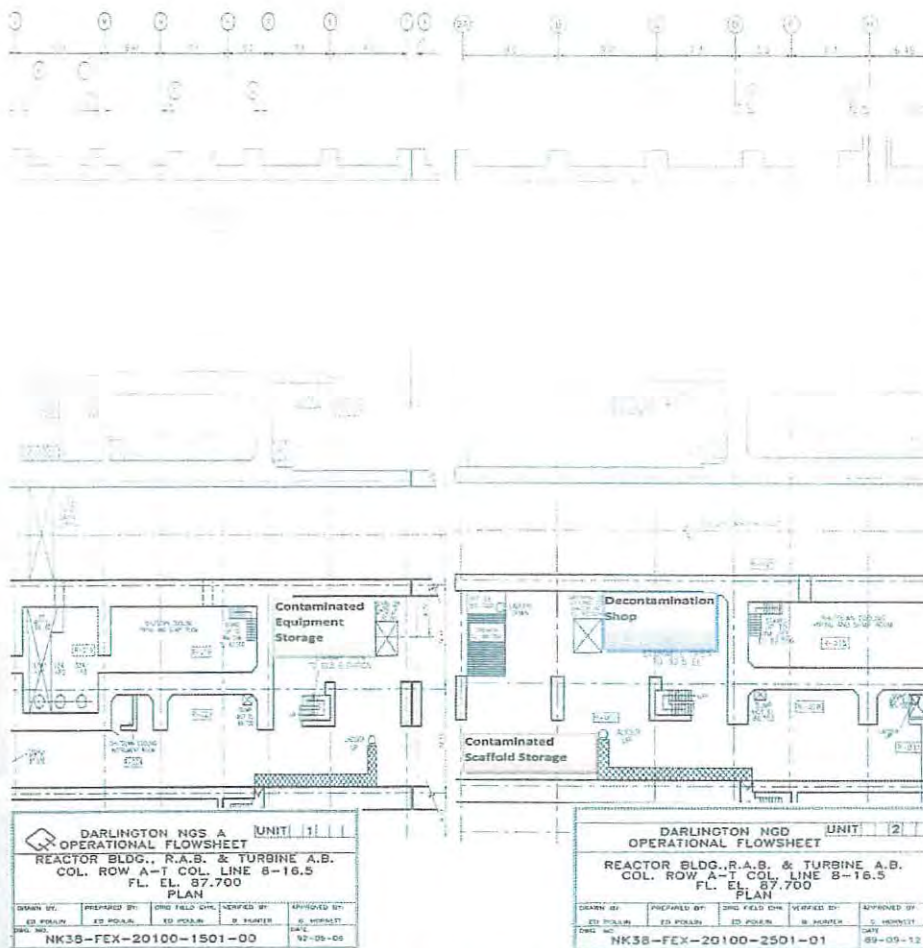
FIGURE 11 – Control Maintenance and Electrical Shop

4.5 Civil Maintenance Shop

The Civil Maintenance area is intended to house sheet metal and insulation shops including painting activities for general maintenance around the plant. The shop needs sheet metal equipment for insulation wrap such as rollers, edgers and benders. A scaffolding preparation area (to cut tubing and planks) is needed, as well as a painting supplies storage area. Equipment painting will be done off site to the extent possible, on site touch-ups will be required during Refurbishment. Labourers will require a custodial equipment storage area. The Project Charter (Document #D-PCH-09701-10015) identified an area of 6,000 ft² of space for the Civil Maintenance shop.

During meeting discussions it was proposed that given the assumptions, the Sheet Metal shop could be combined with the Mechanical Maintenance shop, located south of the condensers on the 100 metre elevation, as illustrated previously in **Figure 9**. The Sheet Metal shop would occupy approximately 500 ft² in the Mechanical Maintenance Shop. Separate areas would be designated for scaffold preparation, storage of insulation, sheet metal, custodial equipment and painting supplies representing approximately 2,000 ft² of laydown area space.

4.6 Hot Shop and Decontamination Facility



4.7 Clean & Contaminated Scaffolding

4.7.1 Clean Scaffolding Storage

During refurbishment, a bulk supply of clean new scaffolding will be required in order to enable workers to access the various Refurbishment work locations safely. The Project Charter (Document #D-PCH-09701-10015) identified an area of 400-600 ft² of space for clean scaffold storage within the Refurbishment Island. At present, there is an existing clean scaffold storage area on the 100 metre elevation between columns O7 and S7.9 providing approximately 1,450 ft² that is intended to remain, as illustrated in **Figure 13**. The space identified will also be used for the scaffold preparation area for cutting tubes and planks.

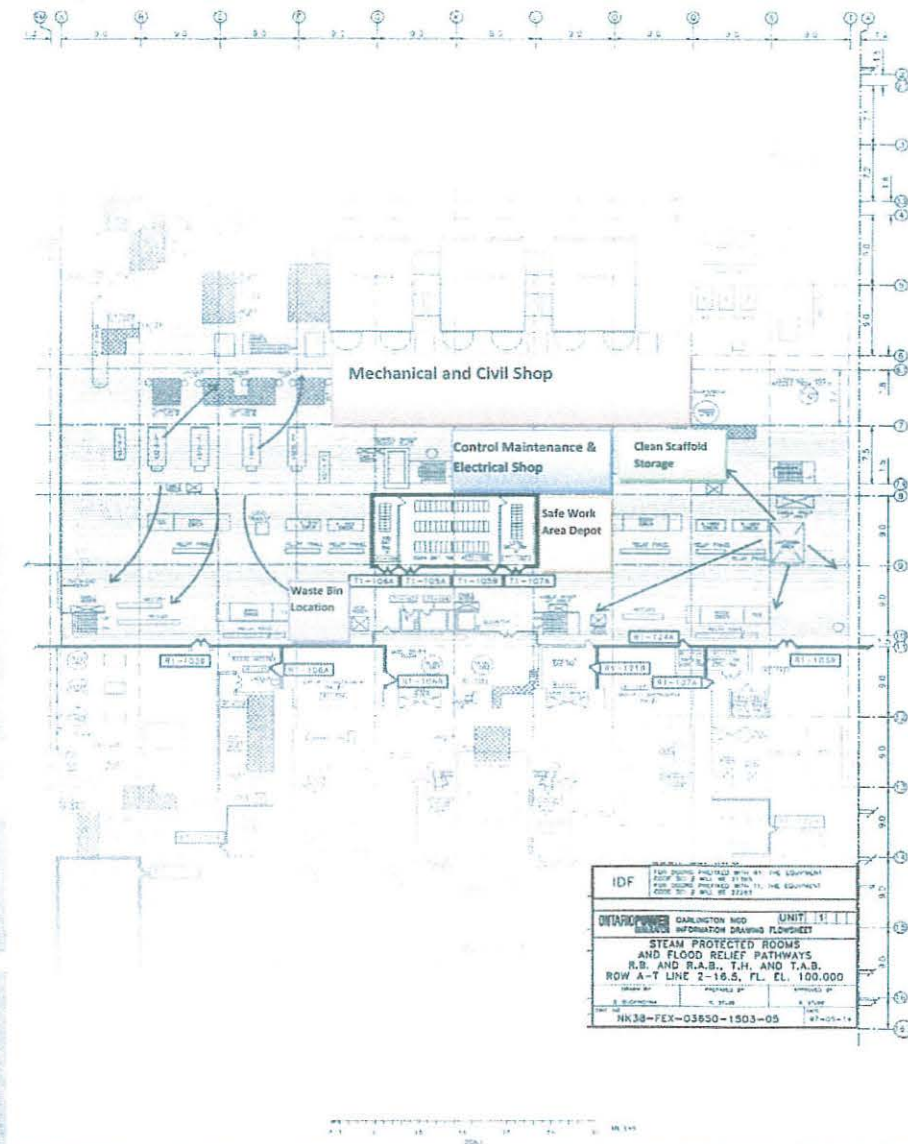


FIGURE 13 – Clean Scaffolding Storage

4.7.2 Clean Scaffolding Bulk Storage

For clean scaffold storage outside of the plant, a tented or pre-fabricated building is envisioned for bulk storage. This building, estimated to be approximately 10,000 ft², can be situated outside of the protected area. Potential locations may be along Lakeshore Road, south of the vacuum building, or near the Auxiliary Security Building, as illustrated in **Figure 14**. Recommendation #2 within Section 4.15.2 ("Shops & Work Spaces Recommendations") identifies the requirement to build a structure over the bulk scaffolding storage area.

An alternative location inside the protected area could be utilized on U4 south of the Standby Generators (SG's) in the large vacant open gravel area. This location is potentially suitable for both clean scaffolding bulk storage and for the potential storage of bulk Land/Sea containers. This area is marked as "Potential Lay-down Space/Alternate Use in Figure 14.

The area outside the PA is currently used by P&M CMO and their contractors as well as Nuclear East Facilities so the appropriate footprint would need to be established at time of allocation of space.

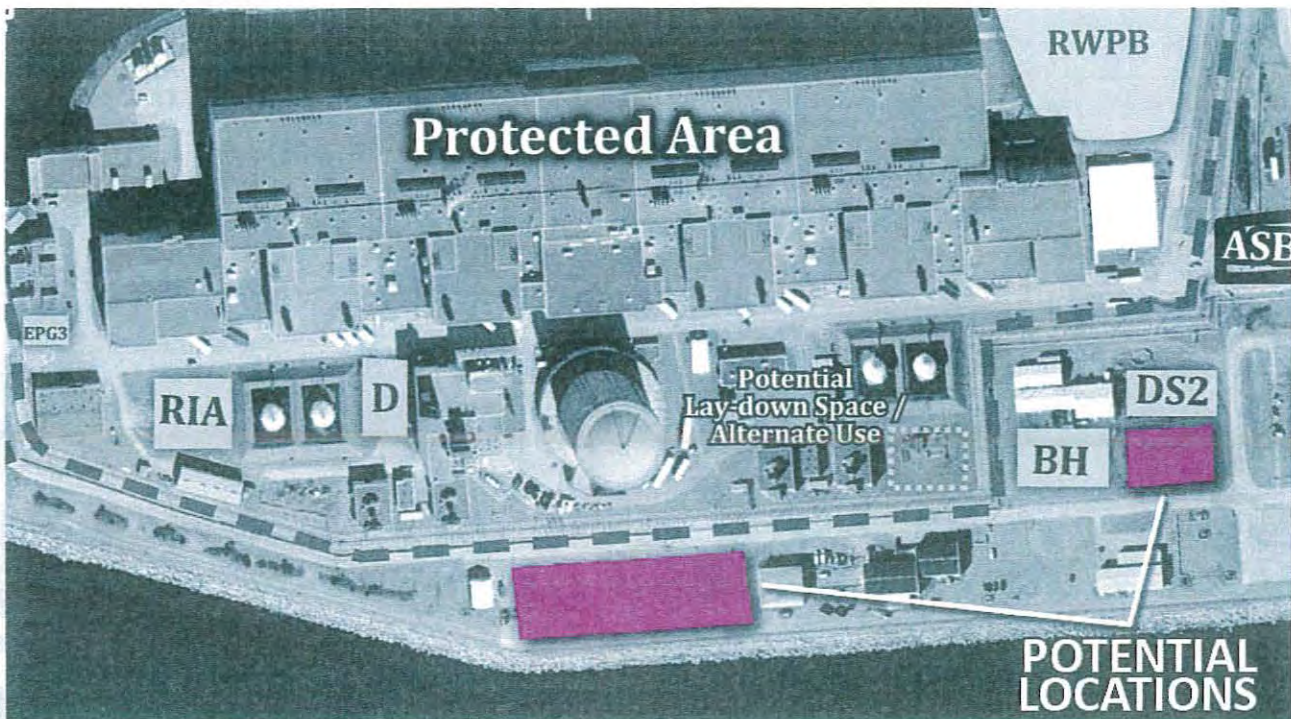


FIGURE 14 – Outdoor Bulk Scaffold Storage Areas

4.7.3 Contaminated Scaffolding & Equipment Storage

A temporary laydown area is needed for contaminated scaffolding & equipment until it is decontaminated or stored. The Project Charter (Document #D-PCH-09701-10015) identified an area of 500 ft² of space for contaminated scaffold storage. Meeting discussions revised this area requirement to approximately 1000 ft² in two locations. A potential location for the equipment storage area is on the U1 side of 87.7 metre elevation between column R14 and grid location T15 and on the Unit 2 side of 87.7 metre elevation between column 2A15 and grid location B16 providing approximately 1400 ft², as illustrated in **Figure 15**. (This is situated in close proximity to the decontamination area on the 87.7 metre elevation). This area is suitable in a unit pair configuration for Refurbishment of Unit 1&2 if required.

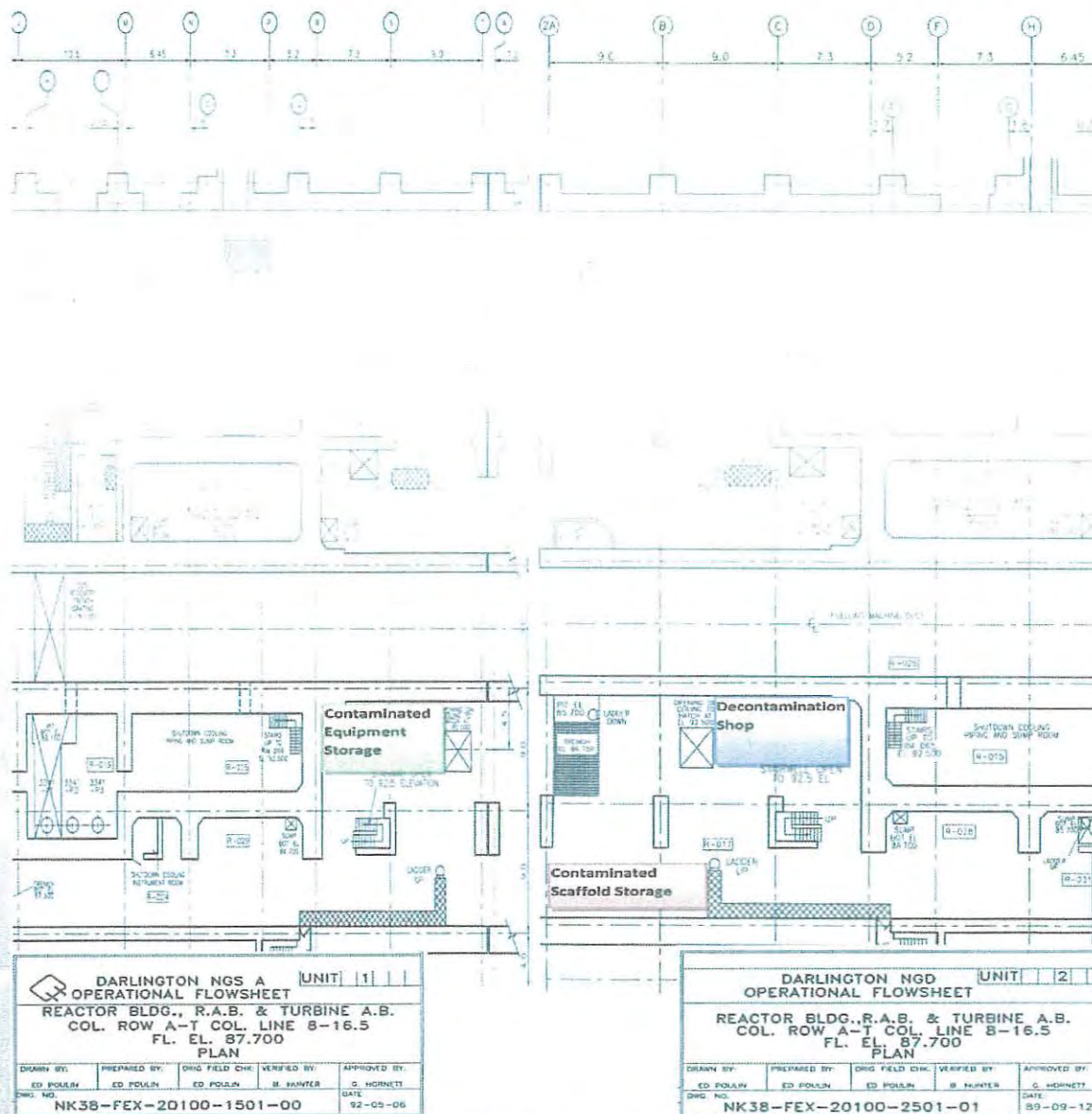


FIGURE 15 – Contaminated Scaffold & Equipment Storage

4.7.4 Contaminated Scaffolding Bulk Storage

Outside of the powerhouse, there is a need for bulk land/sea container storage of contaminated scaffolding and equipment. This storage area needs to be approximately 10,000 ft² in size, and have a gravel/level base (to enable potential stacking of containers). Potential locations are east of the vacuum building or south of steam generator fuel tank 3&4, as illustrated in *Figure 16*.

This location has the potential to support both the clean scaffolding bulk storage supply area as well as bulk land/sea contaminated container storage. This area would be considered acceptable for multiple units Refurbishment projects.

A strategy for off-site decontamination of sea can contents has been considered and is recommended as part of this initiative. Recommendation #1 within Section 4.15.2 ("Shops and Work Spaces Recommendations") recommends a bulk decontamination strategy.



FIGURE 16 – Outdoor Contaminated Scaffold Storage Areas

4.8 Work Control Area

The work control area issues equipment isolation Permits and Work Authorization to the people performing the work. The Project Charter (Document #D-PCH-09701-10015) identified an area of 960 ft² of space for the work control area. Meeting discussions identified a potential location to issue the work permits on elevation 115 in Unit#2 between columns S9 and T10, as illustrated in **Figure 17**. This is the existing location of the Field OCC Office. This location is proposed to be retained during the Refurbishment of all units and is approximately 500 ft². A negotiation between site and the Refurbishment Project will be required for an alternate location to re-locate or build a new regular Unit Outage Field OCC (Outage Control Center) facility. A recommendation (Recommendation #3) on this initiative has been outlined in Section 6.1.2 ("Site Layout Recommendations"). If the recommendation is not accepted from the DNGS site, NR Operations first preferred alternative is a double deck trailer on the South side of the 115 metre elevation for all Unit 1-4 Refurbishments as noted in Section 4.9 "Permit Preparation Area".

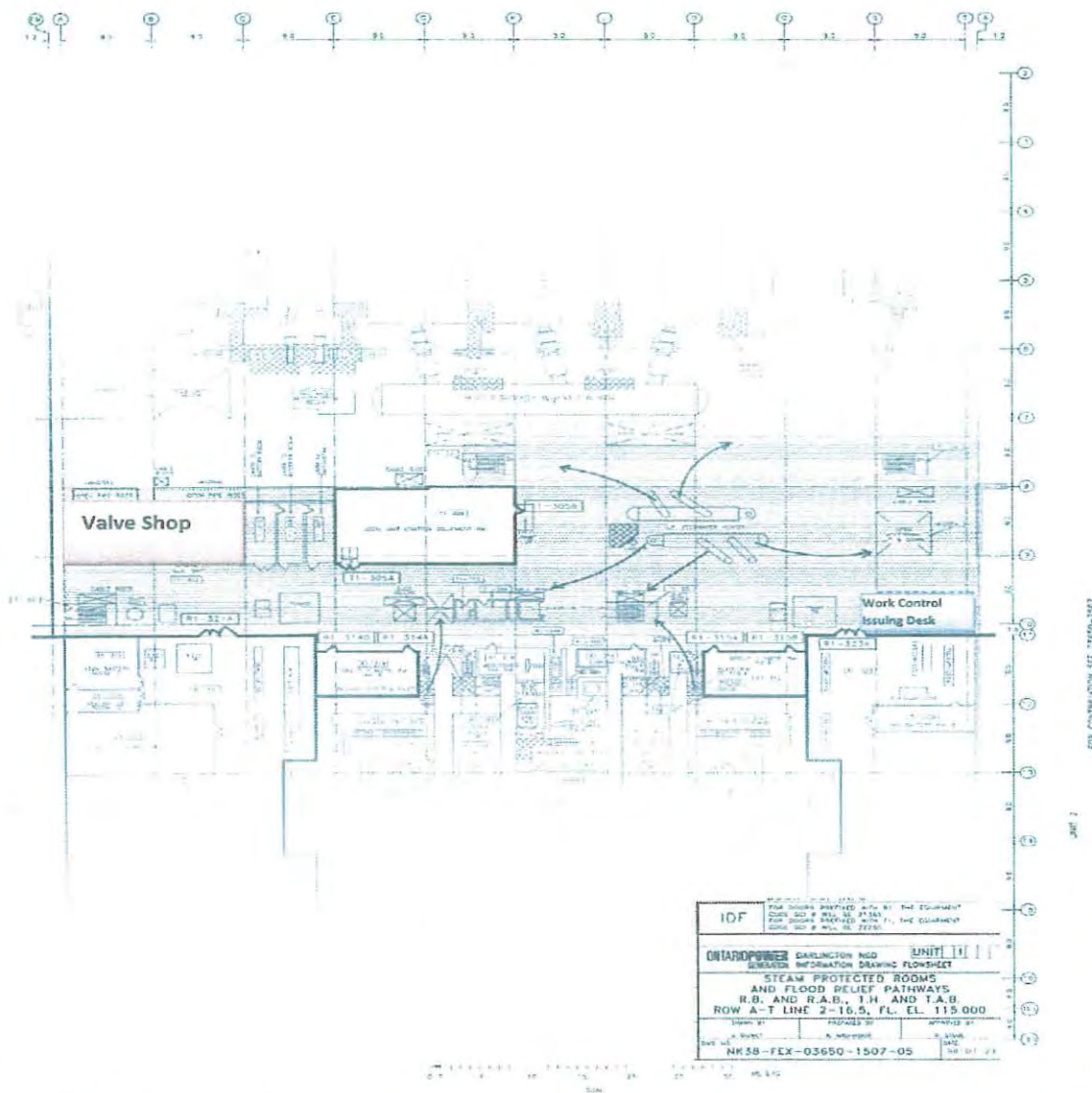


FIGURE 17 – Work Control Area

4.9 Permit Preparation Area

The permit preparation area is needed to check drawings/documents and put together instructions to perform work. The Project Charter (Document #D-PCH-09701-10015) identified an area of 1,925 ft² of space for Work Protection preparation. To prepare Work Protection permits, a potential location is identified on the 107.5 metre elevation, between columns S and T, and between rows 11 and 12, as illustrated in **Figure 18**. This area represents approximately 600 ft².

An alternate location would be to include a turbine maintenance type trailer (double deck) on the south side of the 115 metre CSA elevation as previously and historically utilized by Operations prior to its removal due to insufficient fire standards. If the DNGS site decision is made not to utilize the existing field OCC as a Work Control Area then it would be Operations first preference to combine the Work Control Area and Permit Preparation office into a double deck trailer in this location. As a second alternative to the OCC office, a trailer could be utilized at the south side of the plant near the R&FR staging area and Radiation Protection office to centralize the R&FR/RP/Work Protection services hub ("one stop shop") for the Refurbishment Project.

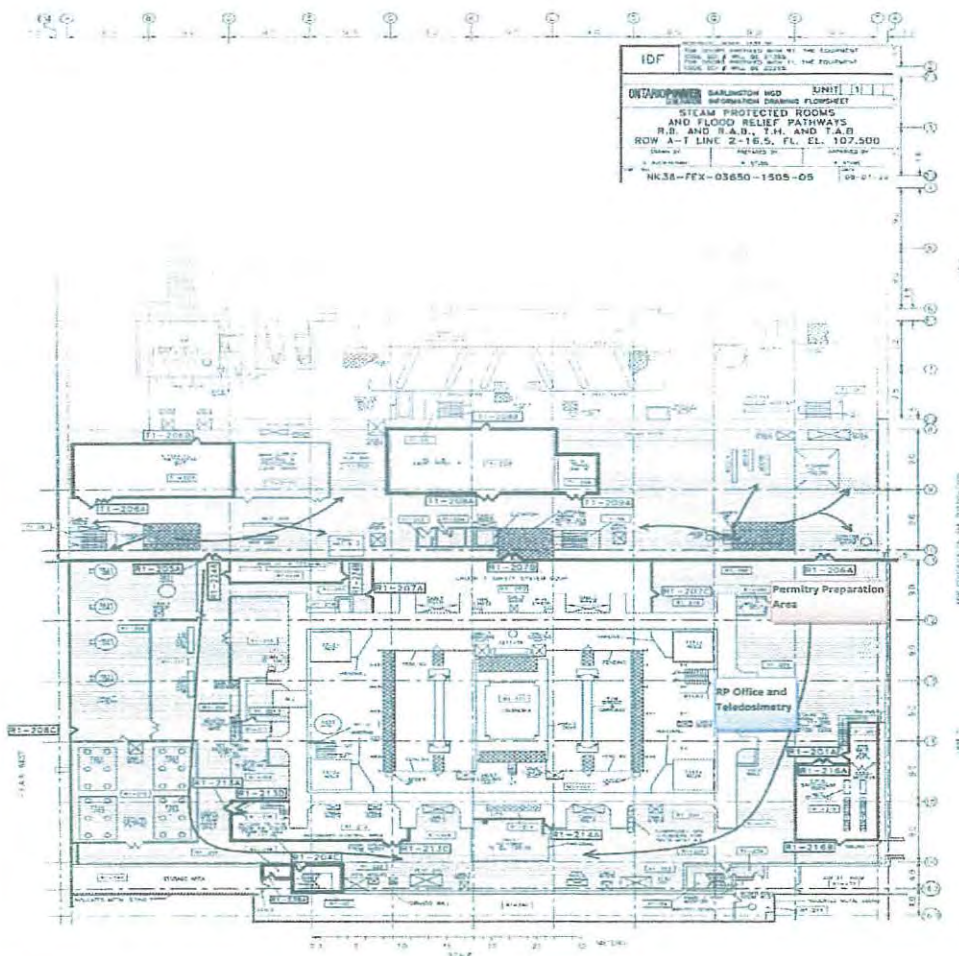


FIGURE 18 – Permit Preparation Area

FIGURE 19 – Radiation Protection Office / Teledosimetry

4.11 First Aid Station

A first aid station equipped with first aid tools and materials is needed. For personnel dressed in "browns", workers will use the existing first aid station / decontamination room at the "4 corners" on the 107.5 metre elevation in the DNGS operating island in the CSA between Unit #2 & Unit #3. Personnel who are not in "browns" will utilize the first aid station located in the WSOB.

4.12 Safe Work Area Depot

A safe work area depot is needed to store supplies required to set up safe work areas. Supplies include: signs, barricades, chains, and stations. The Project Charter (Document #D-PCH-09701-10015) identified an area of 150-200 ft² of space for the safe work area depot. Meeting discussions confirmed that 200 ft² is needed for this work area. This area is envisioned to be located on the 100 metre elevation between columns L8 and O9 providing approximately 300 ft², as illustrated in **Figure 20**.

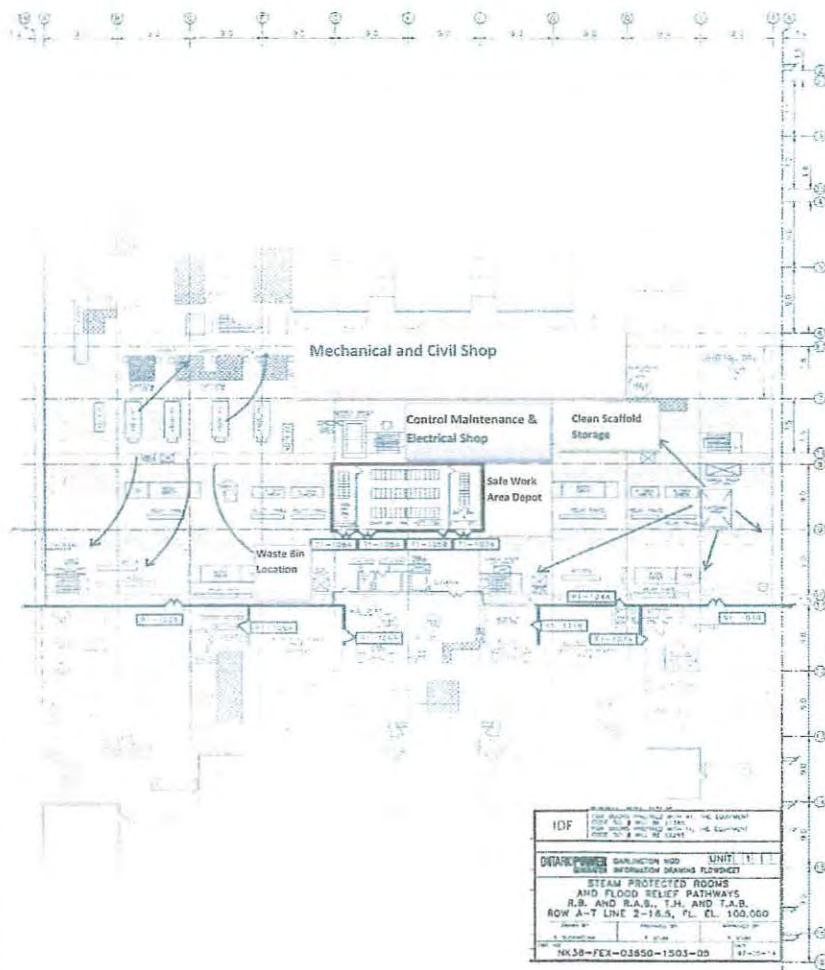


FIGURE 20 – Safe Work Area Depot

4.13 Waste Collection and Handling Area

An area is needed to place bins for segregated waste. These bins would be picked up on a daily basis. A potential location for the bins is on the 100 metre elevation, between columns E9 and G10, as illustrated in **Figure 21**.

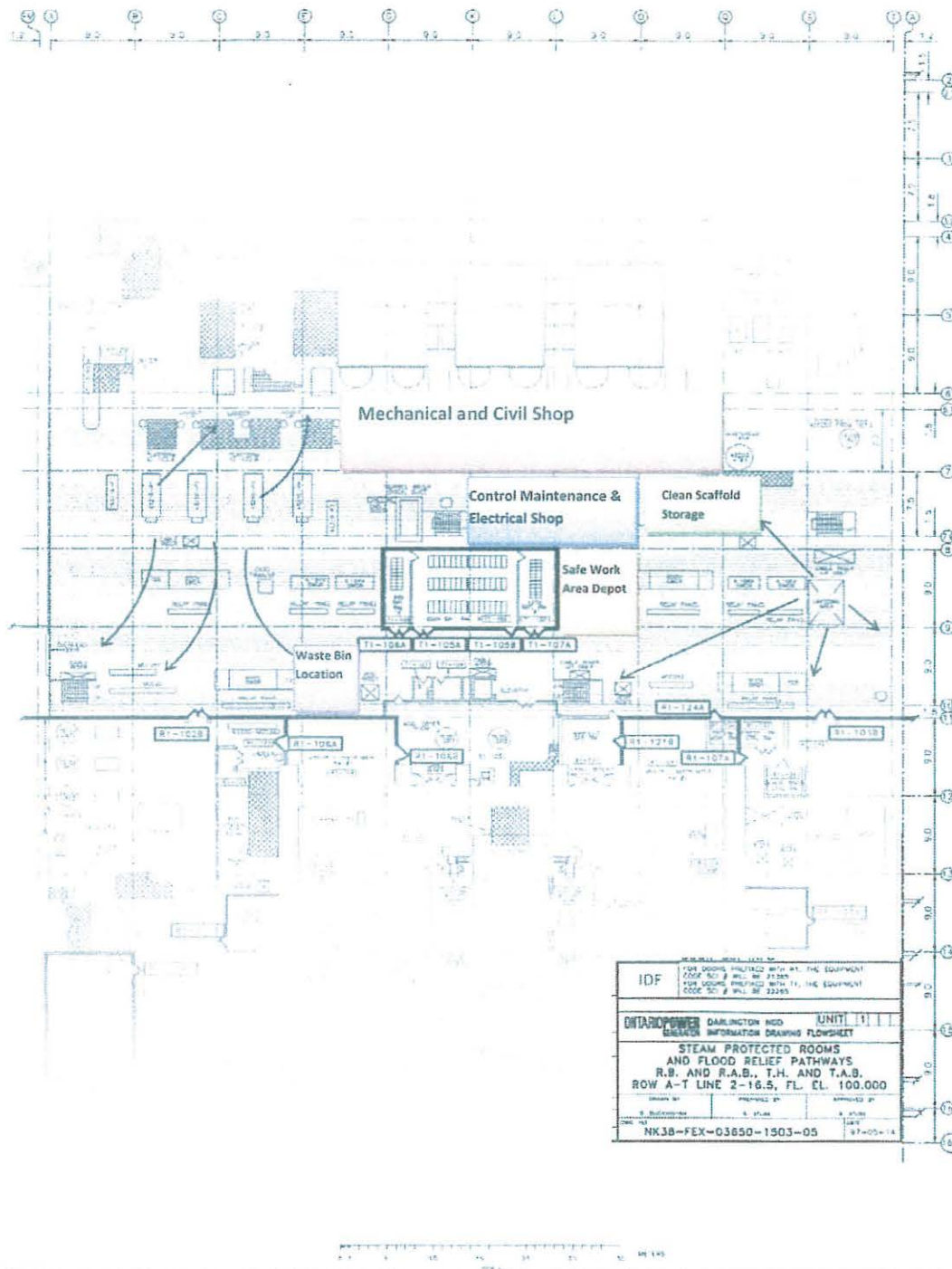


FIGURE 21 – Waste Bin Location

4.14 Other Services, Shops & Work Spaces

Through meeting discussions, there were some construction support services that were identified but not included in the Project Charter. Those items are listed in *Table 3*.

It is anticipated that through completion of actions and disposition of recommendations in this report an effort to achieve a more consolidated site facility, work space, storage and work flow plan can be developed in support of both the Refurbishment Islanding Project and the Operation and Maintenance SATM (Space Allocation of Transient Materials) initiative that will evaluate and prioritize all requests for space.

Table 3 – Other Shops & Work Spaces

Shop / Work Space	Potential Location	Details
Flammable / Corrosive Products Cabinets	92.5 metre elevation, as illustrated in <i>Figure 22</i>	One per Vendor
Laydown Tool Cribs and Lock up	131.5 metre elevation, as illustrated in <i>Figure 23</i>	Provide 3-5 caged areas for Vendor's consumables and, pressure boundary tooling. Vendors may have an east or west cage here also.
Tool Cribs (Long-Term Storage), Contaminated Equipment	92.5 & 87.7 metre elevation	3-5 cages measuring 10'x20' for pressure boundary storage
Coat storage	Knack box	Job location
Storage area for Vendors' QA binders and documents	Refurbishment Island Annex	One per Vendor
RPPE storage and lay down	RPPE Dressing station near airlock 100 metre elevation.	Additional RPPE Supply stations will be required to support Vault activities.
Transport and Work Equipment (TWE) parking area	Alternate location to be negotiated with DNGS station.	Need a shared location with charging receptacles and ventilation
General Lock-up for frequently used tools by Balance of Plant workers	92.5 metre elevation	This may be a Vendor or OPG-maintained storage and calibration facility.
Material Movement and Project Support Swing Space (Managed Flow Space)	107.5 metre elevation Room 203	Project laydown just in time space coordinated for delivery of materials to support scheduled evolutions of the Refurbishment Projects.





4.15 Shops & Work Spaces Actions and Recommendations

Table A2 summarizes the actions and recommendations resulting from the discussions on shops and work spaces for the Project. The proposed issue owners can also be found in the table, located in Appendix A.

4.15.1 Shops & Work Spaces Actions

The following 6 actions resulted from the discussion concerning shops and work spaces.

Action #1:

The existing BTU Outage fabrication shop spaces in caged locations on the 107.5, 87.7 & 92.5 metre elevation in Unit 4, and the east site BTU Pipe Fabrication / Machine Shop facilities should be utilized by Vendors during Refurbishment to alleviate the need for additional structures/buildings. A Service Level Agreement (SLA) needs to be developed/negotiated.

By utilizing existing outage fabrication shop space, there is no need to create fabrication shop space for Vendors as part of the Project. A negotiated Service Level Agreement between Refurbishment and P&M CMO would be established for usage. Vendors would need to maintain upkeep of this shop space. Recommendation #1 (within Section 4.15.2 "Shops & Work Spaces Recommendations") regarding Fabrication Shop upgrades would need to be resolved prior to including this item in the SLA.

Action #2:

Pending the outcome of the recommendation on both general tooling & calibrated / pressure boundary tooling, Vendors will need to develop contracting strategies for an on-site tool crib & calibration facility. A location and structure will need to be constructed to meet this requirement.

This action will revolve around the decision on whether OPG supplies, maintains and calibrates tools or whether the Vendor does. If OPG supplies the tools, then a space is needed for a tool crib and calibration facility. If the Vendors undertake this function, then each may need a separate space or a common use agreement that supports all the Vendor's QA programs. Should the Vendors develop an off-site strategy as part of the tooling action, a space footprint will still be required for on-site tool distribution only.

Action #3:

A BTU/PWU negotiated agreement is required on shared shops for facilities like the Decontamination Facility and Hot Shop facility. Jurisdictional issues need to be resolved in advance of the Refurbishment Project.

It should be recognized in advance of the Project that the facilities will be shared.

Action #4:

Unit-by-unit site re-location of TWE & scaffold storage areas is required during Refurbishment. For the needs of the Refurbishment Project, it is suggested that TWE/scaffold storage items be located in the same locations as the Refurbishment Outage. Some sharing of locations or a re-negotiated laydown agreement is needed.

When the designated storage areas are located in a unit that is undergoing refurbishment, then a “shared use or relocation agreement” is required.

Action #5:

To alleviate constraints on facility size and cost, a bias is needed to prioritize the “dry ice method” of decontamination (CO₂-Blast Method) for the required facility over the traditional wet/decontamination method. The dry ice method would result in low waste, no water, and reduced engineering tie-in requirements, as per the Bruce Nuclear Generating Station operating experience.

Traditional decontamination methods create significant amounts of contaminated water and other solid wastes, and significant plant modifications for tie in of required station services. There is an opportunity to incorporate a better alternative for decontamination methods for the Project which will reduce waste streams and as a result reduce Project waste costs.

Action #6:

If the recommendation to house the R&FR Command Centre at the south entrance in a trailer is accepted, then room 203 on the 107.5 metre elevation becomes available as alternate space for Refurbishment laydown areas for material/equipment storage, or for the OPS work permit preparation area / Radiation Protection Teledose structure / BTU Tool Crib.

This presents **a space opportunity** for some previously identified space inside the powerhouse to be used for other priority functions.

4.15.2 Shops & Work Spaces Recommendations

The following 10 recommendations resulted from the discussion concerning shops and work spaces.

Recommendation #1:

It is recommended that a contract strategy be developed for Refurbishment that includes a review of off-site decontamination opportunities to support the existing decontamination shop initiative with respect to Bulk Land/Sea can storage. This strategy would include the review of alternate storage/shipping containers that are transportation ready to support bulk transfer to and from an approved Vendor.

Off-site decontamination strategies for bulk scaffolding and equipment can be very cost effective for the Project given larger facility capacities, larger decontamination work forces and less competing priorities resulting in faster turnaround times. Bulk decontamination on-site could compete with the daily decontamination needs of the Project and cause unnecessary delays to various work programs.

Recommendation #2:

Since it is recommended that the BTU East Fabrication Shops be utilized during Station Refurbishment to alleviate the need for additional structures/buildings, the existing BTU Mechanical Maintenance Fabrication Shop should be reviewed to determine if any required upgrades are needed prior to Nuclear Refurbishment.

The East Fabrication Shops are considered to be “life-expired structures”, meaning that these shops have been recommended for demolition. If these existing shops are to be used as part of the Project, then they will need to be reviewed to determine what upgrades are required to be compliant with codes. The responsibility of future maintenance associated with these shops will have to be determined as well.

Recommendation #3:

It is recommended that a concrete or gravel area be identified on the Campus Plan and a structure built (Tented Area/Covered) for bulk scaffold material delivery and storage, and for parking bulk land/sea containers for the Refurbishment Project.

There is a need for storing bulk scaffold material as well as land/sea containers. The area for storing this material can be outside in the protected area, but needs to have a hard level foundation to prevent containers from sinking (if placed on a dirt foundation) or tipping over if stacked on an uneven foundation.

Recommendation #4:

The R&FR Annex facility is currently exclusive to the R&FR Project for DNGS Refurbishment (including feeder preparation). It is recommended that the R&FR Project validate whether the vendor can execute feeder preparations at off-site facilities so that BTU construction staff can utilize the RIA Maintenance Shops to alleviate the need for additional structures/buildings.

If Vendors can deliver replacement materials such as feeder components, end fittings, calandria tubes, etc. in an “installation ready” form, then space is not needed in the Annex Shops or the footprint can be reduced for this work by the R&FR Project Team analyzing feeder preparation requirements. This space can then be potentially used by Balance of Plant construction workers for shop area needs, free up powerhouse floor space and eliminate engineered tie in of shop services.

Recommendation #5:

It is recommended that the R&FR Project finalize its evaluation to decide the future location of the Retube Waste Processing Facility. This facility is currently planned for the area immediately east of the Unit 4 powerhouse. The decision is required to determine whether this space is available for other requirements (e.g., Bulk Land/Sea container storage).

The campus plan currently shows space reserved east of the powerhouse for a Retube Waste Processing Facility. The R&FR project needs to determine whether the full extent of the space shown on the campus plan is required for this facility. If it is not, then space would become available for other uses such as bulk land/sea container storage.

Recommendation #6:

It is recommended that a contract strategy be developed for all Breaker & Relay calibrations to be performed at off-site locations (Vendors/OEM/Other) to alleviate the need for additional structures/buildings.

The Project Charter identified a need to ensure facilities on-site are available for Breaker & Relay calibrations. If those calibrations can be done off-site, it would negate the need for OPG space inside the powerhouse or elsewhere for this function.

Recommendation #7:

It is recommended that a contract strategy be developed for Refurbishment that includes a bias for Vendors to execute maintenance shop work activities as much as possible at off-site work locations to improve efficiency, and to save on project costs (i.e., all new work/conventional preparations including equipment and valve scope).

There would be significant savings to OPG by not having to build shops and/or certified facilities on-site for these functions.

Recommendation #8:

It is recommended that a contract strategy be developed for Refurbishment that includes a bias for equipment from the protected area via UTP be repaired or reworked as much as possible off-site rather than on the east site fabrication shops to improve efficiency and to maximize savings on project costs.

There are resulting cost savings to be realized by having equipment repaired/re-worked off-site.

Recommendation #9:

It is recommended that a contract strategy be developed for Refurbishment that includes a bias for Vendors to supply all their own tools for the Project, so that an OPG tool crib is not required as per existing Vendor contract terms and conditions, and to improve efficiency and alleviate the need for additional structures/buildings.

This is related to Action #2, which is dependent on the outcome of a decision regarding who (OPG or Vendors) would supply, and maintain tooling for the Refurbishment Project.

Recommendation #10:

It is recommended that a contract strategy be developed for Refurbishment that includes a bias for Vendors to supply all their own calibrated / pressure boundary tooling under their Certificate of Approval for the Project, so that an OPG central facility is not required, and to improve efficiency and alleviate the need for additional services, structures/buildings.

This would put the onus on Vendors to supply their own calibrated tooling for the Project. A location would still be required for Vendors to store and issue out their tools in a designated area. A strategy involving a central supplier other than OPG could be utilized to support all the Vendors under this initiative. The strategy would need to consider the need to borrow OPG specialized tooling for one time use or where an OPG procedure specifies the use of a specific OPG calibrated tool.

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5.0 MATERIAL FLOW

Summary

Material flow can be critical in undertaking work during the Refurbishment Project. If a part or piece of material or equipment is not on site when required (due to delays) then Project work can correspondingly be delayed.

The material flow analysis explored:

- **Off-Site Material Screening.** By discussing the process by which materials can be inspected prior to shipment from off-site points of origin, potential efficiencies (selection of an off-site facility for pre-screening, undertaking off-site security checks) were realized which would facilitate faster processing of materials downstream.
- **Arrival of Materials On-Site.** A review of the travel paths and processes that would be undertaken on-site found that there are potential efficiencies that could be realized through “just in time” deliveries and “calling in” upcoming deliveries ahead of time (to advise security that they are coming). Also, through scheduling deliveries at off-peak times (4:00 PM – 8:00 PM) bottlenecks could be reduced and assurance that materials reach their intended destinations in a timely manner would be achieved.
- **Unloading Materials On-Site.** Drivers making deliveries with end destinations inside the powerhouse will utilize a roll up door at the west side of the powerhouse. A vestibule will need to be constructed in the vicinity of this roll up door to provide some shelter for the unloading of trucks, as well as address the flow of construction staff entering and exiting the powerhouse. It is also intended for dedicated drivers to have Orange Badge qualifications to expedite on site deliveries more efficiently without security sponsorship.
- **Removing Materials from the Site.** To reduce the amount of waste on site, materials are to be de-packaged prior to shipment, commensurate with maintaining quality and protection of critical component or equipment surfaces. Any remaining packaging or waste material could be removed on the same delivery truck that delivered it prior to releasing the material for site use or storage.

Introduction

The material flow discussions focused on the following issues:

- Shipping activities to be performed off-site, prior to shipment of the material to the DNGS site
- How does material arrive at the DNGS site
- Where will in-coming material be unloaded from trucks
- How does packaging material get handled for the DNGS site

The assumptions that were used to facilitate discussions of material flow are identified in Section 5.1. The balance of material flow issues are discussed in the subsections 5.2 through 5.5.

5.1 Off-Site Review of Materials

There are three main components associated with reviewing materials off-site. These are: the selection of packaging; the selection of an off-site shipping location; and off-site security checks.

Selection of Packaging

Prior to shipment to the site, Vendors will need to consider how materials are packaged so as to minimize transient combustibles and to remove unnecessary packaging. To facilitate the review of these materials, it is recommended that Vendors utilize non-combustible totes for deliveries whenever possible. The supplies are to be provided by the Vendors in coordination with OPG on site delivery and storage.

Selection of Off-Site Location

The EPC and ES-MSA process provides for Vendor supply of materials. The Vendors will receive and store materials at an off-site facility. Any pressure-boundary materials will be segregated and stored separately. These off-site storage facilities are intended to be geographically located close to the DNGS site to facilitate pre-clearance by security and warehousing inspections.

Off-Site Security Checks

Prior to materials being delivered to the site, it is recommended that security officers be dispatched to the Vendor storage facilities or alternate locations to conduct a pre-clearance security inspection. This inspection will involve unloading, x-raying and reloading the contents of the truck. A physical inspection is still required for any enclosed items. A bill of lading is required to the same standard as shipments to the Darlington warehouse.

Once the pre-screening / security clearance is completed by security officers, closed trucks / vans will be "sealed" by security officers to avoid tampering of the contents between the storage facility and the DNGS site. If the truck cannot be sealed, then re-inspection on site will be required, or the shipment must be escorted by a line of sight NSO (one per vehicle) from the pre-clearance area to the site delivery location.

Since Vendors are expected to assemble materials off-site and then provide "just-in-time" shipments, time is of the essence in dispatching security officers to off-site storage facilities for pre-screening of deliveries.

To facilitate faster processing on-site, the Vendor is to ensure that they provide a security-cleared, Orange II-Badged, Teamster-registered staff person(s) to transport/deliver the materials not only to the DNGS site, but also into the powerhouse and to the work location, if required. To facilitate deliveries, Vendors are encouraged to regularly assign the same delivery people so that they become known to Security staff.

5.2 Materials Arrive at the DNGS Site

Arrival at DNGS Site

Trucks are anticipated to utilize Highway 401 to arrive at the DNGS site. From Highway 401, truck drivers will exit and use Holt Road (or potentially Park Road) to access the DNGS property. Discussions explored the use of various entry points by trucks to the protected area. Both the Auxiliary Security Building (which handles all existing truck deliveries) and the Bill Gearing Guardhouse (BGG) were explored during meeting discussions as options for accommodating Project deliveries. It was found that if the BGG is used, security would require additional staff, since this facility is currently unmanned. Therefore, the majority of Project deliveries will likely be processed at the ASB.

Security staff indicated that pre-cleared deliveries can take priority over other deliveries at the station. Calling ahead to advise of a pre-cleared delivery arriving will greatly expedite time saving entry on to the Project site.

Normal Processing at the Auxiliary Security Building

At the ASB, security will allow the truck to enter and then conduct a complete physical inspection of the truck (cabin search, swabs, etc.). This will typically take about 5-10 minutes; the same amount of time it takes to process the truck driver through security, which is well within the target goal of 30 minutes or less to process a delivery truck for the Project. Once the truck contents are checked and approved, security will lock up the truck, seal it, open the gate and allow the truck into the protected area. From the ASB, the truck will proceed to the appropriate delivery / laydown area.

Security staff noted that the ASB is not as busy after 4:00 PM, and is typically open until 8:00 PM. Therefore, Vendors are encouraged to schedule expedited deliveries in the late afternoon, which are off-peak hours for the ASB to reduce delivery bottlenecks and allow for faster processing during non-peak, low delivery traffic times.

5.3 Unloading Areas for Delivered Materials

For materials delivered to locations inside the powerhouse, the truck driver will proceed to the west side of the protected area at Unit #1. On the west side of the powerhouse there is a roll-up door that could accommodate large truck deliveries. Consideration may need to be given to modifying this roll-up door to a Ray-Tech style door. This is also in the vicinity of a proposed personnel/equipment elevator for Project work on the turbine floor. Materials could also be unloaded at this point for ease of operation.

Consideration should be given to constructing a weather enclosure (i.e., vestibule) to accommodate personnel entry/exit and monitoring, truck door, hand and foot or portal monitors, and equipment entry at the west entrance of Unit #1. The delivery of refurbishment equipment will likely occur via closed and sealed vans or trailers with hinged sides. There will need to be a way to unload trucks without constructing a truck level dock. An assessment of the impact to the running units will need to be made to proceed with this initiative.

Vendors will be responsible for completing quantity and verification checks, as well as bagging and tagging components, where appropriate. The truck driver will bring the materials to the Vendor's point of use (i.e., workface, lock up, storage area) within the Refurbishment Island.

An alternative solution that could be considered to alleviate personnel traffic during the unloading of deliveries is to have materials delivered to the Unit 4 east roll-up door and personnel continue to enter the plant at Unit 1. This option would necessitate the construction of vestibules at both roll-up door locations on Unit 1 and Unit 4.

Figure 24 illustrates the path of material flow on site.

Figure 24 - Material Flow



5.4 Removing Materials from the Site

Given that minimization of waste and packaging is the responsibility of the Vendor, it is appropriate for Vendors to reduce packaging where appropriate and return any remaining packaging with the same Vendor delivery truck prior to off-loading. Return shipments could be incorporated within delivery schedules.

There is a need for the Radiation Protection Department to have a dedicated Radiation Protection crew to prepare UTP's for shipping. All vehicles must leave the site via the ASB due to the need to go through the Exploranium monitoring equipment.

5.5 Material Flow Actions and Recommendations

Table A3 summarizes the actions and recommendations resulting from the discussions on material flow for the Project. The proposed issue owners can also be found in the table, located in Appendix A.

5.5.1 Material Flow Actions

The following 4 actions resulted from the discussion concerning material flow.

Action #1:

Material being moved as part of the Refurbishment Project could exceed the 70-tonne bridge weight limit for the Holt Road and Park Road bridges. An alternate strategy needs to be communicated to the Infrastructure/MOT team so that appropriate alternatives can be reviewed in a timely manner for material that needs to be moved which exceeds these bridge weight limits.

If there is material that needs to arrive/depart the DNGS site which exceeds the bridge weight limits, then other options for shipping/receiving of these heavy materials needs to be developed.

Action #2:

Vendors need to supply any Refurbishment Project materials with appropriate history and equipment data so that the information can be appropriately populated in Passport to an agreed standard. OPG receipt inspection is to be confirmed not required or an equivalent process needs to be established.

If the Vendors supply all the necessary procurement and QA documentation with the materials being delivered, then inspection of material receipt can be expedited. If not, then the part/equipment is placed on hold, and consequently the work related to that part/equipment could be delayed. OPG Supply Chain will need to specify whether they will provide final acceptance of materials on site, or whether they will accept the history docket provided by Vendors for entry into Passport.

Action #3:

The Manager of Security is to confirm whether site deliveries related to the Refurbishment Project which are pre-cleared can be processed in 30 minutes or less.

Security staff are to confirm that Project deliveries that can be adequately pre-screened/pre-cleared, can be processed such that shipments can be delivered in 30 minutes or less.

Action #4:

The Manager of Security is to confirm that no guardhouse stops will be in effect at the Holt Road and Park Road entrances, and that the Bill Gearing Guardhouse will not be utilized. All site deliveries will access the site through the ASB security post.

Security staff are to confirm that no additional security checkpoints will be installed for deliveries coming to the DNGS site, and that deliveries for the Project will be processed through the ASB location.

5.5.2 Material Flow Recommendations

The following 9 recommendations resulted from the discussion concerning material flow.

Recommendation #1:

It is recommended that all work orders being written to address the Balance of Plant Valve Maintenance scope assume cutting and replacing of valves as opposed to inspecting and repairing them. Inspecting and repairing valves requires having appropriate lead times for parts. Relief valves are intended to follow the existing program for maintenance.

By cutting out and replacing valves, the maintenance effort is simplified by reducing discovery work to a minimum and is quicker to perform. It also reduces the need for shop space to inspect, repair or rebuild valves.

Recommendation #2:

Since radio frequency identification (RFID) can serve multiple purposes, it is recommended that this technology (or an equivalent one) be explored for use in tracking all material, people & equipment related to the Refurbishment Project so that accurate real time information can exist. Additional review/testing will be required with the appropriate stakeholders.

This would facilitate not only materials tracking on site, but also personnel. Personnel tracking by RFID could be helpful for security and accounting purposes in the event of an emergency. The appropriate IT and Operations review would be required to ensure the RFID solution does not interfere with the safe operation of the plant.

Recommendation #3:

It is recommended that improvements be made once the ASB delivery strategy is confirmed so that the location can better accommodate a staging lane for Refurbishment delivery vehicle shipments. The intent of this staging lane is to ensure that the Exploranium does not back up with delivery vehicles.

In addition to pre-screening/pre-clearing Project deliveries off-site, a truck staging lane should be implemented to enable the pre-cleared trucks to by-pass other trucks queued at the ASB for processing. This would ensure deliveries for the Project arrive in a timely manner.

Recommendation #4:

It is recommended that Security reviews and recommends an appropriate OPG off-site location to pre-clear Refurbishment site delivery shipments prior to on-site arrival, to prevent bottlenecks.

An off-site warehouse or alternate location for pre-screening and pre-clearance of Project deliveries is needed to expedite shipments to the work location once they arrive on the DNGS site.

Recommendation #5:

It is recommended that a deliveries strategy be reviewed using the Bill Gearing Guardhouse for scheduled concrete deliveries, small truck deliveries and pre-cleared shipments, if deemed appropriate to provide site delivery efficiencies to the Refurbishment Project.

As an alternate means of expediting Project deliveries on-site, a strategy involving the Bill Gearing Guardhouse should be reviewed. This would remove pre-cleared shipments from the regular stream of deliveries at the ASB and facilitate access to the site through an alternate route.

Recommendation #6:

It is recommended that all site deliveries related to the Refurbishment Project be just in time (JIT) deliveries, no more than 48 hours in advance. Regular site deliveries are not pre-cleared for the ASB entrance during normal activities. Low volume off peak times (4:00-8:00 PM), could be used to expedite Refurbishment non pre-cleared deliveries. No Refurbishment deliveries are scheduled after 8:00 PM.

Just in time deliveries will reduce the amount of material storage on site, which in turn will make material flow on-site more manageable. Between the hours of 4:00 PM and 8:00 PM, the ASB experiences fewer truck deliveries. As such, the Project could target non pre-cleared deliveries for this time window to expedite processing (since security staff are off peak demand during this time). Deliveries related to the Project should not be allowed after 8:00 PM, since it will have impacts on security staffing and will become more costly for the Refurbishment Project.

Recommendation #7:

It is recommended that a contract strategy be developed for Refurbishment that includes direction for Vendors to de-package materials off-site (at the vendor's facility) where practical to improve efficiencies. If this is not practical, it will need to occur at the west delivery entrance, so that it remains with the delivery truck.

In an effort to reduce material packaging waste on-site, Vendors should de-package materials off-site where practical. If this is not possible or practical, then unwrapping would need to occur at the west side powerhouse entrance near the truck entrance so that packaging can remain with the truck prior to off-loading, and ultimately exit the site with the truck, as opposed to staying on-site and becoming part of the station waste streams with significant cost implications. Non-combustible totes may be utilized for material deliveries to reduce packaging entering the Refurbishment site. It is recognized that packaging that supports the integrity of equipment or material handling during storage will not be removed.

Recommendation #8:

It is recommended that the contract strategy for Refurbishment Vendors ensure a logistics person is available, or forms part of their respective teams, for deliveries and any coordinated on-site repair/replace efforts that maybe required during the pre-planning/execution phase.

Vendors should employ or contract a logistics person to coordinate logistics and deliveries both to and from the site. This would also optimize the flow and storage of material while on the DNGS Refurbishment site.

Recommendation #9:

It is recommended that a contract strategy be developed for Refurbishment that includes Vendors providing security cleared/orange-badged delivery drivers for site Refurbishment deliveries which would reduce the need for Radiation Protection/Security escorts on site.

Vendors should have a small pool of drivers which are teamsters, security-cleared and orange-badged to allow on-site movement without an escort. This would also free up security staff to focus on other things. By having a small pool of qualified drivers, the drivers will eventually become known to DNGS security staff, further facilitating/expedited Project deliveries and improving efficiencies with obtained site familiarity.

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6.0 SITE LAYOUT

Summary

Following the discussions about personnel flow, shops and work spaces, and material flow, the overall site layout was reviewed to determine whether any conflicts existed with respect to the anticipated use of the site for the Project.

The following issues / items were identified for further consideration / confirmation.

- To separate truck deliveries from car traffic on site, consideration should be given to the feasibility of extending Holt Road straight south (to the east of the existing Used Fuel Dry Storage Buildings). Trucks could then proceed straight south on Holt Road and make a right-turn near the south end of the site to proceed straight west toward the ASB. This would segregate trucks from cars in the congested area north and east of the ESSB.
- An existing warehouse located near the DNGS site should be explored for its potential use as a staging area for pre-inspection of truck deliveries to the DNGS Refurbishment site. An x-ray machine may still exist in this warehouse. If so, it may make for an ideal staging and material storage area. Alternatively other options should be explored.
- Even though refurbishment deliveries are intended to occur via closed and sealed trucks, some consideration should be given to designating an on-site truck search area to facilitate inspections of deliveries that arrive in unsealed pick-up or flatbed trucks.
- Trailers have been identified on the campus plan to the northwest of the proposed WSOB. The trailers outside the WSOB may be needed for Administration purposes only, but should be kept on the campus plan for other contingency purposes and contractors.
- Vendors will need to assist in the control of coloured parking tags for their refurbishment workers.
- Bulk storage is needed on-site for approximately 20 land/sea containers containing:
 - Scaffolding (approximately 8 containers, based on Bruce Nuclear Generation Station operating experience)
 - Re-usable insulation (approximately 2-4 containers)
 - Handrail/piping/equipment (approximately 2-4 containers)
 - Miscellaneous inventoried items (approximately 4 containers)

6.1 Site Layout Actions and Recommendations

Table A4 summarizes the actions and recommendations resulting from the discussion on site layout and construction for the Project. The proposed issue owners can also be found in this table, located in Appendix A.

6.1.1 Site Layout Actions

The following 7 actions resulted from the discussion concerning site layout and construction.

Action #1:

An integrated review will be conducted of other P&M/Project work activities outside of the Refurbishment Project that will be undertaken at the same time as the Refurbishment Project to validate throughput of construction resources in this work flow analysis.

There is the potential for a spike in short term work (refurbishment project, other station activities). During this spike in work, there is a need to balance out the work between refurbishment, outages and other station activity to minimize the amount of additional workers on site.

Action #2:

The Construction Manager is to confirm that the Ontario Ministry of Transportation (MTO) will complete its work at the Highway 401 and Holt Road interchange by the end of 2015. The intent is to communicate the completion date, and to track the MTO's progress with respect to OPG's Refurbishment Project timelines.

If the MTO's work at the Highway 401 and Holt Road interchange is not completed by 2015, then OPG will need to have contingency plans in place regarding access to the site for Project deliveries (which are anticipated to use the Holt Road interchange).

Action #3:

The Maintenance Manager will verify the definition of "In Service" for PWU staff performing PM maintenance work during the Refurbishment Project as it relates to terms of work assignments and potential labour issues with construction workers.

There is a need to clarify the equipment "in service" definition as it pertains to Maintenance work so that there are no jurisdictional conflicts between BTU and PWU workers.

Action #4:

The Director of Infrastructure must ensure any Hydro One plans to build an additional transformer station is reflected in the Campus Plan. Also, tower alignments need to be taken into account on the existing campus plan to ensure the space allocation is adequately understood.

This relates to the expansion of the switchyard by Hydro One. If tower alignments are not adequately allocated on the campus plan, there may be impacts on the future planning of OPG facilities at the DNGS site.

Action #5:

The Project Manager of Fuel Handling will confirm that ES MSA Vendors will be used for Fuel Handling and Power Track Maintenance as part of their Refurbishment contract strategy.

This means that ES MSA Vendor workers would be used for Fuel Handling Project work as opposed to other contractor workers or PWU workers. The intent of this action is to determine the number of contracts and companies involved in the Project.

Action #6:

The Project Manager of Balance of Plant will confirm that ES MSA Vendors will be used for the Balance of Plant Maintenance as part of their Refurbishment contract strategy.

This means that Vendor workers would be used for balance of plant work as opposed to other contractor workers or PWU workers. The intent of this action is to determine the number of contracts and companies involved in the Project.

Action #7:

The Project Manager for Security Projects will confirm heated concrete/stairwell pathways will be installed in the west parking lot to help address winter ice/snow safety issues.

To address any slip/fall issues related to snow/ice buildup during the winter, heated stairwells will be installed at appropriate locations in the new parking areas to the west/northwest of the WSOB.

6.1.2 Site Layout Recommendations

The following 7 recommendations resulted from the discussion concerning site layout and construction.

Recommendation #1:

It is recommended that an entry vestibule be constructed at the west side of the powerhouse at the Unit 1 roll-up door for the construction staff entrance/exit and material loading/unloading at the east side of the Powerhouse at the Unit 4 roll up door.

A vestibule would ensure that delivery trucks are sheltered while conducting unloading activities. The area would also provide space for the significant number of construction workers entering and exiting the powerhouse at this location. The outcome of this recommendation may show that Unit 1 is best used for personnel entry and Unit 4 for material deliveries.

Recommendation #2:

It is recommended that discussions with Durham Region Transit be undertaken regarding the potential for new/modified transit routes to service the DNGS site via Park Road or Holt Road. On-site shuttles maybe considered as part of this initiative to improve efficiencies.

To reduce the number of vehicles coming to the DNGS site, consideration should be given to the potential for shuttles or public transit to service the site. Shuttles between the Darlington Energy Complex, the General Motors Building and the DNGS site could be considered to address the need to transport people between the sites, and alleviate further demands for parking at the DNGS site.

Recommendation #3:

The Maintenance Manager will review the use of space in the existing field located OCC (CSA/115 metre/Outside CRA) for optimum usage. It is recommended that this location be utilized by Operations for the Work Control Area which would result in the need to locate space for, and build, the field OCC in an alternate location.

Since Operations needs space for a work control area, the suggestion is to utilize the existing OCC space as it is centrally located near the existing Main Control Room. For this to occur, an alternate location for the existing OCC would need to be found and a strategy implemented for new construction or re-location.

Recommendation #4:

It is recommended that a contract strategy be developed for the Refurbishment Project where Vendors ensure that OPG Engineering approvals and a P.Eng. stamp is in place for all scaffolds above 10 feet. A sub-contracting strategy should also be determined for Vendor support (i.e., scaffolding, insulation, labourers – 1 per contractor or 1 service provider).

Vendors are recommended to obtain their own structural engineering review and sign-off (by a P.Eng.) of scaffolds over 10 feet in height. Otherwise, OPG civil engineering staff would need to be utilized to review and approve these scaffolds. If Vendors performed this function, it would alleviate the time required for OPG civil engineering staff to respond and improve efficiencies through “just in time” self-sufficiency.

Recommendation #5:

It is recommended that the Darlington Refurbishment infrastructure approvals include the use of the east entrance during the Project for specific requirements, including the best use of new and existing facilities, including east site ASB delivery access and Mechanical Maintenance construction fabrication shop locations.

The intent of this recommendation is to further investigate the viability of using the ASB as a cost savings measure once the Project progresses towards the eastern site of the protected area (i.e., Units #3 and #4). It is also intended to reduce costs associated with construction of new buildings by utilizing specific identified buildings currently on the DNGS site.

Recommendation #6:

It is recommended that a contract strategy be developed for Refurbishment where Vendors provide all care and control of their own transport and work equipment (TWE) / Material Handling equipment.

This recommendation would transfer the maintenance of TWE and material handling equipment for the Refurbishment Project to the Vendors. If OPG is required to do this, additional OPG staff and space (ventilated charging area) would be required for this function. Cost savings can be realized using “just in time” rental of TWE and material handling equipment managed by the Vendors.

Recommendation #7: -

It is recommended that a decision be made on the existing contract strategy for future Refurbishment construction work to be executed within the Execution Project Manager's scope of work. To the extent possible, the planned utilization of ES MSA Vendors for Balance of Plant / Fuel Handling / Steam Generator / other Projects needs to be determined.

This is a recommendation to consider maximizing the use of ES MSA Vendors for Refurbishment Project work as opposed to introducing other contractors where regular construction labour is needed on the Project. Specialty areas (i.e., Calandria Tubes/Turbines) would be exceptions to this case and there may be some other as the Project is further defined.

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7.0 CONCLUSIONS

The Work Flow Analysis study brought together the key players that will be performing the Refurbishment work including the Vendors in a collaborative setting with the intent to understand and make recommendations to maximize efficiencies in site layout and around personnel and material work flow. The team successfully identified a number of issues and opportunities for improvement.

The Work Flow Analysis Team concluded that the existing Campus Plan building location layout is appropriate from a work flow perspective given the existing Site layout and limited footprint for conducting a Project of this magnitude.

Actions and recommendations made in the Work Flow Analysis Report complement the existing Campus Plan from a work flow perspective and can be used to assist the Senior Management Team in developing a more comprehensive site space Campus Plan that includes both the Refurbishment Island inside the Plant as well as buildings currently located inside and outside of the Protected Area.

The Work Flow Analysis highlights a number of improvement initiatives in the areas of personnel flow, location of shop and work areas inside the refurbishment unit, alternate strategies for locating support shops, improvements in material flow and expediting materials to site, and it identifies potential locations for large laydown areas to support Refurbishment Infrastructure.

There are five alternative initiatives to support the requirement for shops and work areas during the Refurbishment Project. The alternatives include:

- **Vendors perform shop work at their respective off site Facilities**
- **Incorporate the use of the BTU work space cages at Darlington Unit #4 at 107.5, 92.5 & 87.7 metre elevations**
- **Incorporate the use of the existing Darlington Site Pipe Fabrication / Machine Shop (Building 302)**
- **Incorporate the use of the R&FR Annex (RIA) shops in the site plan if the decision is made to conduct Feeder preparations at off-site facilities.**
- **Execution of equipment such as breakers, relays and pumps at OEM shops where practical.**

These alternatives will be further evaluated during the action and recommendation completion stage of the Work Flow Analysis Report.

Additional findings concluded by the Work Flow Analysis Team not already highlighted in the Executive Summary of this report may be summarized as follows:

- **The West Security and Operations Building (WSOB) and the Refurbishment Annex (RIA) are adequately sized and located given the constraints of the site.**

- The only new construction recommended not previously identified in the Project Charter or the Campus Plan is a vestibule on the outside of the west side of the powerhouse at Unit #1.
- Although there will be minimal use of Project trailers outside of the protected area; they should be maintained in the Plan at this time.
- The size and footprint of in-plant shops required on the Project site has the potential to be reduced based on scope definition.
- The decontamination method of choice should be prioritized to review the use of the dry ice method of decontamination over traditional methods to reduce waste streams and costs associated with site implementation.

These initiatives have been detailed in the body of the report, and are summarized in Appendix A. Actions and Recommendations identified by the Work Flow Analysis Team should be reviewed and if accepted by the Management Team, assigned and tracked for disposition using existing systems such as Asset Suite Management Action Tracking (formerly known as Passport) with Owners identified and target completion dates agreed to.

The contingency office space identified in the In-Station Infrastructure Project Charter D-PCH-09701-10015 will not be part of the Conceptual Design effort going forward since the Work Flow Analysis Report makes the assumption that the existing Campus Plan Buildings (WSOB, DEC, RIA) have an adequate number of offices planned for the Refurbishment Project.

The In-Station Infrastructure Project will address the final scope of the Shops & Work Spaces Project from the output of the Work Flow Analysis Report and identified in Charter D-PCH-09701-10015 during the Conceptual Design phase.

APPENDIX A

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Appendix A

Tables A1 through A4 identify a number of assumptions, actions and recommendations that were identified, through team discussions, regarding personnel flow, shops and workspaces, material flow and site layout.

Table A1 – Personnel Flow Assumptions, Actions and Recommendations

Reference	Disposition	Category	Owner Position	Owner Name	Agreed TCO	Key Word Identify	ISSUE
1	Assumption	P	N/A	N/A	N/A	Labour	Existing Refurbishment staff numbers are assumed to be accurate for the analysis undertaken in the Work Flow Analysis report. A more defined scope of work is required for OPG to finalize the actual Project construction staff numbers.
2	Assumption	P	N/A	N/A	N/A	Labour	Staffing requirements for Darlington New Nuclear build construction labour has the potential to cause labour and schedule conflicts during the 10-year life of the Project. It is assumed that the New Nuclear build labour analysis is outside the scope of this report.
3	Assumption	P	N/A	N/A	N/A	Labour	Existing space for Vendors will be available in the WSOB/RIA for general foremen, front line managers and key staff required in the operating island. Pre-job briefings for construction staff will take place at the work site location.
4	Assumption	P	N/A	N/A	N/A	Washrooms	Based on current staff assumptions, additional washroom facilities will be required during the Project.
5	Assumption	P	N/A	N/A	N/A	Washrooms	Access and pathways to washroom facilities will be given priority over pathways for laydown space for material/equipment and material handling efficiencies.
6	Assumption	P	N/A	N/A	N/A	WSOB	Accommodations (serviced areas) for six contractor trailers outside the WSOB will be added.
7	Action	P	PM - Turbine	Todd Juszkowski		Turbine	The Turbine Project needs to determine the location and timing of space requirements in the Turbine Hall.
8	Action	P	PM Turbine	Todd Juszkowski		Turbine	A turbine lunch room needs to be built on the turbine floor on the 115 metre elevation to take advantage of work flow efficiencies. (Utilization of this facility by Balance of Plant workers during off hours/backshifts needs to be evaluated.)
9	Action	P	PM - Turbine	Todd Juszkowski		Elevator	A Building Trades Union (BTU) personnel/equipment elevator (including an operating teamster) needs to be installed and dedicated to construction staff working on the Turbine Project on the conventional side of the plant to benefit work flow efficiencies. A direct access route is needed from the WSOB to the turbine work location for BTU staff working in street clothing.
10	Action	P	Director - BOP	Scott Guthrie		Elevator	A BTU personnel/equipment elevator (includes an operating teamster) needs to be installed and dedicated to construction staff working on the Balance of Plant project on the south side of the plant at the reactor building hoistway to benefit from the work flow efficiencies.
11	Action	P	Campus Plan Manager	Paul Gorys		Washrooms	Washroom facilities need to be added to support the R&FR and Balance of Plant radiation construction staff from Vendors from the site south entrance.
12	Action	P	Campus Plan Manager	Paul Gorys		Washrooms	Washroom facilities need to be added to support the Turbine and Balance of Plant non radiation construction staff from Vendors from the site north entrance.
13	Action	P	Operations Manager	Rita Chatterton		Accounting Areas	Radiation/Emergency/Fire Assembly and Accounting areas need to be clearly designated in the Island plan.
14	Action	P	Manager Rad Protection	Scott Stafford		Monitors	Develop a plan to add hand and foot monitors to the Refurbishment site where needed. The correct number of hand and foot monitors required to enter the powerhouse and adequately exit the powerhouse needs to be determined.
15	Action	P	Manager Rad Protection	Scott Stafford		RF Zoning	Confirm all proposed zoning changes with the Manager of Radiation Protection for "Go/No Go" decisions currently under consideration.
16	Action	P	Construction Manager	Robin Granger		WSOB	Station site space needs to be available for BTU construction staff hard hats/gloves and other personal protective equipment (e.g., harnesses, etc.).

Table A1 – Personnel Flow Assumptions, Actions and Recommendations

Reference	Disposition	Category	Owner Position	Owner Name	Agreed TCD	Key Word Identity	ISSUE
17	Action	P	Campus Plan Manager	Paul Gorys		WSOB	An alternate snow removal and dumping area plan needs to be considered to alleviate parking supply constraints (e.g., DNGS soccer fields/off site), since available WSOB area parking can be reduced by 20% during the winter due to snow storage.
18	Action	P	Manager Maintenance	Chris MacLachlan		Station Support	Station Operations and Maintenance input is needed into the Refurbishment Project at some frequency to alleviate organizational stresses (coordination, communication and alignment between the Refurbishment Project and Site Representatives).
19	Recommendation	P	VP Project Execution	Mark Arnone		Information Center	The DNGS Information Center should be used for Vendor training during the Refurbishment Project for make up, re-qualification, computer-based training (CBT) or specific OPG auditorium training to improve work flow efficiencies. (This initiative is exclusive of Initial/general training.)
20	Recommendation	P	Manager Rad Protection	Scott Stafford		Information Center	The DNGS Information Center should be utilized for Vendor issuance of TLD's and Initial-Final Whole Body Monitoring (WBM) to improve work flow efficiencies. This initiative would include the evaluation of the benefits of installing a Whole Body Monitor in this location.
21	Recommendation	P	Manager Rad Protection	Scott Stafford		RAD Clothing	Reactor building vault contamination reduction may allow for easier access by BTU trades staff, improving work flow efficiencies. An evaluation should be made to determine if the reactor building can be "browns free" following the Calandria Tube (CT) removal.
22	Recommendation	P	Manager Rad Protection	Scott Stafford		EPD's	Need to evaluate the issuance of EPD's from a central radiation office location near the south reactor building staff deployment area with a bias to deploy EPD's to construction work locations as needed to improve efficiencies. The issuance of EPD's at the RIA building should also be considered by Radiation Protection as part of this initiative.
23	Recommendation	P	Manager Rad Protection	Scott Stafford		Staff Deployment	Need to evaluate how Radiation Protection personnel can be integrated with Vendor workers to improve work flow efficiencies for BTU construction staff.
24	Recommendation	P	Manager Rad Protection	Scott Stafford		Trailers	Vendors recommended that the preferred location for the Radiation Protection Control Office is in (2) trailers (Double Wide) located near the R&FR staging area south of the reactor building air lock.
25	Recommendation	P	PM R&FR	Tom McCrory		Trailers	Vendors recommended that the preferred people staging area for R&FR workers are in (2) trailers (Double Wide) located south of reactor building air lock. An alternate R&FR worker staging/jump & benches area located outside the reactor building containment lock is also required. Vendors also recommended the R&FR Command Center be located in one trailer (1) positioned south of the rear building.
26	Recommendation	P	Director - BOP	Scott Guthrie		BOP Scheduling	To maintain continuity of work and to optimize the BTU labour within the Vendor workforce, a review is recommended which looks at potential economies of scale & scheduling window opportunities to reduce labour issues while executing Balance of Plant activities during normal Station Outages (i.e., BOP = JOG JAR in specified windows).
27	Recommendation	P	Operations Manager	Ron Chatterton		Work Protection	Worker efficiency gains can be realized through utilizing electronic sign-on for Work Authorization & Work Protection. It is further recommended that an evaluation be completed on the use of video communication in specific areas for work flow efficiencies where deemed appropriate.
28	Recommendation	P	PM Islanding	Marc Palmer		WSOB	Designated walkways are recommended to improve work flow efficiencies through the Powerhouse to/from the RIA building & WSOB to reduce monitoring and wait times.
29	Recommendation	P	Campus Plan Manager	Paul Gorys		WSOB	Need to evaluate designating space for both Visitor & "Kiss & Ride" parking during DNGS Refurbishment near the WSOB entrance on the campus plan (i.e., need to address parking requirements for meeting attendees/external guests and construction worker drop off).
30	Recommendation	P	Director Security	Claude April		WSOB	Recommend that parking for the Refurbishment Project will be first come, first served in the lots to the west and northwest of the WSOB. It is further recommended that specific colour parking tags for Refurbishment Vendors and staff be issued (to identify all staff directly linked to Refurbishment).
31	Recommendation	P	VP Project Execution	Mark Arnone		Labour	For work flow efficiency reasons, it is recommended that a no smoking policy on site (no smoking areas) be evaluated. Negotiations and policy strategy are to be determined.
32	Recommendation	P	VP Project Execution	Mark Arnone		Labour	For work flow efficiency reasons, it is recommended that a review be undertaken of the site shower policy for construction staff, amend/negotiate changes as needed. (Showering is mandatory for all radiation work. For all other types of work, showering would be done on the employee's own time).
33	Recommendation	P	VP Project Execution	Mark Arnone		Labour	For work flow efficiency reasons, it is recommended that an evaluation be undertaken to assess the potential for a "no blues/dress ensemble" policy for non-radiation work on the Turbine and Balance of Plant work projects. Instead, work would be executed in street clothing.

Table A1 – Personnel Flow Assumptions, Actions and Recommendations

Reference	Disposition	Category	Owner Position	Owner Name	Agreed TCD	Key Word Identity	ISSUE
34	Recommendation	P	VP Project Execution	Mark Arnons		Labour	For work flow efficiency reasons, it is recommended that an evaluation be undertaken of the need for OPG to provide Balance of Plant / Turbine STU construction staff with fire retardant safety personal protective equipment (Blues/Greens). If provided by OPG, laundering should fall under the accountability of Vendors. OPG would not be accountable once provision is complete.
35	Recommendation	P	VP Project Execution	Mark Arnons		Labour	For work flow efficiency reasons, it is recommended that an evaluation be undertaken regarding the provision of winter parkas/coats where coats are not provided by OPG. Construction worker coats are brought into the station from the WSOB and hung in a job site work box (Knack Box - work site field office).
36	Recommendation	P	VP Project Execution	Mark Arnons		Labour	For work flow efficiency reasons, it is recommended that an evaluation be undertaken regarding to review and validate the use of Security Access data for accounting/assembly information, brassing & Island entry and exit. It is expected that labour negotiations are needed to support this initiative.
37	Recommendation	P	VP Project Execution	Mark Arnons		Labour	For work flow efficiency reasons, it is recommended that an evaluation be undertaken regarding staggered start times and lunch times for Vendors on the Refurbishment Project. Also shift coverage terms & conditions should be reviewed/negotiated as part of this initiative.

Table A2 – Shops & Work Spaces Assumptions, Actions and Recommendations

Reference	Disposition	Category	Owner Position	Owner Name	Agreed TCD	Key Word Identity	ISSUE
1	Assumption	S	N/A	N/A	N/A	Scope	The DNGS Refurbishment DSR (Darlington Scope Request) list was presented by the Refurbishment Maintenance Manager to the Vendors to allow the team to review the scope of work in relation to shop requirements. The team concluded that the scope conservatively represents 60% of the Pickering Nuclear Generating Station RTS Balance of Plant Scope (DNGS EQ Project complete/stronger PM program/fewer valves per system).
2	Assumption	S	N/A	N/A	N/A	Shared Facilities	Previous Refurbishment/Maintenance Manager negotiations concluded that existing PWU Maintenance shops are required by Station Maintenance staff.
3	Assumption	S	N/A	N/A	N/A	Shared Facilities	Previous Refurbishment/Maintenance Manager negotiations concluded that existing PWU Maintenance shops will be utilized for specialty purposes only (RV's/Lapping/Other). An existing service level agreement (SLA) is in effect between the Site Maintenance and Refurbishment Maintenance Managers, and will remain in effect.
4	Assumption	S	N/A	N/A	N/A	Shared Facilities	Since existing non specialty PWU Maintenance Facilities are not available for Refurbishment as per the service level agreement (SLA), the DSR process is utilized for all additional requirements.
5	Action	S	Construction Manager	Robin Granger		BTU Facilities	The existing BTU Outage Fabrication shop spaces in caged locations on the 107.5, 92.5 & 87.7 metre elevation in Unit 4, and the east site BTU Pipe Fabrication / Machine Shop facilities should be utilized by the Vendors during Refurbishment to alleviate the need for additional structures/buildings. A Service Level Agreement needs to be developed/negotiated.
6	Action	S	Construction Manager	Robin Granger		BTU Facilities	Pending the outcome of the recommendation on both general tooling & calibrated / pressure boundary tooling, Vendors will need to develop contracting strategies for an on-site tool crib & calibration facility. A location and structure will need to be constructed to meet this requirement.
7	Action	S	Construction Manager	Robin Granger		Shared Facilities	A BTU/PWU negotiated agreement is required on shared shops for facilities like the Decontamination Facility and Hot Shop Facility. Jurisdictional issues need to be resolved in advance of the Refurbishment Project.
8	Action	S	Manager Maintenance	Chris Markewicz		Shared Facilities	Unit-by-unit site re-location of TWE & scaffold storage areas is required during Refurbishment. For the needs of the Refurbishment Project, it is suggested that TWE/scaffold storage items be located in the same locations as the Refurbishment Outage. Some sharing of locations or a re-negotiated laydown agreement needed.
9	Action	S	Manager Maintenance	Chris Markewicz		Decontamination Method	To alleviate constraints on facility size and cost, a bias is needed to prioritize the "dry ice method" of decontamination (CO ₂ -Blast Method) for the required facility over the traditional wet/decontamination method. The dry ice method would result in low waste, no water, and reduced engineering tie-in requirements, as per Bruce Nuclear Generating Station operating experience.
10	Action	S	Manager Maintenance	Chris Markewicz		Site Space	If the recommendation to house the R&FR Command Center at the south entrance in a trailer is accepted, then room 203 on the 107.5 metre elevation becomes available as alternate space for Refurbishment laydown areas for material/equipment storage or the OPS work permit preparation area/Radiation Protection Teledose structure/BTU Tool Crib.
11	Recommendation	S	Manager Maintenance	Chris Markewicz		Decontamination	It is recommended that a contract strategy be developed for Refurbishment that includes a review of off-site decontamination opportunities to support the existing decontamination shop initiative with respect to Bulk Land/Sea can storage. This strategy would include the review of alternate storage/shipping containers that are transportation ready to support bulk transfer to and from an approved Vendor.
12	Recommendation	S	Campus Plan Manager	Paul Gorys		BTU Facilities	Since it is recommended that the BTU East Fabrication Shops be utilized during Station Refurbishment to alleviate the need for additional structures/buildings, the existing BTU Mechanical Maintenance Fabrication Shop should be reviewed to determine if any required upgrades are needed prior to Nuclear Refurbishment.
13	Recommendation	S	Campus Plan Manager	Paul Gorys		BTU Facilities	It is recommended that a concrete or gravel area be identified on the Campus Plan and a structure built (Tented Area/Covered) for bulk scaffold material delivery and storage, and for parking bulk land/sea containers for the Refurbishment Project.
14	Recommendation	S	R&FR PM	Ian McCrory		BTU Facilities (R&FR)	The R&FR Annex facility is currently exclusive to the R&FR Project for DNGS Refurbishment (including feeder preparation). It is recommended that the R&FR Project validate whether the vendor can execute feeder preparations at off-site facilities so that BTU construction staff can utilize the R&FR Maintenance Shops to alleviate the need for additional structures/buildings.
15	Recommendation	S	R&FR PM	Ian McCrory		BTU Facilities (R&FR)	It is recommended that the R&FR Project finalize its evaluation to decide the future location of the Retube Waste Processing Facility. This facility is currently planned for the area immediately east of the Unit 4 powerhouse. The decision is required to determine whether this space is available for other requirements (e.g., Bulk Land/Sea container storage).
16	Recommendation	S	Director - BOP	Scott Guthrie		Contract Strategy	It is recommended that a contract strategy be developed for all Breaker & Relay calibrations to be performed at off-site locations (Vendors/OEM/Other) to alleviate the need for additional structures/buildings.
17	Recommendation	S	VP Project Execution	Mark Reesor		Contract Strategy	It is recommended that a contract strategy be developed for Refurbishment that includes a bias for Vendors to execute maintenance shop work activities as much as possible at off-site work locations to improve efficiency, and to save on project costs (i.e., all new work/conventional preparations including equipment & valve scope).

Table A2 – Shops & Work Spaces Assumptions, Actions and Recommendations

Reference	Disposition	Category	Owner Position	Owner Name	Agreed TCD	Key Word Identity	ISSUE
18	Recommendation	S	VP Project Execution	Mark Arnone		Contract Strategy	It is recommended that a contract strategy be developed for Refurbishment that includes a bias for equipment from the protected area via UTP be repaired or reworked as much as possible off-site rather than on the east site fabrication shops to improve efficiency and to maximize savings on project costs.
19	Recommendation	S	VP Project Execution	Mark Arnone		Contract Strategy	It is recommended that a contract strategy be developed for Refurbishment that includes a bias for Vendors to supply all their own tools for the Project, so that an OPG tool crib is not required as per existing Vendor contract terms and conditions, and to improve efficiency and alleviate the need for additional structures/buildings.
Vendor	Recommendation	S	VP Project Execution	Mark Arnone		Contract Strategy	It is recommended that a contract strategy be developed for Refurbishment that includes a bias for Vendors to supply all their own calibrated/pressure boundary tooling under their Certificate of Approval for the Project so that an OPG central facility is not required, and to improve efficiency and alleviate the need for additional services, structures/buildings.

Table A3 – Material Flow Actions and Recommendations

Reference	Disposition	Category	Owner Position	Owner Name	Agreed TCD	Key Word Identity	ISSUE
1	Action	M	Construction Manager	Robin Grainger		Infrastructure	Material being moved as part of the Refurbishment Project could exceed the 70-tonne bridge weight limit for the Holt Road and Park Road bridges. An alternate strategy needs to be communicated to the Infrastructure/MOT team so that appropriate alternatives can be reviewed in a timely manner for material that needs to be moved which exceeds these bridge weight limits.
2	Action	M	Director Supply Chain	Gary Paterson		Configuration	Vendors need to supply any Refurbishment Project materials with appropriate history and equipment data so the information can be appropriately populated in Passport to an agreed standard. OPG receipt inspection is to be confirmed not required or an equivalent process needs to be established.
3	Action	M	Director Security	Claude April		Security/Deliveries	The Manager of Security is to confirm whether site deliveries related to the Refurbishment Project which are pre-cleared can be processed in 30 minutes or less.
4	Action	M	Director Security	Claude April		Security/Deliveries	The Manager of Security is to confirm that no guardhouse stops will be in effect at the Holt Road and Park Road entrances, and that the Bill Gearing Guardhouse will not be utilized. All site deliveries will access the site through the ASB security post.
5	Recommendation	M	Director - BOP	Scott Guthrie		Scope	It is recommended that all work orders being written to address Balance of Plant Valve Maintenance scope assume cutting and replacing of valves as opposed to inspecting and repairing them. Inspecting and repairing valves requires having appropriate lead times for parts. Relief valves are intended to follow the existing program for maintenance.
6	Recommendation	M	Manager Maintenance	Chris Mackenzie		SATM	Since radio frequency identification (RFID) can serve multi-purposes, it is recommended that this technology (or an equivalent one) be explored for use in tracking all material, people & equipment related to the Refurbishment Project so that accurate real time information can exist. Additional review/testing will be required with the appropriate stakeholders.
7	Recommendation	M	Campus Plan Manager	Paul Gorys		Security/Deliveries	It is recommended that improvements be made once the ASB delivery strategy is confirmed so that the location can better accommodate a staging lane for Refurbishment delivery vehicle shipments. The intent of this staging lane is to ensure that the Exploranium does not back up with delivery vehicles.
8	Recommendation	M	Director Security	Claude April		Security/Deliveries	It is recommended that Security reviews and recommends an appropriate OPG off-site location to pre-clear Refurbishment site delivery shipments prior to on-site arrival, to prevent bottlenecks.
9	Recommendation	M	Director Security	Claude April		Security/Deliveries	It is recommended that a deliveries strategy be reviewed using the Bill Gearing Guardhouse for scheduled concrete deliveries, small truck deliveries and pre-cleared shipments, if deemed appropriate to provide site delivery efficiencies to the Refurbishment Project.
10	Recommendation	M	Director Security	Claude April		Security/Deliveries	It is recommended that all site deliveries related to the Refurbishment Project be just in time (JIT) deliveries, no more than 48 hours in advance. Regular site deliveries are not pre-cleared for the ASB entrance during normal activities. Low volume off-peak times (4-8PM) could be used to expedite Refurbishment non pre-cleared deliveries. No Refurbishment deliveries are scheduled after 8:00 PM.
11	Recommendation	M	Director Security	Claude April		Security/Deliveries	It is recommended that a contract strategy be developed for Refurbishment that includes direction for Vendors to de-package materials off-site (at the Vendor's facility) where practical to improve efficiencies. If this is not practical, it will need to occur at the west delivery entrance, so that it remains with the delivery truck.
12	Recommendation	S	VP Project Execution	Mark Arnone		Contract Strategy	It is recommended that the contract strategy for Refurbishment Vendors ensure a logistics person is available, or forms part of their respective team, for deliveries and any coordinated on-site repair/replace efforts that may be required during the pre-planning/execution phase.
13	Recommendation	S	VP Project Execution	Mark Arnone		Contract Strategy	It is recommended that a contract strategy be developed for Refurbishment that includes Vendors providing security cleared/orange-badged delivery drivers for site Refurbishment deliveries which would reduce the need for Radiation Protection/Security escorts on site.
14	Recommendation	S	VP Project Execution	Mark Arnone		Contract Strategy	

Table A4 – Site Layout Actions and Recommendations

Reference	Disposition	Category	Owner Position	Owner Name	Agreed TCD	Key Word Identity	ISSUE
1	Action	CSL	Construction Manager	Robin Granger		People Flow	An integrated review will be conducted of other P&M/Project work activities outside of the Refurbishment Project that will be undertaken at the same time as the Refurbishment Project to validate throughput of construction resources in this work flow analysis.
2	Action	CSL	Construction Manager	Robin Granger		Infrastructure	The Construction Manager is to confirm that the Ontario Ministry of Transportation (MTO) will complete its work at the Highway 401 and Holt Road Interchange by end of 2015. The intent is to communicate completion date, and to track the MTO's progress with respect to OPG's Refurbishment Project timelines.
3	Action	CSL	Manager Maintenance	Chris MacKenzie		Labour	The Maintenance Manager will verify the definition of "In Service" for PWU staff performing PM maintenance work during the Refurbishment Project as it relates to terms of work assignments and potential labour issues with construction workers.
4	Action	CSL	Campus Plan Manager	Paul Gorys		Campus Plan	The Director of Infrastructure must ensure any Hydro One plans to build an additional transformer station is reflected in the Campus Plan. Also, tower alignments need to be taken into account on the existing site campus plan to ensure the space allocation is adequately understood.
5	Action	CSL	PM - Fuel Handling	Sorin Marinescu		Scope	The Project Manager of Fuel Handling will confirm that ES MSA Vendors will be used for Fuel Handling and Power Track Maintenance as part of their Refurbishment contract strategy.
6	Action	CSL	Director - BOP	Scott Gullivie		Scope	The Project Manager of Balance of Plant will confirm that ES MSA Vendors will be used for the Balance of Plant Maintenance as part of their Refurbishment contract strategy.
7	Action	CSL	PM Security Projects	Anthony Colella		WSOB	The Project Manager for Security Projects will confirm heated concrete/stairwell pathways will be installed in the west parking lot to help address winter ice/snow safety issues.
8	Recommendation	CSL	Campus Plan Manager	Paul Gorys		Security/Deliveries	It is recommended that an entry vestibule be constructed at the west side of the powerhouse at the Unit 1 roll-up door for the construction staff entrance/exit and material loading/unloading at the east side of the powerhouse at the Unit 4 roll up door.
9	Recommendation	CSL	Campus Plan Manager	Paul Gorys		Infrastructure	It is recommended that discussions with Durham Region Transit be undertaken regarding the potential for new/modified transit routes to service the DNGS site via Park Road or Holt Road. On site shuttles maybe considered as part of this initiative to improve efficiencies.
10	Recommendation	CSL	Manager Maintenance	Chris MacKenzie		Infrastructure	The Maintenance Manager will review the use of space in the existing field located OCC (CSA/115 metre/Outside CRA) for optimum usage. It is recommended that this location be utilized by Operations for the Work Control Area which would result in the need to locate space for, and build, the field OCC in an alternate location.
11	Recommendation	CSL	VP Refurb Execution	Mark Arnone		Contract Strategy	It is recommended that a contract strategy be developed for Refurbishment Project where Vendors ensure that OPG Engineering approvals and a P.Eng. stamp is in place for all scaffolds above 10 feet. A sub-contracting strategy should also be determined for Vendor support (i.e., scaffolding, insulation, labourers – 1 per contractor or 1 service provider).
12	Recommendation	CSL	VP Refurb Execution	Mark Arnone		Contract Strategy	It is recommended that the Darlington Refurbishment Infrastructure approvals include the use of the east entrance during the Project for specific requirements, including best use of new and existing facilities, including east site ASB delivery access and Mechanical Maintenance construction fabrication shop locations.
13	Recommendation	CSL	VP Refurb Execution	Mark Arnone		Contract Strategy	It is recommended that a contract strategy be developed for Refurbishment where Vendors provide all care and control of their own Transport and Work Equipment (TWE) / Material Handling equipment.
14	Recommendation	CSL	VP Refurb Execution	Mark Arnone		Contract Strategy	It is recommended that a decision be made on the existing contract strategy for future Refurbishment construction work to be executed within the Execution Project Manager's scope of work. To the extent possible, the planned utilization of the ES MSA Vendors for Balance of Plant / Fuel Handling / Steam Generator / other Projects needs to be determined.

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APPENDIX B

An aerial photograph of a landscape, likely a rural or undeveloped area. A prominent, light-colored, winding road or path cuts through the terrain, which appears to be a mix of fields and possibly some forested areas. The overall tone of the photograph is somewhat desaturated, with a mix of light and dark patches representing different land features.

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ASSUMPTIONS

PAUL GORYS – CHAPTER 1
APRIL 17TH

DISCUSSION

- Use new electronic Sign-On, for work protection and work authorization.
- Use Current Staff number estimates presented in the addendum to the Project Charter.
- Trades support is estimated as 40% of those supporting Pickering restart, or approx 650 incl R&FR. 49% is based on Darlington being a newer plant, having less valves, better PM program, EQ program already completed, most BoP scope is remove & replace.
- No Smoking policy yet to be determined
- Refurb R&FR – West/East entrances – make best use of new and existing facilities
- Vault will be cleaned for easy access – could be browns-free after calandria tube removal and before refueling, (however next unit refurb will start shortly after, so browns use will be constant)
- Maintenance shops may be located on-site or off-site eg: DEC or beyond
- Plan for “just in time” deliveries – no more than 48 hours in advance, preferably at night.
- Designated walkways between powerhouse, Annex and WSOB to reduce monitoring and wait times.
- Turbine Crew to have designated space on the turbine Floor
- Fuel Handling and Power Track will be ES-MSA Vendors
- RP (Rad Protection personnel) to be integrated into Vendor workforce and coordinate with site Rad Protection dep’t.
- Existing facilities are off limits (unless for specialty valve work as a cost-effective option to building a certified refurb facility)
- Use of the ASB and East Changeroom will be subject to DSR approval process
- Information Center to be used for introduction of personnel to site, WBM (whole body monitor), and CBT’s.
- Construction/Personnel Elevators to be installed: i) To turbine hall ii) In South reactor Hoist ways
- Preferred R&FR staging area will be in trailers south of the Refurb unit (to reduce travel time and mixing of jump teams if performed in Annex).
- Alternate staging area will be outside containment airlock (AL1).
- R&FR personnel would access Unit from the south, ie from the Annex.
- BoP personnel will enter the powerhouse from the west end of the main aisle.
- Bruce used 5 monitors at all major exit points. Confirm the required number of H&F Monitors and powerhouse access locations.

- Use of dedicated pathways from the powerhouse to WSOB could reduce wait times for monitoring, and possibly expedite lunch and break delays.
- Prioritize access to washrooms over material handling efficiencies
- BoP "Blues" policy to be determined. Assume that BoP perform Radiation work in Browns, BoP Non-Rad work will be in Civvies (or personal coveralls).
- BoP "fire-retardant Blues" policy to be determined
- Coats are to be hung in Vendor's Job Box, caged areas.
- Location of Vendor's caged areas to be determined.
- Trailers positioned South of the Reactor building will be used for R&FR PJB.
- BoP would locate trailers beside the WSOB for work assignments and PJB's, or,
- BoP would position smaller trailers beside the East Changeroom for GF's and Supervisors. Changeroom would be used for work assignments and PJB's
- RCC to be located in other trailers south side of the Reactor building – Annex is too far away for useful support or work clarification.
- Use of the "overhang" for crew lunches is discounted due to: required Zone 3 to Zone 1 monitoring requirements, difficulty in keeping work groups together, loss of control of trades personnel, loss of accounting control.
- Use of "overhang" is possible for staging personnel (R&FR). Work assignment area, Rad Protection issuing area, etc.
- Lunch area is to be the WSOB for all personnel other than the Turbine crew, who will have a dedicated lunch area on the turbine floor.
- Use of the Annex for lunches will shorten R&FR walk times, but will require a redesign of the facility or provision of a 3rd floor for lunchrooms, shower and change facility.
- Use of the ASB and East Changeroom (subject to DSR approval) can provide reduced travel times for refurb activity on Unit 3 & 4. Discretionary use of this facility could lead to scattering of refurb personnel, difficulty in accounting, etc.

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PARKING LOT

PAUL GORYS – CHAPTER 1
APRIL 17TH

DISCUSSION

- Contractors to Validate staffing numbers for Refurb office and trades staff. (Use estimates for now as Aecon does not have sufficient detail to finalize the numbers).
- Assemble a consolidated Project List to include all Station Activities, P/M work, Projects and MSA working on Refurb or other projects.
- Assessing Organizational Stress – Islanding Group to consult & maintain communications with Station Operations.
- Can the East Entrance (ASB) be used by BoP/ R&FR workers in the future?
- Opportunities to relocate shops (Consider East/West locations when going forward)
- Contractors to Share Decontamination areas
- Confirm Clothing – which groups need Browns, Blues, Greens, civvies, etc.
- Winter clothing: where will coats be kept in the powerhouse (Vendors lock up)
- Consider adding a 3rd Floor to the RIA in addition to use of Contractor trailers. This would add showers, change areas and lunch area to the Annex and eliminate travel to the WSOB for lunch. Annex would be self-sufficient for R&FR work.)
- Use of Turbine Hall Roof for Temp Offices – HVAC Units
- Shower Access – Amend Shower Policy. (ie: mandatory showers for Rad work, discretionary & on employee's own time for conventional work).
- Availability of Fridges and lockers in the WSOB for storing lunches, or on the Turbine floor for the T/G workers.
- Change Time - TBD
- Smoking Policy - TBD
- Parking Policy and Practices: Do tags need to be issued for specific lot access?
- Staging areas with benches are required next to the airlocks – vault entry jump area. This is to facilitate keeping the crew briefed and assembled prior to entering the vault.
- Temporary location for washrooms in the powerhouse for BoP, R&FR, T/G crew, etc. (Consider pre-assembled temporary washrooms plumbed into existing washrooms)
- Negotiate a washroom agreement. (Space is a challenge and we are not in compliance with Green Book regarding distance to and quantity of facilities.)
- Designate cross walks, and PPE-free routes
- Reduce Monitoring requirements from P/H to WSOB for lunch, breaks, etc by use of designated walkways?.
- Turbine Hall Lunchroom – can this be used for "clean" BoP workers on off-hours?.
- Consider locating the Whole Body Monitor in the WSOB vs the Info Center. (Info Center is to be the first point of contact with new workers to be processed on site.
- Determine Site Accounting process: Use electronic time clock to establish who is in & who is out. Other methods – use "brassing", Security access records, or other

electronic means.

- Assembly/Accounting area - Use of Security Access Data or other electronic data? Vendors to establish a primary and alternate assembly area for their workers. OP's to resolve the accounting issue as part of the Islanding Plan.
- Negotiate transition of BoP work to Station outage work if concurrent activities cause a bottleneck in resource availability, in the ASB if it is used regularly by BoP staff.
- Advance BoP activities as job jar work during outages?
- Tools policy: Who will supply and control tools? (Including all specialty tools)
- BoP – to supply tools for non-rad work?
- Resolve storage of tools, welding rod & pressure boundary tools...
- Management Strategy for tools, materials, pressure boundary materials to be determined: one common area vs. 1 area per Vendor.
- Shifts – Confirm # & opportunities (ie: use of staggered start times, 2-3 shifts for 24/7 operation)
- Will OPG supply Trades with safety equipment – Blues/Greens etc.
- Hard Hats – Confirm there is space for storage on the Station side of the WSOB. Also consider space for lockers, storage of boots, badges, other PPE and rad protection equipment.
- Will everyone receive Blues – to throw over Civvies, laundry would be the responsibility of the BoP worker.
- Whole body count move from Info center to WSOB?
- Consider making the Annex self sufficient to R&FR – provide Browns, lockers, showers and Lunch areas.

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CONFIRMED/CONSIDERED

MARTIN BROEKHUYSE –
CHAPTER 1 APRIL 17TH

DISCUSSION	
	<ul style="list-style-type: none">• Lunch Room Access - WSOB Lunchroom –Turbine Lunchroom made larger• Locker Assignments (individual or shared?)• Staggered Start times – This is an opportunity to reduce shift change congestion - Vendors to decide and verify• Showers – A licensing requirement for Rad workers. Available to everyone else on their own time. Presently the only refurb facility with showers is the WSOB, unless Annex is redesigned.• Presumed Dress Ensembles: R&FR worse case is Browns, BoP Rad worker: Browns, BoP conventional work: Civvies, SG: Browns, Fuel Handling: Browns, Turbine: (Non rad)- Civvies.• Confirm Trailer requirements, or a 3rd storey added to Annex – Allocation for more office space. Supervision requires a meet/greet area inside the powerhouse.• No 3rd Floor or WSOB trailers may be necessary if the entrance is from the east side of the protected Area.• Use of "overhang" for lunch area is not a viable option (zone 3 -> zone 1), may lead to loss of control of trades personnel, loss of accounting control• Use of the "overhang" in conjunction with a Zone 2 route could be used for Turbine crew lunches, freeing up space on the turbine floor for storage.

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OVERVIEW OF REFURB PROJECT

WORK GROUPS

MARTIN BROEKHUYSE –
CHAPTER 1 APRIL 17TH

DISCUSSION	
<p><u>Refurb Maintenance;</u> to continue work on Safety or Non Isolated equipment.</p> <p><u>Fuel Handling;</u> by BTU Trades – Rad Clothing Full Gear.</p> <p><u>RFR;</u> Vault, Waste Processing, staging, Transport and Decontamination areas – Rad Clothing Full Gear.</p> <p><u>BOP;</u> Conventional, Radiological, BTU/PWU for all 3 refurb years – Regular Clothing, no Blues.</p> <p><u>Other OPG;</u> PMS, Plant Ops, Interface, Civvies</p> <p><u>Turbine;</u> IMS - Blues</p> <p><u>Steam Generators (SG);</u> – Rad Clothing - Full Gear</p> <ul style="list-style-type: none">• * = Challenge <p>Note; * Mass Flow of refurb personnel will be construction Personnel, and independent of the station</p>	

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OVERVIEW OF REFURB PROJECT

**BREAK DOWN OF BOP – NON
RAD**

MARTIN BROEKHUYSE –
CHAPTER 1 APRIL 17TH

DISCUSSION	
<u>Morning:</u>	
Use of Park Road	
Park in NPA	
Enter site via WSOB	
Wear Civvies through WSOB	
Bring Jackets/Coats to Job box inside the Powerhouse	
Perform PJB – at the Workface	
<u>Lunch & Breaks:</u>	
Travel back to WSOB	
<u>Issues:</u>	
Work assignments will be given in the WSOB or in trailers adjacent to, to separate rad from non-rad worker streams prior to entering the WSOB. (see discussion below)	
Possibly eat lunch in the Powerhouse – use the Turbine crew lunchrooms if available.	

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OVERVIEW OF REFURB PROJECT

BREAK DOWN OF BOP - RAD

MARTIN BROEKHUYSE –
CHAPTER 1 APRIL 17TH

DISCUSSION

Morning:

Use of Park Road
Park in NPA
Enter site via WSOB – Lunchroom/Lockers –(Kit to include TLD)
Badge in
Drop off lunch
Change into Brown

Lunch & Breaks:

All workers return to the WSOB for showers (for rad work, as required) and lunch.

Route to the WSOB is via the main powerhouse corridor, monitor and exit at the west door.

Options:

BoP workers will obtain their work assignments, EPD's and Greenman support in the WSOB or in trailers (double size, one for each Vendor) prior to entering the WSOB. Then change as appropriate (rad vs non-Rad assignment), proceed to the work face for the PJB.

BoP activity Supervisors will need to have an allocated location either in this trailer or the WSOB.

If the East entrance is approved:

BoP workers would receive their assignments in the East Changeroom lunch area. Change and pick up PPR, etc in the change room (same process as workers are used now).

Change room lunchroom would be used for lunches and breaks.

Pre-Job's would be conducted at the work face.

Smaller trailers would be needed for supervisors.

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OVERVIEW OF REFURB PROJECT

BREAK DOWN OF R&FR

MARTIN BROEKHUYSE –
CHAPTER 1 APRIL 17TH

DISCUSSION
<p><u>Morning:</u></p> <p>Use of Park Road Park in NPA (designated new parking area – west of site) Enter via WSOB - Lunchroom and Lockers (personal Kit includes TLD) Badge in Drop off lunch Change Report to RIA (Annex) Get PJB Obtain Specialty Tooling Use walk ways to Unit 1 – 4, or Consider use of ASB Prepare for vault work and staging outside Airlock Obtain Plastics near vault</p> <p><u>Lunch:</u></p> <p>Go to WSOB for lunchroom and showers Washrooms – depends on location and availability</p> <p><u>Issues:</u></p> <p>Need to see Rad Protection, TLDs, EPDS, Rad Office Need to create One stop shopping (EPD) Possibility to perform pre-job in WSOB, or an area close to the vault Need Area for Supervision and Rad Protection to Meet and Greet their workers</p>

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OVERVIEW OF REFURB PROJECT

BREAK DOWN OF TURBINE

MARTIN BROEKHUYSE –
CHAPTER 1 APRIL 17TH

DISCUSSION
<p><u>Morning: (Similar to BoP – Non-Rad)</u></p> <p>Go Through CSA Bring Jackets/Coats to Job box inside the Powerhouse Perform PJB – at the Workface</p> <p>Turbine crew eats lunch in Turbine Hall floor</p> <p><u>Breakdown of REFURB MTNC</u> <u>PWU Plant personnel – (Planning and Tools)</u> 117 persons</p> <p><u>Morning:</u></p> <p>Use OSB Entrance Regular changerooms Does not have an effect on work flow</p>

APPENDIX C

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PHASE OF SHOPS & WORKSPACE

PARKING LOT

TODD TAYLOR – CHAPTER
2 APRIL 20TH

DISCUSSION	
	<ul style="list-style-type: none">• Refurb/ BoP still have not finalized or narrowed down their scope. Further decisions are based on assumptions regarding past refurb/ restart work.• Confirm who performs RVs• Chestnut Park Accord – verify “In service” definition for PWU PM work• Off site efficiencies, scope of work – undertaken in each step• For emergent Refurb work; determine cost effectiveness to build a new facility inside the fence or to rehab the existing pipe fab shop• Regular outage shop space• Identify the need/location for scaffolding (TBD)• Contractors to obtain Engineering approval for any scaffold above 10 ft• Storage areas for PPE (Personal protective Equipment)• Refurb will launder Browns but not Blues• Contractors will be responsible to provide and care for Blues (fire retardant or non)• Understanding of contracting strategy and potential impact – example Tool Crib, common storage areas• If Feeder prep can be done off-site, will Annex shop space be available for BoP?• Vendors should hire a logistics person to handle material movements and coordinate repair activities.• The RFR project's intent remains to use the Shop space in the RIA (Annex).

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PHASE OF SHOPS & WORKSPACE

ASSUMPTIONS

TODD TAYLOR– CHAPTER
2 APRIL 20TH

DISCUSSION

- RIA (Annex) is exclusive to R&FR use
- Existing maintenance shops are exclusive to station maintenance.
- Feeder preparation and R&FR work will be performed in the Annex
- Existing maintenance equipment may be needed for specialty valve work
- Conventional – Anything that can be done off site should be
- Assume existing contractor shops are available for mechanical work (outside the Island)
- All new work (equipment, materials, etc) and preparations are performed off-site
- Shop facilities are based on 60% of BoP scope from Pickering RTS: (Darlington is newer, fewer valves per system, better PM program, EQ program already finished).
- Breakers and Relay calibrations to be performed off-site
- If a piece of equipment needs to be removed from the Protected area for repair, it may as well be sent off-site as opposed to a satellite shop on site.
- Calibration Shops numbers and locations
- No jurisdictional issues in use of shops (BTW/PWU) to be shared
- Potential Dry Ice Cleaning/Decontamination App.
- R/V's are to be re-worked
- (most) other valves to be cut out and replaced
- Obtaining repair parts for valve rebuilding is a problem (lengthy, parts not available)
- Qualifying an R/V shop is difficult

Chapter 2 – Item # 2 from the Agenda
Meeting Minutes & Notes

PHASE OF SHOPS & WORKSPACE

**SPECIFIC ITEMS NOT PART OF
EXISTING CHARTER/CAMPUS
PLAN**

TODD TAYLOR– CHAPTER
2 APRIL 20TH

DISCUSSION	
	<ul style="list-style-type: none">• Bulk Gas and Welding consumables – Delivery and Storage protocols for contractors• Confined space work to be Coordinated by the Contractor, use SERM for rescue• No food truck service at the West side• SCR's for breakthrough events only – Contractors use internal reporting systems for other events• Tool Crib/ Tool calibrations – C of A. Vendors to audit each other's C of A's (same for pressure boundary procedures)• Welding consumables• Gas Bottle storage• PB (Pressure Boundary) Cages• Chem Cabinets• Coat storage• RPPE Storage and Lay down• Lunch areas in overhang (Balance of Plant) BoP• Add Robin Granger's "Un-Owned" list to the Report (ref: NK38-REP-33110-10099)

Chapter 2 – Item # 3 from the Agenda
Meeting Minutes & Notes

PHASE OF SHOPS & WORKSPACE

**SELECT SHOPS TO BRAINSTORM AND
REVIEW FOCUS SESSION**

TODD TAYLOR– CHAPTER
2 APRIL 20TH

DISCUSSION	PERFORM BREAKDOWNS ON THE FOLLOWING SHOPS THROUGHOUT THE DAY...
	<ul style="list-style-type: none">• Mechanical Shop• Electrical Shop• Civil Shop• Hot Shop• Clean & Contaminated Scaffolding• Work Control Permit Prep• RP Office Teledosimetry• First Aid Station• Safe Work Area Depot• Waste Handling Reduction• Methodology: Pick a shop, determine requirements, layout, work performed, engineering details (services, etc)

Chapter 2 – Item # 4 from the Agenda
Meeting Minutes & Notes

PHASE OF SHOPS & WORKSPACE

WALK TIME CHART - DNGS

DOUG BOYLE – CHAPTER 2 APRIL
20TH

DISCUSSION				
	From	To	Walk time	Comments
	ASB entrance door	ASB exit door	6 min, 10s	
	ASB exit door	Peewees	1 min	
	Peewees	Lunchroom (includes monitor)	1min, 30s	
	Lunchroom	Change room(exit door)	1 min, 35s	Add 10 minutes to change
	Peewees	U4	52s	
	U4	U3	1min, 55s	
	U3	U0	1 min, 20s	
	U0	U2	58s	
	U2	U1	1min, 16s	
	U1	exit door (includes monitor)	1min, 51s	West door
	U1 exit door (West door)	WSOB	1min, 45s	End of Fence
	Parking	WSOB	10 minutes	
	WSOB	RIA	3min, 5s	
	RIA	U1	1min, 10s	Door 1A
	RIA	U2	2min, 12s	Door 2A
	U1	U2	1min, 41s	Outdoor walk from doors 1A to 2A
	U2 outside door	U2 middle point in Zone 2	1min, 1sec	Includes hand and foot monitor
	U2 middle point in Zone 2	to outside U2 door 2A	1min, 30sec	Includes full body monitor
	U2	U0	1min, 40s	Outdoors (Door 2A to 0A)
	U0	U3	1min, 30sec	Outdoors (Door 0A to 3A)
	U3	U4	1min, 40s	Outdoors (Door 3A to 4A)
	U4	Peewee entrance	3min, 30s	Outdoors (Door 4A to Peewee)
	WSOB entrance door	WSOB exit door	6min,10s	Based on ASB
	Smoking area located south side beside Unit 3, Door 4A in front of Standby generator 4)			

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PHASE OF SHOPS & WORKSPACE

MECHANICAL SHOP

TODD TAYLOR– CHAPTER
2 APRIL 20TH

DISCUSSION	BoP/FH/SGs/Maintenance/Turbine/Layup-Islanding/Shutdown Cooling...
	<ul style="list-style-type: none">• Scope: Pumps, motors, ACU's, Valves and R/V's• Bruce OPEX: MM took over Plant Valve shop, all non-Rad work went off-site, UTP's were well coordinated and streamlined, anything other than U/A and sheet metal can be sent out for work.• Pumps and Valves are maintained by millwrights, often the same individual (don't make separate shops)• Size 100' x 50': some lathes (no mills), approx 10 workbenches, tables• Potential Locations: Similar to existing MA shop at Darlington• Use Former Annex location; Waste Reduction facility, (old) WTP location, new Mtce Facility, breakdown shop –• Satellite locations for: maintenance/ valve/ pump shop, welding/brazing area, Kalsai/ Viper/ Flowscan stations• Valves and R/V work to be kept separate for QA purposes• BTU Scope/Maintenance Scope:• Specialty needs for Turbine scope (Specialty equipment)• All valves that are out of service (steam path) will be BTU• Any valves that are in-service (moderator, liquid zone, safety) will be PWU• Assume all work and preparations are completed off site• Can valve specialists bring on-site trailers for valve work?• On site: Repair/Emergent/Outage work – Outside Refurb• Satellite: Machine Shop, Mechanical valve shop/pumps• Weld/Brazing Area – Kalsai – set up Viper Flowscan.• Hoisting and Rigging equipment Storage

Chapter 2 – Item # 5 from the Agenda
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PHASE OF SHOPS & WORKSPACE

**ELECTRICAL / CONTROL
MTCE SHOP**

TODD TAYLOR– CHAPTER
2 APRIL 20TH

DISCUSSION	
	<ul style="list-style-type: none">• Approx 400 sq ft required (20' x 20')• Satellite Electrical work area – tube bending• Instrument bench area• Power pack repair• Assume 3 Vendor calibration shops (1-3 areas) due to the need to separate 3 Vendor's QA programs (unless each Vendor signs on to the others)

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PHASE OF SHOPS & WORKSPACE

CIVIL SHOP

TODD TAYLOR– CHAPTER
2 APRIL 20TH

DISCUSSION	
	<ul style="list-style-type: none">• Sheet Metal and Insulation• Needs equipment for Insulation wrap: rollers, edgers, benders• Scaffolding Prep area (to cut tubing and planks, etc)• Painting area• Laborers require custodial equipment storage

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PHASE OF SHOPS & WORKSPACE

**HOT SHOP –
CONTAMINATED AREA**

TODD TAYLOR– CHAPTER
2 APRIL 20TH

DISCUSSION	
	<ul style="list-style-type: none">• Everyone except for R&FR is to share (eg: Contractors, PWU, ES-MSA Vendors, etc)• Machining (mostly Lathe/Mill/Drill press work)• Welding area• Bench work• Hoists• Hot Shop requires separate bays for: Shops, off-gassing, laydown, Decontamination• a 25' x 50' area can cover all 4 bays

Chapter 2 – Item # 5 from the Agenda
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PHASE OF SHOPS & WORKSPACE

**CLEAN & CONTAMINATED
SCAFFOLDING**

TODD TAYLOR– CHAPTER
2 APRIL 20TH

DISCUSSION	CLEAN SCAFFOLDING BULK
	<ul style="list-style-type: none">• Tented or pre-fab building (outside protected area)• Include storage and cut and prep area• Approx: 100' x 100' similar to Fukushima building• Locations: Lakeshore Road south of the Vacuum building, or near the ASB but out of the way <p>For clean scaffolding inside the plant:</p> <ul style="list-style-type: none">• South side of condensers, similar to existing plant use areas.• Cage or lay down approx 30' x 30'

DISCUSSION	CONTAMINATED SCAFFOLDING BULK
	<ul style="list-style-type: none">• Sea Cans (Decontaminated)• Gravel footing• Foot Print approx 100' x 100'• East or north of Vacuum building• R&FR – 100 Sea-Con options <p>Keep some contaminated scaffold materials in the powerhouse:</p> <ul style="list-style-type: none">• Inside the protected area by the steam generators• Inside the plant storage; 10' x 60' on the 87m or 92.5m Elevation

Chapter 2 – Item # 5 from the Agenda
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PHASE OF SHOPS & WORKSPACE

**WORK CONTROL & PERMIT PREP /
RP OFFICE TELEDISE / FIRST AID
STATION**

TODD TAYLOR– CHAPTER
2 APRIL 20TH

DISCUSSION	WORK CONTROL & PERMIT PREP
	<ul style="list-style-type: none">• Contact Kevin Wodzak (Refurb) for detailed sizes• Options; 100m el at the Refurb Unit – North side of corridor• 115m at the old OCC Location• 115' South side of Turbine Hall• Trailer South side of plant or west end• Possibly 2 locations (R&FR and BoP areas)

DISCUSSION	RP OFFICE TELEDOSIMETRY
	<ul style="list-style-type: none">• 2 Locations needed (for overlap of 2 Refurb Units)• 100m south side of the reactor building near R&FR Jump area• 107.5m or 100m in the main corridor (as per Charter drawing)

DISCUSSION	FIRST AID STATION
	<ul style="list-style-type: none">• Should be in the Protected area to accommodate an injury in Browns• Need an area with 100 sq foot space• 107m at the 4-Corners (existing first aid / Decontam room)• Review RIA (Annex) or WSOB for space for non-Browns First Aid station

Chapter 2 – Item # 5 from the Agenda
Meeting Minutes & Notes

PHASE OF SHOPS & WORKSPACE

**SAFE WORK AREA DEPOT
& WASTE HANDLING
REDUCTIONS**

TODD TAYLOR– CHAPTER
2 APRIL 20TH

DISCUSSION	SAFE WORK AREA DEPOT
	<ul style="list-style-type: none">• For storage/ dispensing of signs, barriers, etc.• Approximately 200 sq ft required (per Charter)• 100 or 107m near lay down area• 100' Across from the stairs RH T1-107 or 108

DISCUSSION	WASTE HANDLING/ REDUCTION Area
	<ul style="list-style-type: none">• Review CSA options• Existing facility?• Rad & Conventional transfer location required - approx 30' x 50'• Use small bins at each elevation (approx 4'x4' boxes) for crew to pick up daily• Options...• #1: 100 Level – Walk down/Review• #2: 107.5 – Walk down/Review• #3: 100' Room 103/104• #4: 87 South of FM Duct

Chapter 2 – Item # 6 from the Agenda
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PHASE OF SHOPS & WORKSPACE

DRY ICE PRESENTATION

ROCCO CANTILINI – CHAPTER
2 APRIL 20TH

DISCUSSION	See attached for full presentation



Dry Ice Cleaning/Decontamination

ONTARIOPOWER
GENERATION

Dry Ice Cleaning/Decontamination

What is Dry Ice Blasting?

- A relatively new cleaning process using solid CO₂ pellets. The pellets are made by taking liquid carbon dioxide from a pressurized storage tank and expanding it at ambient pressure to produce snow. The snow is then compressed with a die to make hard pellets.

Dry Ice Cleaning/Decontamination

The Process

CO₂ pellets/snow are propelled at a high velocity, impacting and thus cleaning a given surface. This is broken down into three specific steps.

Step 1: Energy transfer – knocks off the contaminant without abrasion.

Step 2: Micro-Thermal Shock – cold temperature (-79') of pellet creates thermal shock between surface contaminant and substrate (parent material).

Step 3: Gas Pressure – pellet upon impact goes from solid to gas (sublimation) rapid expanding gas forces contaminant from underneath substrate.

Dry Ice Cleaning/Decontamination

Benefits:

- Reduction of liquid waste stream in house.
- Reduce manpower hours required for decontamination and/or cleaning. (Cost Savings \$\$\$\$\$)
- Reduced worker dose/public dose.
- Reduced solid waste stream.
- Eliminates potential damage to machine parts and tools.
- Reduces used of hazardous chemicals – worker exposure and waste (non-toxic)
- In-situ cleaning – cleaned at source.
- More thorough decontamination/cleaning

Dry Ice Cleaning / Decontamination

Current Industrial Applications:

- Aircraft/aerospace
- Pulp and Paper
- Oil and Gas
- Printing
- Plastics and rubber industries
- Food Industry
- Marine
- Utilities

Dry Ice Cleaning/Decontamination

Possible Applications at OPG Radiological

- Equipment which requires rebuilding i.e. relief valves Scaffold tubing – currently 1600 linear miles stored on site.
- Contaminated, motors
- Heat Exchangers “boiler barc”
- Solid Waste Stream i.e. welding machine destined for the Bruce Nuclear Waste Facility
- Unit 2/3 Safe Storage Project i.e. decontamination of equipment and concrete structure.
- Fuel Handling

Dry Ice Cleaning/Decontamination

Conventional

- Electrical Switch gear
- Electrical motors “eliminate hot spots, greater equipment reliability
- Cleaning of oily residues
- Heat Exchangers
- Turbine blades/roots
- Generator Stator
- Paint removal

Dry Ice Cleaning/Decontamination

Path Forward

- Develop a “TEAM” of stakeholders (engineers, operations, maintenance)
- Benchmark against other Utilities (Nuclear) to determine current applications.
- Develop business case to determine feasibility of this application for OPG Nuclear

APPENDIX D



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Chapter 3 – Item # 2 from the Agenda
Meeting Minutes & Notes

MATERIAL FLOW

TODD TAYLOR– CHAPTER 3
APRIL 24TH

DISCUSSION	ASSUMPTIONS
	<ul style="list-style-type: none">• Materials will be Vendor supplied and inspected. OPG receipt inspection is not required.• Material must be in Passport• Vendor to provide OPG with Passport information for material history docket; how the entries are to be input is TBD. Populate material/equipment data to agreed standards• Vendors to provide designated Security cleared and Orange-Badged drivers to make the deliveries to Site and into the Powerhouse (avoids the need for rad/security escort on site).• Bill Gearing Guardhouse will be made available to Refurb for pre-cleared shipments• Site clearance can be processed in under 30 minutes per delivery• Vendors to remove packaging offsite (at Vendor's facility) where practical• Vendors to de-package sensitive materials at the loading bay (west roll up door). Packaging waste to be removed on the delivery truck.• Shipments to site are pre-cleared by security• Regular (non-cleared) deliveries to be made via the ASB at night (off peak times)

Chapter 3 – Item # 2 from the Agenda
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MATERIAL FLOW

TODD TAYLOR– CHAPTER 3
APRIL 24TH

DISCUSSION	PARKING LOT
<ul style="list-style-type: none">• Vendors to provide and maintain their own material handling equipment (lift trucks, cranes, etc)• Operating Machinery; care and control of TWE equipment• Site shipments are scheduled at night and evening time• Site to designate a Staging Area for pre-cleared trucks waiting for site access (final security and material checks to be completed here to expedite transit time through security gate)• Consider RFIDs for tracking, Care & Control of material and equipment• Retube waste reduction facility location• Consider concrete or gravel areas for land/sea containers for bulk storage (area tented/covered)	

Chapter 3 – Item # 2 from the Agenda
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MATERIAL FLOW

TODD TAYLOR– CHAPTER 3
APRIL 24TH

DISCUSSION	CONSIDER/CONFIRM
(no items on this discussion)	

Chapter 3 – Item # 3 from the Agenda
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MATERIAL FLOW

TODD TAYLOR– CHAPTER 3
APRIL 24TH

DISCUSSION	MATERIAL FLOW
	<p>OFF SITE (Prior to shipment):</p> <ul style="list-style-type: none">• Vendor supplies Material/Equipment/consumables/ plastic totes• Consider packaging materials; preplan to minimize transient combustibles or perform de-packaging where practical• Vendor receipts and stores supplies at an offsite facility• Segregated Pressure-Boundary material storage• Shipments to site are pre-cleared by security• Schedule "x" amount of shipments per day per Vendor• Dispatch Security Officer to Vendor/multiple Vendors• Vendor to keep materials in house until ready for a "just in time" shipment• Locations (of off-site storage) intended to be close to plant to facilitate security or warehousing inspection.• Vendor to provide security-cleared, Orange qualified staff to transport/deliver material/equipment into the powerhouse and to the work location (includes forklift etc...)• Resolve EPSCA and Labor jurisdiction issues regarding first contact of materials on site by Teamsters• Verify Security interface; ie: ensure lock or delivery truck have not been tampered with etc...

Chapter 3 – Item # 4 from the Agenda
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MATERIAL FLOW

TODD TAYLOR– CHAPTER 3
APRIL 24TH

DISCUSSION	OPG SITE – DELIVERIES ONTO SITE
	<p>MATERIALS ARRIVE ON-SITE:</p> <ul style="list-style-type: none">• From 401 to Holt Road (or Park Road) to east site• Arrival at ASB gate and joins line-up• Driver phones security to notify of arrival• Security drops the gate and vehicle physical inspection completed, contents checked and OK'd.• Security locks up the truck, opens the gate and allows the truck in• Proceed to the delivery location. For non-R&FR this will be the west roll up door to the main corridor.• Unload material at this point• Finalize de-packaging. Bag and tag components where appropriate.• Send waste packing out with the same truck. (Waste control responsibility is with Vendor)• Quantity, Verification completed by Vendor.• Bring materials to Vendor's point of use (workface, lockup, etc)• Reverse process for the truck to leave.

Chapter 3 – Item # 5 from the Agenda
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MATERIAL FLOW

TODD TAYLOR– CHAPTER 3
APRIL 24TH

DISCUSSION	OPG LAY DOWN AREAS
MATERIALS IN-PLANT:	
<ul style="list-style-type: none">• ISSUES: Materials brought in to plant• Materials to be removed from plant• Laydown areas for materials in/out• Material Tracking and counting	
<ul style="list-style-type: none">• LAYDOWN AREAS: new materials• Dis-assembled parts• MSA Vendor materials• Pressure Boundary segregation• Scrap materials clean/ contaminated	
<ul style="list-style-type: none">• Need multiple lockable caged areas for contaminated equipment (controlled)• Try 87m or 92m Elevation beside the CCW duct wall• Caged areas to be as close as possible to, or attached to the Hot Shop• Pressure boundary cages (approx 10' x 20') multiplied by number of Vendors• Look for space on 115m• Consumables cages (approx 10' x 20' x number of Vendors)• Flammables/Chemical/ HAZMAT storage cabinets need to be located close to shops; maintained by Vendors per OPG SATM requirements• Gang box, look for space on 87m elevation• TWE parking area	

Chapter 3 – Item # 6 from the Agenda
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MATERIAL FLOW

TODD TAYLOR & CHRIS
MACKENZIE CHAPTER 3
APRIL24TH

DISCUSSION	BULK STORAGE
<ul style="list-style-type: none">• Use Land/Sea containers• Vendor approved units for offsite decontamination• Est quantities:• Approx 6 - 8 containers of scaffolding (based on Bruce OPEX)• 2 – 4 containers for used insulation• 2 – 4 containers for handrail/ piping/ equipment• 4 containers "misc"• (total on site: approx 20)• Possible locations: south shore area, east annex, by vacuum building south	

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MATERIAL FLOW

TODD TAYLOR & CHRIS
MACKENZIE CHAPTER 3
APRIL24TH

DISCUSSION	REMOVING MATERIAL FROM SITE
	<ul style="list-style-type: none">• Maintain a dedicated RP crew to prepare UTP's (provided by the Vendors, working under DNGD Rad Prot'n)• Incorporate return shipments in twice a day shipping schedule• Use West roll-up door at 100m elev for drop off/pick up for Refurb 1&2• Stage vault waste near south side reactor doors.

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MATERIAL FLOW

TODD TAYLOR & CHRIS
MACKENZIE CHAPTER 3
APRIL24TH

DISCUSSION	OTHER
	<ul style="list-style-type: none">• Storage area for Vendors' QA binders & documents, multiplied by the number of Vendors

APPENDIX E



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Chapter 4 – Item # 2 from the Agenda
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Site Infrastructure Layout and Plan

MARTY BROEKHUYSE - CHAPTER IV
APRIL 26TH 2012

DISCUSSION	ASSUMPTIONS
	<ul style="list-style-type: none">• MTO to complete Holt Road/ 401 Interchange by the end of 2015• Holt Road is not expected to be a bottleneck to traffic arriving on site.• New build has been factored into the traffic studies.• Road construction will also improve the South Service road to the DEC• Holt/Park road Bridge repairs will ensure rating at 70 tons• No Refurb load to exceed Bridge rating• No security stops at Holt/Park Road (Security hut will have a manual barrier for emergencies only)• Hydro One will be expanding the switchyard east to Holt Road, and adding 3 new rows of transmission towers north, and one new set of towers east.• Parking; First come First served – Color tags for Parking• Parking, First come first serve• Total parking is 1750 in 4 new lots• 20% Reduction in Parking due to snow storage in the winter (alternate options; soccer fields and offsite areas)• Heated concrete stairs and pathway to be installed for walking to parking lots• Trucks can be expedited into the Protected Area within 30 minutes• No PJB training in the trailers, work assignments to be held in the trailers• EPD distribution – Centrally• RP Group 107 Elevation• Refurb Scope Control to coordinate all PM and maintenance work, breakdown repair of refurb unit equipment, all refurb unit project work. New work freeze date is Oct 2014 (scoping process similar to MA-0013).

Chapter 4 – Item # 2 from the Agenda
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Site Infrastructure Layout and Plan

MARTY BROEKHUYSE - CHAPTER IV
APRIL 26TH 2012

DISCUSSION	PARKING LOT
	<ul style="list-style-type: none">• Trades availability is a high risk (Cumulative risk of trades demands for Refurb, of New Build, possible Bruce Power work).• Car Drop off section in front of WSOB for car pools• Consider Worker mass transport (Clarington Bus or OPG shuttle service to DEC/ WSOB entrance)• Consider use of an electronic sign advising of parking spot availability per refurb lot• Visitors/ Management Parking spots (approx 50) near to the WSOB• Address Safety concerns – (Slips/Trips/Falls in parking lots), install heated stairs to upper levels• Parking issues are more problematic on the east side• R&FR work will be round the clock (24 hrs), BoP will be 2 shifts, T/G will be days only• Contractors to negotiate staggered starts for trades to spread out waves of workers arriving for work• Where will the workers "clock in" (ie: @WSOB, Annex, work face, etc?)• Consult with Health Physics to establish monitoring requirements from: Reactor bay to Unzoned area or staging trailers, and exit monitoring requirements from west aisle to unzoned area (route to lunch in the WSOB).• Plan use of BGG for small truck scheduled and pre-security cleared deliveries• Designate a staging area for semi trucks• Exploranium causes a back up of vehicles• Rad monitoring inconsistencies – query why Hand and Foot monitor is only located one way, Full body located south to the unzoned area.• Zoning challenges• No deliveries after 8:00pm• Retain Pipe Fab shop to accommodate Refurb Contractors (option; Vendor offsite)• Aecon's Plan Control – Retube Plant Cen, Permit Prep Aecon to approve Room 203 on 107.5 elevations.• TWE Parking Area for Forklifts etc... (Discussion with station for shared parking location and charging station for 6 devices)• Vendors to consider a dedicated Logistics person to facilitate deliveries, UTP,s etc.• Additional washroom facilities – use the Annex or add portable units plumbed into existing powerhouse washrooms

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Site Infrastructure Layout and Plan

MARTY BROEKHUYSE - CHAPTER IV
APRIL 26TH 2012

DISCUSSION

CONSIDER/CONFIRM

- Building a road behind UFDSF for use by trucks accessing the ASB
- Explore potential use of OPG-Forbes warehouse, located in Whitby off Thickson to stage and pre-inspect deliveries to Darlington.
- X-ray machine may still exist in this building. Infrastructure is already there.
- Is staging area and material storage available in this warehouse as well?
- Straightening out Holt road south of the railway bend to incorporate a road behind the WFSB's, to separate truck traffic from car traffic.
- Designate an on-site truck search area to facilitate refurb deliveries that arrive in unsealed pick-up or flatbeds.
- Showers/Change/lunch room in a new third floor in the Annex
- WSOB to accommodate Balance of Plant
- Use of Trailers in the west may not be essential for daily work if supervisors can be seated in the WSOB.

Chapter 4 – Item # 3 from the Agenda
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Site Infrastructure Layout and Plan

MARTY BROEKHUYSE - CHAPTER IV
APRIL 26TH 2012

DISCUSSION	SECURITY CONCERNS & OPPORTUNITIES
	<ul style="list-style-type: none">• X-ray the contents of the truck, everything that fits on a skid (unloading, x-ray and reloading)• X-ray is to take place at the warehouse (pre-clearing x-ray at warehouse)• Physical Inspection is still required for enclosed items by security and to prepare bill of lading (to the same standard as shipments to the Darlington warehouse).• Closed van/ trailer will be sealed by Security.• If the delivery vehicle cannot be sealed, then re-inspection on site is required, or the shipment must be escorted by a line of sight NSO (one per vehicle).• Drivers to be designated by the Vendor, be security-cleared, Orange II-Badged, Teamster-registered, regularly assigned so as to become familiar to Security.• Scheduled pre-cleared deliveries to take priority over other deliveries at the station (Fuel Rods are top priority)• Weekly/biweekly schedules can be arranged• Use ASB Sally port as intended• MSB / BGG has a Manual Lift Gate as a backup – not normally staffed by Security• Regular use of BGG will require an additional 4 NSO's per shift• Call ahead from warehouse for priority delivery – only one more NSO is needed• Main reason for present delays is improper sponsorship at site, or lack of security clearances, incomplete forms.• Interaction with driver for Inspection/Swabs/Cabin Search process – 5-10 minutes usually.• For Refurb Security could staff up for a safely and timely search with 2 more NSO's and process 2 - 3 vehicles at the same time.• 3 lane option... expand truck waiting area outside ASB by using diagonal parking• Pre-cleared vehicles can be expedited to the front of the line and processed ahead of regular deliveries.• All vehicles must leave via the ASB due to Exploranium monitoring requirement.• ASB is less busy after 4pm, but is typically open until 8pm. Take advantage of late afternoon deliveries.

- Additional shift at the ASB will require up to 10 NSO's to properly staff the Observation Post, operate the Sally port, conduct multi-lane vehicle searches.
- Vendors will need to assist in control of Trades parking tags for Refurb parking.

Unloading Strategy:

- Modify roll-up door at the West end of the powerhouse mail corridor to a Ray-Tech style door
- Construct a weather enclosure to accommodate personnel entry/exit and monitoring, truck door, Hand and Foot or Portal monitors, equipment entry.
- Deliveries of refurb equipment to be via closed and sealed vans or trailers, with hinged sides.
- Need a way to unload trucks without constructing a truck level dock.
- Mark a "PPE-Free" walkway from the west station entrance to the WSOB.

Re-Visit Personnel Flow:

- BoP trades estimated as 250 persons; approx 60% by day and 40% at night
- WSOB Lunchroom can hold 408 persons.
- WSOB Change rooms can accommodate 1000 men and 200 women.
- Supervisors will find a "quiet corner" in the station to conduct pre-Job Briefings and give work assignments.
- R&FR will conduct PJB's in the Annex lunchroom
- OCC will be in the Annex
- RCC to be in a trailer south of the refurb unit
- Balance of Plant have 240 seats available in the WSOB office area.
- G/F's, Foremen, Supervisors will be planning future week's work and so will not be entering the plant on a regular basis (so seating in the WSOB is acceptable).
- The Annex will have 46 office seats for BoP, 25 for supervisors and 6 for G/F's
- Approx 250 trades will need approx 25 supervisors and 10 G/F's (to manage trades groups of 10).
- Use the WSOB lunchroom for stand downs or general assembly area.
- Place 3 trailers south of the Refurb unit: A double trailer for staging vault jumps, RCC trailer, Rad Protection office and staging area.
- Optimize set up of trailers for 2 units.
- EPD issuing station can be a set of tables and hoteling stations in the main aisle.

Comments from Radiation Protection:

- Rad Protection is working to phase out Hand and Foot (H&F) monitors (as budget permits).

- Portals are installed south of the reactor area due to multi-zone change from Zone3 to Unzoned.
- H&F monitors at the north due to single zone change from Zone3 – 2.
- RP would like to position Whole Body Monitors (WBM) at vault exits and Zone 3 boundaries
- EPD distribution is considered best from a central location.
- Additional RP techs will be added to support the Vendor's staff.
- RP needs to be a central group under the Refurb organization.
- OPG needs to have a direct line of accountability for Rad Protection.
- Preferred organization is for RP to be embedded in Vendor's crews but report to OPG Rad Protection for daily updates and direction.
- RP is committed to provide sufficient quantity and quality for RP support.
- Outage RP and dosimetry station are usually located on the 107.5 across from AL2
- RP agrees with the use of a trailer for staff and Teledosimetry equipment.
- EPD's could be issued in the Annex, at the Rad Office, or by Greenmen on behalf of their crews for the day.

Chapter 4 – Item # 4 from the Agenda
Meeting Minutes & Notes






Site Infrastructure Layout and Plan

MARTY BROEKHUYSE & ROUND
TABLE DISCUSSION - CHAPTER IV
APRIL 26TH 2012

DISCUSSION	CONSTRUCTION LAY DOWN STRATEGY
	<ul style="list-style-type: none">• <u>Mechanical Maintenance Shop:</u> Use the existing Pipe Fab Shop – do not destroy until after Refurb. (all work pieces must be expedited UTP'd from the station). Alternative is to take all parts off-site to Vendor's shops, or find space in the East Annex (tbd – north of the construction change room).• <u>Hot Shop Area:</u> Columns B-C, Rows 11-12, Elevation 92.5 Includes lay down/off gas/decontamination shop. NOTE – this area was found to be not suitable – consider instead 87.7 m elev: C10 – G10.• <u>Control Maintenance Shop:</u> 115m elev, A8 – C9, or take parts off-site• <u>Tentative Civil and Electrical Shop:</u> No breaker work required. Need approx 20'x20' with 120V/208V/600V. Locate south of condensers: 100m elev, K7- L7.9• <u>Clean Scaffold Storage:</u> 100m elev – O7 – Q7.9 (already existing)• <u>Decontaminated Scaffolding:</u> 92.5m elev B9 – B9.2 or 87.7m elev B9 – B9.2• <u>Non contaminated Scaffolding:</u> west of Boiler house, Land/sea container storage near the Old Annex or south of SG fuel tank 3&4.• <u>First Aid:</u> for person in Browns: use the 4-corners first aid/ personnel decontamination room or a location in the Annex, otherwise use the WSOB• <u>Work Control Area:</u> 115m elev, S11 – T12 (Issuing desk only)• <u>Permit Prep:</u> 107.5m elev, S11 – T13 (Permitry Preparations). Room 203 belongs to Aecon currently• <u>RP Office:</u> – One of three trailers south of Refurb Unit, or a satellite Teledosimetry desk in R203 as at present.• <u>BoP RAD:</u> 107.5m elev, Q12 – S13• <u>R&FR Teledosimetry:</u> South side of Powerhouse

- **Safe Work Area Depot:** 100m elev, L8 – O9
- **Waste Handling Reduction Area:** Small bins for segregated waste, pick up daily. 100m elev G9.5 - G10
- **Flammable/ Corrosive products Cabinets:** One per Vendor near the Decontam area (87.7 or 92.5 m elev), or near the condensers
- **Lay down Tool Cribs & Lock up:** 131.5 m elev R-500 & R-501. Provide 3 – 5 caged areas for Vendor's consumables, pressure boundary cages. MSA Vendors to have an east and west cage here also.
- **TWE parking area:** TBD – need a shared location with charging receptacles and ventilation.
- **Tool Cribs, Contaminated Equipment:** 92.5 m elev along the CCW duct wall, 3 – 5 10'x20' cages for pressure boundary storage

Site Layout - Action Tracking
Status as of October 01 2013 (AR #28146510 - Complete)

AR	AS	Action Description	Completion Notes	Owner	Due Date
28146510	1	An Integrated Review Will Be Conducted Of Other P&M/Project Work Activities Outside Of The Refurbishment Project That Will Be Undertaken At The Same Time As The Refurbishment Project To Validate Throughput Of Construction Resources In This Work Flow Analysis.	Campus Plan Workflow Analysis will be distributed on a monthly basis by Campus Plan Manager. Please see attached document under in-progress notes. December 10, 2012 - Please find attached document below as part of completion notes: Campus plan workflow analysis will be distributed to on a monthly Basis by Campus plan Manager.  C Plan - Lev 1 P6 Sch for Nov end (DD29No	R. Granger	Complete
28146510	2	The Construction Manager Is To Confirm That The Ontario Ministry Of Transportation (Mto) Will Complete Its Work At The Highway 401 And Holt Road Interchange By End Of 2015. The Intent Is To Communicate Completion Date, And To Track The Mto'S Progress With Respect To Opg'S Refurbishment Project Timelines.	Mto Schedule Has Holt Rd./ Hwy401/South Service Rd. With A Dec 2015 Completion. Action Complete	R. Granger	Complete
28146510	3	The Maintenance Manager Will Verify The Definition Of "In Service" For Pwu Staff Performing Pm Maintenance Work During The Refurbishment Project As It Relates To Terms Of Work Assignments And Potential Labour Issues With Construction Workers.	Equipment under the control of Darlington Refurbishment Operations staff and not within the safe work areas of the Refurbishment Project vendors will meet the definition of "In Service" for PWU staff performing PM Maintenance during the Refurbishment Project. Reviewed and entered by C. Mackenzie 12-11-22.	C.Mackenzie	Complete
28146510	4	The Director Of Infrastructure Must Ensure Any Hydro One Plans To Build An Additional Transformer Station Is Reflected In The Campus Plan. Also, Tower Alignments Need To Be Taken Into Account On The Existing Site Campus Plan To Ensure The Space Allocation Is Adequately Understood.	The requirements for Hydro One Transformer station including tower alignments will be included on the Campus Plan when known. Per T.Quong/Paul Gorys - September 21, 2012. SEE UPDATED COMPLETION NOTES IN OLE PER P.GORYS. Updated completed notes as per P.Gorys September 17 2013. DNNP requirements are not confirmed at this time; and "throughout the preliminary design phase and now through the detail design phase, MTO and URS have always considered the potential for New Build and Hydro towers and switchyard expansion". See attachments (per Robin Granger August 21, 2013).  Hot HydroOne Section.  Hot Road IC - Potential Impec...  Hydro One - Draft Impacts (Wor...  Hot Rd IC - Potential Encroac...	P.Gorys	Complete
28146510	6	It Is Recommended That An Entry Vestibule Be Constructed At The West Side Of The Powerhouse At The Unit #1 Roll-Up Door For The Construction Staff Entrance/Exit And Material Loading/Unloading At The East Side Of The Powerhouse At The Unit #4 Roll Up Door.	The Conceptual Design Report Of The In-Station Facilities Project (10-73705) Will Evaluate And Recommend Options To Facilitate The Addition Of An Additional Entry Vestibule At The West Side Of The Powerhouse To Facilitate Monitoring Of Personnel Transiting To/From The Wsob For Breaks And Shift Changes, And Space For Additional Monitoring Portals At The West End Of The Main Powerhouse Corridor.	P.Gorys	Complete
28146510	7	It Is Recommended That Discussions With Durham Region Transit Be Undertaken Regarding The Potential For New/Modified Transit Routes To Service The Dngs Site Via Park Road Or Holt Road. On Site Shuttles Maybe Considered As Part Of This Initiative To Improve Efficiencies	Traffic And Transit Studies Have Been Undertaken As Part Of Dn Ea And Other Planning Studies. The Need For New Or Modified Transit Routes Will Be Considered By Durham Region Transit As Part Of Its Normal Planning Review. On-Site Shuttles May Be Considered To Complement Other Transportation Means On Site But This Determination On Need Will Be Addressed Once The Parking And Transportation Infrastructure Is Confirmed.	P.Gorys	Complete
28146510	8	The Maintenance Manager Will Review The Use Of Space In The Existing Field Located Occ (Csa/115 Metre/Outside Cra) For Optimum Usage. It Is Recommended That This Location Be Utilized By Operations For The Work Control Area Which Would Result In The Need To Locate Space For, And Build, The Field Occ In An Alternate Location.	The Refurbishment Maintenance Manager Advised The Dngs Site Refurbishment Interface Manager On July 23 2012 That Nuclear Refurbishment Would No Longer Be Looking At The In Service Site Occ As A Work Control Area And An Alternate Primary Building Location Option Would Be Pursued To Build The Darlington Refurbishment Operations Work Control Area. Dngs Site Turned Down The Refurbishment Infrastructure Offer To Build A New Dngs Site Occ Facility In An Alternate Location. Refurbishment Operations Intent Is To Maximize Proximity To The Darlington Mcr.	C.Mackenzie	Complete

28146510	9	It Is Recommended That A Contract Strategy Be Developed For Refurbishment Project Where Vendors Ensure That Opg Engineering Approvals And A P, Eng. Stamp Is In Place For All Scaffolds Above 10 Feet. A Sub-Contracting Strategy Should Also Be Determined For Vendor Support (I.E. Scaffolding, Insulation, Labourers - 1 Per Contractor Or 1 Service Provider).	Action Complete Each Vendor Responsible For Their Own Work As Part Of Each Contract Support Services And Equipment.	M.Arnone	Complete
28146510	10	It Is Recommended That The Darlington Refurbishment Infrastructure Approvals Include The Use Of The East Entrance During The Project For Specific Requirements, Including Best Use Of New And Existing Facilities, Including East Site Asb Delivery Access & Mechanical Maintenance Construction Fabrication Shop Locations.	Action Complete. Item Considered And Rejected As Not Consistent With Refurbishment Strategy.**	M.Arnone	Complete
28146510	11	It Is Recommended That A Contract Strategy Be Developed For Refurbishment Where Vendors Provide All Care And Control Of Their Own Transport And Work Equipment (Twe) / Material Handling Equipment	Action Complete. Each Vendor Is Responsible For Their Own Equipment Through Use Of Support Services And Equipment. Is Already Part Of Each Refurbishment Contract.**	M.Arnone	Complete
28146510	12	It Is Recommended That A Decision Be Made On The Existing Contract Strategy For Future Refurbishment Construction Work To Be Executed Within The Execution Project Manager'S Scope Of Work, To The Extent Possible, The Planned Utilization Of The Es Msa Vendors For Balance Of Plant / Fuel Handling / Steam Generator / Other Projects Needs To Be Determined.	Action Complete. Strategies Established And Agreed As To Balance Of Plant, Fuel Handling And Steam Generators**	M.Arnone	Complete
28146510	13	The Project Manager Of Fuel Handling Will Communicate The Use Of That Es Msa Vendors And Areas For Fuel Handling (Including Power Track) As Per Approved Refurbishment Contract Strategy For Fuel Handling.	Action completed - the ESMsa vendors were included in the expression of interest for the Fuel Handling Refurbishment: C1 Trolley, Powertrack and Auxiliaries. They will be included in the RFP process as outlined in the approved Fuel Handling Refurbishment Contracting Strategy Document, NK38-REP-09701-10130 R001 - Jos Dening May 15, 2013.	S.Marinescu	Complete
28146510	14	The Project Manager For Security Projects Will Confirm Heated Concrete/Stairwell Pathways Will Be Installed In The West Parking Lot To Help Address Winter Ice/Snow Safety Issues.	Closure notes per Paul Gorys Dec 12 2012: "The Project (Refurbishment Project Office) has indicated that under the current plan the walkways and stairways will not be heated."	P.Gorys	Complete
28146510	15	The Project Manager Balance Of Plant Will Confirm That Es Msa Vendors Will Be Used For The Balance Of Plant Maintenance As Part Of The Refurbishment Contract Strategy	The Contracting Strategy For Balance Of Plant (Bop) Is To Employ The Emsa Contractors For The Majority Of Modifications And Maintenance Work. The Project May Choose To Use A Limited Number Of Specialty Vendors For Specific Areas (Or Utilize Those Vendors As Sub-Contractors To The Emsa'S) Pending A Detailed Review Of The Entire Work Program After Preferred Options For All Modifications & Cyclic Work Is Understood.	S.Guthrie	Complete

Personnel Flow - Action Tracking
Status as of October 01 2013 (AR #28146401 - Complete)




AR	AS	Action Description	Completion Notes	Owner	Due Date
28146401	1	The Turbine Project Needs To Determine The Location And Timing Of Space Requirements In The Turbine Hall.	Preliminary information regarding the space and timing requirement has been provided to the islanding project and refurbishment maintenance. SATM requests will be processed in the system once the space availability is confirmed by the spec. Information regarding timing and space requirements for the islanding project are included in documents NK38-PLAN-09701-10162 - Barriers Strategy NK38-REP-09701-10183 - Needs Document. These documents are issued in Passport (Jim Ferguson 2013-09-23) 24SEP2013 Garnett C.	T.Josifovski	Complete
28146401	2	A Turbine Lunch Room Needs To Be Built On The Turbine Floor On The 115' Metre Elevation To Take Advantage Of Work Flow Efficiencies. (Utilization Of This Facility By Balance Of Plant Workers During Off Hours/Backshifts Needs To Be Evaluated.)	With regards to the turbine hall lunchroom, items generated from work flow analysis (NK38-REF-09701-0439454 T10) include a turbine hall lunchroom. The costs/details of this lunchroom are being assessed. These costs/scope will be added to the scope of the DSR CP-410 (shops, storage areas their support services). No Change September 2013 CARB.	T.Josifovski	Complete
28146401	3	A Building Trades Unit (Btu) Personnel/Equipment Elevator (including An Operating Teamster) Needs To Be Installed And Dedicated To Construction Staff Working On The Turbine Project On The Conventional Side Of The Plant To Benefit From Work Flow Efficiencies. A Direct Access Route Is Needed From The Wsob To The Turbine Work Location For Btu Staff Working In Street Clothing.	The DSR was approved in Q2 2012 SRB . As per the request of the SRB panel the ownership of the DSR has been officially transferred (through change request process in DSR database) to Refurbishment Maintenance Manager. No further action required.	T.Josifovski	Complete
28146401	4	A Btu Personnel/Equipment Elevator (Includes An Operating Teamster) Needs To Be Installed And Dedicated To Construction Staff Working On The Balance Of Plant Project On The South Side Of The Plant At The Reactor Building Hoistway To Benefit From The Work Flow Efficiencies.	Balance of Plant project accepts the pre-conceptual idea of a reactor building hoistway elevator as a work efficiency gain if the cost benefit analysis to Nuclear Refurbishment is clear in the conceptual phase of the infrastructure project as part of DSR CP0410 under the Nuclear Refurbishment Maintenance Manager." Progression of the reactor building hoist way elevator will proceed under DSR CP480 which is now gate 1 approved and assigned to the Shutdown & Layup (SD&LP) project manager. The Balance of Plant project will ensure that any further cost benefit analysis are reviewed with the SD&LP PM as required therefore this action is complete. 30SEP2013 GUTHRIE S.	S.Guthrie	Complete
28146401	5	Washroom Facilities Need To Be Added To Support The R&Fr & Balance Of Plant Radiation Construction Staff From Vendors From The Site South Entrance.	The Requirement For Additional Washroom Facilities Is Being Addressed Under A Separate Initiative As Per Project Charter D-Pch-09701-10007	P.Gorys	Complete
28146401	6	Washroom Facilities Need To Be Added To Support The Turbine And Balance Of Plant Non Radiation Construction Staff From Vendors From The Site North Entrance.	The Requirement For Additional Washroom Facilities Is Being Addressed Under A Separate Initiative As Per Project Charter D-Pch-09701-10007	P.Gorys	Complete
28146401	7	Develop A Plan To Add Hand And Foot Monitors To The Refurbishment Site Where Needed. The Correct Number Of Hand And Foot Monitors Required To Enter The Powerhouse And Adequately Exit The Powerhouse Needs To Be Determined.	The development of the type and quantity of fixed RP instrumentation for the Nuclear Refurbishment Project is being performed by Refurbishment RP, under the P6 schedule items as follows RP-05-1010 "perform review of RP instrumentation needs & procurement strategy" RP-06-1040 "develop plan/strategy to implement zoning path forward" RP-06-1050 "ensure all RP instrumentation procured" RP-06-1060 "stage RP instrumentation" rp-06-1070 "install/place in field RP instrumentation" these actions will include review of both hand and foot monitor requirements, as well as whole body monitors, for the entire refurbishment project. Scott Stafford- Section Manager ALARA.	S.Stafford	Complete

28146401	8	Confirm All Proposed Zoning Changes With The Manager Of Radiation Protection For "Go/No Go" Decisions Currently Under Consideration.	The development of the radiological zoning/contamination control strategy, as well as the fixed RP instrumentation for the Nuclear Refurbishment project is being performed by refurbishment RP, under the P6 schedule items as follows RP-05-1010 "Perform review of RP instrumentation needs & procurement strategy" RP-06-1040 "Develop plan/strategy to implement zoning path forward" RP-06-1050 "Ensure all RP instrumentation procured" RP-06-1060 "Stage RP instrumentation" RP-06-1070 "Install/Place in field RP instrumentation" as well as these P6 items, the joint venture ALARA contact (Jag Mohindra) and OPG ALARA contact (Scott Stafford) have initiated contact and will discuss reactor side zoning strategies. The Darlington Nuclear Refurbishment - Radiation Protection strategy NK38-REP-09701-10088 also discusses radiological zoning strategies. The ALARA Section Manager (Scott Stafford), who is acting as Refurbishment RPM will continue to review and approve/reject any additional proposed zoning changes. Scott Stafford - Section Manager ALARA 12dec2012.	S.Stafford	Complete
28146401	9	Station Site Space Needs To Be Available For Btu Construction Staff Hard Hats/Gloves & Other Personal Protective Equipment (E.G.,Harnesses, Etc).	Complete - It Will Be Handled By The Satm Process.	R.Granger	Complete
28146401	10	An Alternate Snow Removal And Dumping Area Plan Needs To Be Considered To Alleviate Parking Supply Constraints (E.G., Dngs Soccer Fields/Off Site), Since Available Wsob Area Parking Can Be Reduced By 20% During The Winter Due To Snow Storage.	Completion Notes - P. Gorys November 30, 2012-11-30 Closure Notes: A snow removal and storage plan will be developed as part of an overall maintenance strategy encompassing the WSOB parking lots, roadways and buildings.	P.Gorys	Complete
28146401	11	The Dngs Information Center Should Be Used For Vendor Training During The Refurbishment Project For Make Up, Requalification, Computer Based Training (Cbt) Or Specific Opg Auditorium Training To Improve Work Flow Efficiencies (This Initiative Is Exclusive Of Initial/General Training).	Action Complete. Already Part Of Refurbishment Strategy.**	M.Arnore	Complete
28146401	12	The Dngs Information Center Should Be Utilized For Vendor Issuance Of Tld'S And Initial-Final Whole Body Monitoring (Wbm) To Improve Work Flow Efficiencies. This Initiative Would Include The Evaluation Of The Benefits Of Installing A Whole Body Monitor In This Location.	Input by Scott Stafford, Section Manager ALARA, October 17th, 2012: It has been confirmed that there is an OPG project regarding the renovation of the DNGS Information Centre. The Information Centre Renovation - Project #73804 is assigned to the Nuclear Refurbishment Division. The Construction Manager, Nuclear Refurbishment (R. Granger) confirmed in March 2012, and again in October 2012 that the DNGS information centre will be used for on boarding of Refurbishment contractors, and will be the location for the Nuclear Refurbishment Radiation Data Unit, TLD issuing, and whole body counting/bioassay activities. The budget for Radiation Protection - Nuclear Refurbishment execution phase includes an instrument budget with sufficient funds for procurement of a whole body counter to be placed in this location. The Information Centre Renovation project charter will be developed in mid-late 2013 after the DEC is completed. The Nuclear Refurbishment ALARA section will ensure that the requirements for a whole body counter and TLD issuing capability are included.	S.Stafford	Complete


28146401	13	Reactor Building Vault Contamination Reduction May Allow For Easier Access By Btu Trades Staff, Improving Work Flow Efficiencies. An Evaluation Should Be Made To Determine If The Reactor Building Can Be "Browns Free" Following The Calandria Tube (Ct) Removal	The Darlington Nuclear Refurbishment - Radiation Protection strategy NK38-REP-09701-10088, Section 4.3.2 Reactor Vault conditions states that efforts and controls will be pursued in order to keep the reactor vaults as radiologically clean as practical. Following the retube and feeder removal activities, a thorough decontamination will be carried out as part of the establishment of retube clean room conditions (vaults- all accessible areas and reactor face decontaminated). The decontamination necessary to institute a browns free vault may be difficult to achieve. A review of the OPG RP procedures is a project and is being performed by refurbishment RP, under the p6 schedule item RP-01-1010 "perform review of all RP procedures and identify gaps". This review will include determining if current procedures/practices allow for browns free clothing in the presence of low levels of contamination (it will be unlikely that a full decontamination of all sources of loose contamination could be achievable in the vault). Scott Stafford - Section Manager ALARA 12 December 2012.	S.Stafford	Complete
28146401	14	Need To Evaluate The Issuance Of Epd'S From A Central Radiation Office Location Near The South Reactor Building Staff Deployment Area With A Bias To Deploy Epd'S To Construction Work Locations As Needed To Improve Efficiencies. The Issuance Of Epd'S At The Ria Building Should Also Be Considered By Radiation Protection As Part Of This Initiative.	The Nuclear Refurbishment approach to EPD issuance is documented in NK38-REP-09701-10088 "Darlington Nuclear Refurbishment - Radiation Protection Strategy" as follows 4.10.3 Radiation Protection Field Office to provide continuous RP support to personnel working in the Nuclear Refurbishment island, at least one RP Field Office will need to be designed, procured, constructed, and installed. Two offices would be more effective (one for each nuclear refurbishment unit). This Field Office would be the main headquarters for all RP support services supplied by the RPCS. Such support services would potentially be: EPD distribution: to speed up work preparation time, the RPCS would prepare EPD's for all major work groups prior to shift start. The Nuclear Refurbishment Section Manager ALARA (S. Stafford) has also initiated discussions with the joint venture ALARA SPOC (J. Mohindra) to ensure that the RP Field Office is incorporated into the Retube Control Center buildings that will be placed south of the refurbishment unit. The concept of having EPD issuing capability at the RIA building will be evaluated as part of the development of the Refurbishment RP field coverage strategy, as per PG item RP-04-1040 "Develop and Approve RP Field Staffing & Contract Strategy". Scott Stafford, Section Manager ALARA - Nuclear 17 Dec ember 2012, Refurbishment O&M.	S.Stafford	Complete
28146401	15	Need To Evaluate How Radiation Protection Personnel Can Be Integrated With Vendor Workers To Improve Work Flow Efficiencies For Btu Construction Staff.	Scott Stafford, Section Manager ALARA and Ryan McConnell, ALARA HP have initiated the development of a contracting strategy for Radiation Protection Services - Darlington Refurbishment. A team has been formed and the contract strategy is documented in NK38-REP-09701-10207 "contracting strategy for radiation protection services - Darlington Refurbishment". This process indicates that the vendor will "interface with OPG and other contractors of OPG (the "other OPG contractors") to ensure that OPG and the other OPG contractors have adequate RPCS available to integrate such RPCS into each of the crews for each individual DR projects (i.e. RFR, BDP, etc.) the vendor will be tasked with determining the most effective way to integrate the RPC staff with the contractors. Submitted by: Scott Stafford - August 1, 2013. No Change September 2013 CARB.	S.Stafford	Complete
28146401	16	Vendors Recommended That The Preferred Location For The Radiation Protection Control Office Is In (2) Trailers (Double Wide) Located Near The R&FR Staging Area South Of The Reactor Building Airlock.	Refurbishment Radiation Protection (Scott Stafford) concurs with the suggestion that the RP field offices location recommended by the R&FR vendor is acceptable. This location will allow for a central Dosimetry/EPD/etc issuing location and will provide a location for the field office that is close to where the bulk of the radioactive work (R&FR) will be occurring. Refurbishment RP (Scott Stafford) has been communicating with the vendor RP SPOC (Jag Mohindra) on a continuing basis to ensure that the requirements for the RP field office are incorporated into this design.	S.Stafford	Complete

28146401	17	The Vendors Recommended That The Preferred People Staging Area For The R&Fr Workers Are In (2) Trailers (Double Wide) Located South Of The Reactor Building Airlock. An Alternate R&Fr Worker Staging/Jump & Benches Area Located Outside The Reactor Building Containment Airlock Is Also Required. Vendors Also Recommended The R&Fr Command Center Be Located In One Trailer (1) Positioned South Of The Reactor Building.	The Recommended People Staging Area As Documented In This AI Will Be Considered As Part Of The Rfr Planning That Will Be Performed By The Rfr Contractor. The Submitted "Darlington Rfr - Infrastructure And Layout Plan (509407-000-00000-60(m-001 - Rev Pb)" Dated September 14, 2012 Agrees With The Second Recommended Location For The Command Centre.	I.McCrory	Complete
28146401	18	To Maintain Continuity Of Work And To Optimize The Btu Labour Within The Vendor Workforce, A Review Is Recommended Which Looks At Economies Of Scale & Scheduling Window Opportunities To Reduce Labour Issues While Executing Balance Of Plant Activities During Normal Station Outages (I.E., Bop = Job Jar In Specified Windows).	D1341/1321 and D1411 planned outage scoping is complete in OMS for Balance of Plant. The main focus for this work is scope defining inspections which are not BTU jurisdiction. The only BTU work at this point will be IPG related (such as active liquid waste solenoid valve replacement work) which will be completed in late 2013 or early 2014. The other focus point will be VBO related work which has now been scoped in OMS per the Refurb internal scope freeze TCD of an overview of all Refurb scope of work that is anticipated to be completed by the ES MSA vendors (pre & during refurbishment) will be forwarded to the P&M ES MSA SPOC by Dec 17 2012. Discussions with respect to work scope and resource balancing will follow after further work scope & timeline reviews are completed with the ES MSA in January 2013. This will be facilitated by ES MSA Refurb project managers that will be in role before Q1 2013. That initiative is being tracked through the Balance of Plant project therefore this AR is considered closed. Margaret Cole for Scott Guthrie December 2012.	S.Guthrie	Complete
28146401	19	Designated Walkways Are Recommended To Improve Work Flow Efficiencies Through The Powerhouse To/From The Ria Building & Wsob To Reduce Monitoring And Wait Times.	Islanding Project Area Islanding Sub-Project Has Walkways From Wsob To The Refurbishment Worksite It Its Existing Scope (Ref Section 3.4 Of Nk38-Plan-09701-10044 R0) Nr Islanding Project (73450) - Area Island Plan - Protected Area)	M.Paiment	Complete
28146401	20	Need To Evaluate Designating Space For Both Visitor & "Kiss & Ride" Parking During Dngs Refurbishment Near The Wsob Entrance On The Campus Plan (I.E., Need To Address Parking Requirements For Meeting Attendees/External Guests And Construction Worker Drop Off).	Completion Notes - P. Gorys - November 30, 2012. Closure Notes: The designation of parking spaces around the WSOB will be undertaken as part of the final/detail design and include provisions for handicapped spaces, services vehicles, visitors and others, as appropriate.	P.Gorys	Complete
28146401	21	Recommend That Parking For The Refurbishment Project Will Be First Come, First Served In The Lots To The West And Northwest Of The Wsob. It Is Further Recommended That Specific Colour Parking Tags For Refurbishment Vendors & Staff Be Issued (To Identify All Staff Directly Linked To Refurbishment).	On Facilities Is Responsible For The Designation Of Parking Lots. Security Will Support The Issuing Of Refurb Parking Tags. This Action Is Contingent Upon The Identification Of Those Staff Members Meeting This Description To Security Ident. This Action Is Complete	C.April	Complete
28146401	22	For Work Flow Efficiency Reasons, It Is Recommended That A No Smoking Policy On Site (No Smoking Areas) Be Evaluated. Negotiations & Policy Strategy Are To Be Determined.	**September 20-12 Gail Green for Mark Arnone NR EXEVP review /evaluation is currently underway. TCD December 2013****September 23-13: A. Blake for H. Constable. OPG cannot implement a no-smoking policy for BTU only (without implementing for OPG as well) as this would have a very negative impact if not a site-wide all-inclusive ban. Accordingly, this must be an OPG nuclear wide initiative which is beyond the scope of this assignment. Assignment is closed.	M.Arnone	Complete
28146401	23	For Work Flow Efficiency Reasons, It Is Recommended That A Review Be Undertaken Of The Site Shower Policy For Construction Staff, Amend/Negotiate Changes As Needed. (Showering Is Mandatory For All Radiation Work. For All Other Types Of Work, Showering Would Be Done On The Employee's Own Time).	Action Complete. Already Part Of The Existing Agreements. No Further Changes Required.**	M.Arnone	Complete
28146401	24	For Work Flow Efficiency Reasons, It Is Recommended That An Evaluation Be Undertaken To Assess The Potential For A "No Blues/Dress Ensemble" Policy For Non-Radiation Work On The Turbine & Balance Of Plant Work Projects. Instead, Work Would Be Executed In Street Clothing.	**September 20-12 G. Green for Mark Arnone NREXVP. Review is currently underway and will be part of the nuclear project agreement. TCD June 2013** No Change September 2013 CARB.	M.Arnone	Complete

28146401	25	For Work Flow Efficiency Reasons, It Is Recommended That An Evaluation Be Undertaken Of The Need For Opg To Provide Balance Of Plant / Turbine Btu Construction Staff Fire Retardant Safety Personal Protective Equipment (Blues/Greens), If Provided By Opg, Laundering Should Fall Under The Accountability Of Vendors. Opg Would Not Be Accountable Once Provision Is Complete	Action Complete. Part Of Support Services And Equipment For Each Contract.**	M.Arnone	Complete
28146401	26	For Work Flow Efficiency Reasons, It Is Recommended That An Evaluation Be Undertaken Regarding The Provision Of Winter Parkas/Coats Where Coats Are Not Provided By Opg. Construction Worker Coats Are Brought Into The Station From The Wsob & Hung In A Job Site Work Box (Knack Box - Work Site Field Office).	Action Complete. Already Part Of Each Contract As Part Of Support Services And Equipment.**	M.Arnone	Complete
28146401	27	For Work Flow Efficiency Reasons, It Is Recommended That An Evaluation Be Undertaken Regarding To Review And Validate The Use Of Security Access Data For Accounting/Assembly Information, Brassing & Island Entry And Exit, It Is Expected That Labour Negotiations Are Needed To Support This Initiative.	Action Complete. A Separate Brassing System Will Be Used For All Refurbishment Labour.**	M.Arnone	Complete
28146401	28	For Work Flow Efficiency Reasons, It Is Recommended That An Evaluation Be Undertaken Regarding Staggered Start Times And Lunch Times For Vendors On The Refurbishment Project, Also Shift Coverage Terms & Conditions Should Be Reviewed/Negotiated As Part Of This Initiative.	*****September 23-13: A. Blake for H. Constable: the EPSCA CBA already gives OPG and our contractors the right to stipulate lunch and break times which then can be staggered for various trades or contractors. This assignment is closed.*****23Sep2013 Blake Ann.	M.Arnone	Complete
28146401	29	The Existing Btu Outage Fabrication Shop Spaces In Caged Locations On The 107.5, 92.5 & 87.7 Metre Elevation In Unit #4, And The East Site Btu Pipe Fabrication / Machine Shop Facilities Should Be Utilized By The Vendors During Refurbishment To Alleviate The Need For Additional Structures/Buildings. A Service Level Agreement Needs To Be Developed/Negotiated.	Complete - Not Feasible. Work Will Be On-Going In Operating Unit Outages / Inage / Project During Refurb. Do Not Want To Mix Because C Of A And Refurb Contract Target Price For Support Services And Equipment And Execution.	R.Granger	Complete
28146401	30	Pending The Outcome Of The Recommendation On Both General Tooling & Calibrated / Pressure Boundary Tooling, Vendors Will Need To Develop Contracting Strategies For An On-Site Tool Crib & Calibration Facility. A Location & Structure Will Need To Be Constructed To Meet This Requirement.	Complete - Each Vendor Will Be Allocated A Laydown Area To Manage As They Require	R.Granger	Complete
28146401	31	A Btu/Pwu Negotiated Agreement Is Required On Shared Shops For Facilities Like The Decontamination Facility And Hot Shop Facility. Jurisdictional Issues Need To Be Resolved In Advance Of The Refurbishment Project.	Complete - Opg Owns All Shops And Services. No Specific Agreement Required.	R.Granger	Complete

28146401	32	Since It Is Recommended That The Btu East Fabrication Shops Be Utilized During Station Refurbishment To Alleviate The Need For Additional Structures/Buildings. The Existing Btu Mechanical Maintenance Fabrication Shop Should Be Reviewed To Determine If Any Required Upgrades Are Needed Prior To Nuclear Refurbishment	<p>The In-Station facilities project (10-73705) will conduct an assessment of the condition of the Fab Shop as well as possible upgrades to extend the life of the facility to the end of DNGS refurbishment. The project will also recommend upgrades to the Fab Shop to permit its use as an overflow mechanical/civil/electrical shop if required. Per T.Quong/Paul Gorys September 21, 2012. Completion notes updated September 17th, 2013 C. Cawker for Paul Gorys:</p> <p>Since It Is Recommended That the Btu East Fabrication Shops Be Utilized During Station Refurbishment To Alleviate The Need For Additional Structures/Buildings. The Existing Btu Mechanical Maintenance Fabrication Shop Should Be Reviewed To Determine If Any Required Upgrades Are Needed Prior To Nuclear Refurbishment. Following review of conceptual report, this initiative was removed from scope in July 18th pre-scope meeting review by VP Refurb. (Per Todd Taylor, August 21, 2013). Although taken out of scope for Refurbishment, the future use of the Pipe Fab Shop will be determined by Site and Facilities. A Building Condition Assessment completed in October 2012 for a number of buildings including Pipe Fab Shop #302. A new facility incorporating the functions of the existing Pipe Fab Shop was to be included as part of a new integrated Facility Services Building complex along Park Road. This project has subsequently been cancelled. EXECUTIVE SUMMARY AND REPORT ** SEE ATTACH IN OLE FOR ADDITIONAL INFORMATION**</p> <p> Condon Study Executive Summa...  T&E Group - OPG DNG Condition ...</p>	P.Gorys	Complete
28146401	33	It Is Recommended That A Concrete Or Gravel Area Be Identified On The Campus Plan And A Structure Built (Tented Area/Covered) For Bulk Scaffold Material Delivery And Storage, And For Parking Bulk Land/Sea Containers For The Refurbishment Project.	<p>The requirement for laydown and storage areas for bulk scaffold and sea containers will be evaluated in the Conceptual Design Report of the In-Station facilities project 10-73705 Per T.Quong/Paul Gorys - September 21, 2012. Updated closure notes per P.Gorys: Inside PA - In the conceptual report, a structural building for scaffolding was rejected; however, a solid pad for sea cans was approved. Space was identified on the Campus Plan for Bulk Scaffold Storage (C6A-C6D), (per discussion with Todd Taylor, August 21, 2013) UPDATED WITH ADDITIONAL CLOSURE NOTES: SEPT 17TH PER P.GORYS.</p> <p></p> <p>C6A - STB. GENERATOR #3 TRAILERS- SEPT. 2015-NOV. 2015 STB. GENERATOR #4 TRAILERS- MAR. 2016-MAY. 2016 C6B - TBA C6C - TBA C6D - TBA C6 (A,B,C,D)-BULK SCAFFOLD STORAGE- OCT. 2016-DEC. 2024</p>	P.Gorys	Complete
28146401	34	The R&Fr Annex Facility Is Currently Exclusive To The R&Fr Project For Dngs Refurbishment (Including Feeder Preparation). It Is Recommended That The R&Fr Project Validate Whether The Vendor Can Execute Feeder Preparations At Off-Site Facilities So That Btu Construction Staff Can Utilize The R&Fr Maintenance Shops To Alleviate The Need For Additional Structures/Buildings.	<p>Rfr Confirms That The Rfr Contractor Requires The Rfr Annex Facility For Its Use. This Is Based On The Submitted "Darlington Rfr - Infrastructure And Layout Plan (509407-000-00000-601m-001 - Rev Pb)" Dated September 14, 2012.</p>	L.McCrory	Complete

28146401	35	It Is Recommended That The R&Fr Project Finalize Its Evaluation To Decide The Future Location Of The Retube Waste Processing Facility. This Facility Is Currently Planned For The Area Immediately East Of The U4 Powerhouse. The Decision Is Required To Determine Whether This Space Is Available For Other Requirements (E.G. Bulk Land/Sea Container Storage).	The Location Is Finalized. The Location Is As Specified In This AI - In The Area Immediately East Of The U4 Powerhouse Within The Protected Zone.	J.McCrory	Complete
28146401	36	It Is Recommended That A Contract Strategy Be Developed For All Breaker & Relay Calibrations To Be Performed At Off-Site Locations (Vendors/Oem/Other) To Alleviate The Need For Additional Structures/Buildings.	1) EPC type contract strategy will be used with the vendor accountable to complete all calibrations, overhauls and setups offsite in their facilities, maximizing the amount of equipment that will be sent "off site". As some vendors have the potential to handle "contaminated" equipment, this will also be considered during the RFP / bid selection to further maximize this strategy. 2) It is understood that although this strategy will be used for the bulk of the components, there will be exceptions due to radiological contamination. With these exceptions it may be more cost effective to handle these on site or to be disposed of and replaced with "new". These exceptions will be addressed separately. The extent of these exceptions will be better known during the "planning" phase prior to Gate 2. Margaret Cole for Scott Guthrie- November 21, 2012.	S.Guthrie	Complete
28146401	37	It Is Recommended That A Contract Strategy Be Developed For Refurbishment That Includes A Bias For Vendors To Execute Maintenance Shop Work Activities At Off-Site Work Locations To Improve Efficiency, And To Save On Project Costs (I.E., All New Work/Conventional Preparations Including Equipment & Valve Scope).	Action Complete. Majority Of The Pre-Req Work To Be Completed In Vendor CoFa Facilities. Opg Shops And Not Part Of Vendor CoFa.**	M.Arnore	Complete
28146401	38	It Is Recommended That A Contract Strategy Be Developed For Refurbishment That Includes A Bias For Equipment From The Protected Area Via Utp Be Repaired Or Reworked As Much As Possible Off-Site Rather Than On The East Site Fabrication Shops To Improve Efficiency And To Maximize Savings On Project Costs.	Action Complete Part Of Support Services And Equipment In Each Contract. Will Not Be Using Opg Facilities.**	M.Arnore	Complete
28146401	39	It Is Recommended That A Contract Strategy Be Developed For Refurbishment That Includes A Bias For Vendors To Supply All Their Own Tools For The Project, So That An Opg Tool Crib Is Not Required As Per Existing Vendor Contract Terms And Conditions, And To Improve Efficiency And Alleviate The Need For Additional Structures/Buildings.	Action Complete. Already Part Of Support Services And Equipment For Each Contract. Vendors Will Supply All Tools And Equipment To Complete Contract Deliverables.**	M.Arnore	Complete
28146401	40	It Is Recommended That A Contract Strategy Be Developed For Refurbishment That Includes A Bias For Vendors To Supply All Their Own Calibrated/Pressure Boundary Tooling Under Their Certificate Of Approval For The Project So That An Opg Central Facility Is Not Required, And To Improve Efficiency And Alleviate The Need For Additional Services, Structures/Buildings.	Action Complete. Already Part Of The Support Services And Equipment.**	M.Arnore	Complete
28146401	41	Radiation/Emergency/Fire Assembly & Accounting Areas Need To Be Clearly Designated In The Island Plan.	The Powerhouse Area Island Plan Ref: Nk38-Plan -09701 -10043-R000 Includes The Requirement To Set Up Assembly And Accounting Areas Within The Refurbishment Island. Details Regarding The Number And Location Of Assembly Areas And The Emergency Equipment To Be Stocked At The Assembly Area Are To Be Determined At A Later Date Following Discussions With Nuclear Refurbishment Radiation Protection And Contractors. Currently It Is Anticipated That At The Minimum, There Will Be A Contractor Assembly Area On The Conventional Side Of The Unit Refurbishment Island As Well As An Assembly Area On The Nuclear Side Of The Unit Refurbishment Island. Tentative Contractor Accounting Areas Are Proposed As - Contractor Reactor Side Accounting Area: Refurb Unit 100M Rab At R103/R143 At Or Near Grid 512 And Contractor Turbine Side Accounting Area: Refurb Unit 115 M Elev At Or Near Grid B3. Nuclear Refurbishment Ops And Mtce Are Anticipated To Assemble At Normal Darlington Ops And Mtce Assembly Locations. Assembly And Accounting Areas Outside The Powerhouse Are Also Expected To Be Established In Outbuildings That Constitute The Normal Work Locations For Nr Or Contractor Staff (For Example: Rcc, Ria And Wsob). It Is Recognized That Assembly And Accounting Procedures	R.Chatterton	Complete

28146401	42	Station Operations And Maintenance Input Is Needed Into The Refurbishment Project At Some Frequency To Alleviate Organizational Stresses (Coordination, Communication & Alignment Between The Refurbishment Project & Site Representatives).	The Refurbishment Director of Operations & Maintenance schedules a recurring monthly In Plant Facilities Oversight Meeting where an update is provided by the In Plant Facilities Project Team (DSR Scope Item - CP0410 Additional Facilities) and the Refurbishment Maintenance Manager to the Senior Management Oversight Team on the status of the Project. The Darlington Site Refurbishment Interface Manager is a scheduled invitee to this monthly interface meeting. Minutes of meeting including new action review and previous actions taken are recorded and issued as a result of this meeting. (A sample meeting notice with meeting minutes and Level 1 schedule has been included in the In-Progress notes of this action). Reviewed and entered by C. Mackenzie 12-11-22. No Change September 2013 CARB.	C.Mackenzie	Complete
28146401	43	Worker Efficiency Gains Can Be Realized Through Utilizing Electronic Sign-On For Work Authorization & Work Protection. It Is Further Recommended That An Evaluation Be Completed On The Use Of Video Communication In Specific Areas For Work Flow Efficiencies Where Deemed Appropriate.	KEVIN WODZAK, DARLINGTON RECURBISHMENT OPERATIONS AND MAINTENANCE ** COMPLETION NOTES ** - NOV. 05/12. APPROVED BY RON CHATTERTON - NOV. 05/12 - ACTION COMPLETE. Assignment# 28146401-43 (Also Recommendation #9, Page 18 of the DNGS Refurbishment Integrated Work Flow Analysis.  Action #3.docx	R.Chatterton	Complete
28146401	44	Unit-By-Unit Site Re-Location Of Two & Scaffold Storage Areas Is Required During Refurbishment. For The Needs Of The Refurbishment Project, It Is Suggested That Two/Scaffold Storage Items Be Located In The Same Locations As The Refurbishment Outage. Some Sharing Of Locations Or A Re -Negotiated Laydown Agreement Is Needed.	The DNGS Refurbishment Maintenance Manager has developed a Maintenance Ownership Transfer Plan (NK38-PLAN-09701-10113) that addresses activities supporting the Maintenance Department and program at Darlington Nuclear that are associated with the refurbishment and return to service on Units 1-4. The plan addresses shared space under the header "Shared Space and Dispositions" in Section 4.6. Reviewed and entered by C. Mackenzie 12-11-22.	C.Mackenzie	Complete
28146401	45	To Alleviate Constraints On Facility Size And Cost, A Bias Is Needed To Prioritize The "Dry Ice Method" Of Decontamination (Co2-Blast Method) For The Required Facility Over The Traditional Wet/Decontamination Method. The Dry Ice Method Would Result In Low Waste, No Water, And Reduced Engineering Tie-In Requirements, As Per Bruce Nuclear Generating Station Operating Experience.	The Dry Ice Decontamination method is in the scope of CP 0410 In Plant Facilities Project for analysis (NK38-SOW-09701-10012). The Conceptual Definition phase of the Project is proceeding with a bias for analysis of the dry ice method including recommended alternatives with the appropriate cost benefit review to allow the Project to select the appropriate solution/option for the overall Darlington Refurbishment Project. Reviewed and entered by C. Mackenzie 12-11-22.	C.Mackenzie	Complete
28146401	46	If The Recommendation To House The R&FR Command Center At The South Entrance In A Trailer Is Accepted, Then Room 203 On The 107.5 Metre Elevation Becomes Available As Alternate On The 107.5 Metre Elevation Becomes Available As Alternate Storage Or The Ops Work Permitry Preparation Area/Radiation Protection Teledose Structure/Btu Tool Crib.	The Reactor & Feeder Replacement (R&FR) Project is currently planning to locate their Command Center at the south entrance to the plant on the 100 Meter elevation via trailers leaving RM 203 on the 107.5 Meter elevation available for alternative strategies and lay down areas. This location is documented on the 107.5 Meter elevation print on the "U2 Site Space Area Usage Plan" map. This "Site Space Area Usage Plan" is being developed within the Islanding Project to help define the perimeter of the Darlington Refurbishment Project Island and Island Ponds. Fire safety analysis and Reactor Safety analysis is currently being done as part of the Project to ensure the appropriate space is acceptable for its intended purpose. Reviewed and entered by C. Mackenzie 12-11-22.	C.Mackenzie	Complete

28146401	47	<p>It Is Recommended That A Contract Strategy Be Developed For Refurbishment That Includes A Review Of Off-Site Decontamination Opportunities To Support The Existing Decontamination Shop Initiative With Respect To Bulk Land/Sea Can Storage. This Strategy Would Include The Review Of Alternate Storage/Shipping Containers That Are Transportation Ready To Support Bulk Transfer To And From An Approved Vendor.</p>	<p>Preliminary discussions have taken place with outside vendors to explore external decontamination capabilities for the Darlington Refurbishment. Multiple vendors have confirmed their capability with OPG for further contractual options if OPG determines it is in the best interest of the Darlington Refurbishment Project to proceed with an external vendor service contract for Decontamination services. The Refurbishment Construction Manager has the lead on this initiative including funding and would be supported by the Refurbishment Maintenance Manager as this strategy is further developed. Reviewed and entered by C. Mackenzie 12-11-22. The Decontamination Services contract strategy is documented in NK38-REP-09701-10207 "Contracting Strategy for Radiation Protection Services - Darlington Refurbishment" as a standalone services contract. The contract strategy includes shipping containers to & from site. Todd Taylor for Chris Mackenzie September 27 2013.</p>	C.Mackenzie	Complete
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Material Flow - Action Tracking
Status as of October 01 2013 (AR #28146471 - Complete)

AR	AS	Action Description	Completion Notes	Owner	Due Date
28146471	1	Material Being Moved As Part Of The Refurbishment Project Could Exceed The 70-Tonne Bridge Weight Limit For The Holt Road And Park Road Bridges. An Alternate Strategy Needs To Be Communicated To The Infrastructure/Mot Team So That Appropriate Alternatives Can Be Reviewed In A Timely Manner For Material That Needs To Be Moved Which Exceeds These Bridge Weight Limits.	Complete - strategy to utilize St. Mary's cement via rail spur or Port of Oshawa - Sept 12/12 Sears Jen. All projects requested to identify any material/tools/equipment that may need to come to site that is heavier than 70 tonnes. TG project is the only one that identified a potential requirement. Alternates were considered and followed up on by the project team. Alternates include Port of Oshawa, Port of Darlington and rail spur into St.Mary's Cement. Action closed. Granger R. 27 Sep 2013.	R.Granger	Complete
28146471	2	Vendors Need To Supply Any Refurbishment Project Materials With Appropriate History & Equipment Data So The Information Can Be Appropriately Populated In Passport To An Agreed Standard. Opg Receipt Inspection Is To Be Confirmed Not Required Or An Equivalent Process Needs To Be Established.	Interface Requirements Included The Document Submission By The Contractor And Acceptance By Opg Are Laid Out On Contractor/Owner Interface (Coir) Document. Requirement Of Submitting History Dockets For Opg Acceptance Is Also Mandated By Coir Document. All Materials Brought In The Refurbishment Are To Be Procured, Receipt Inspected And Stored As Per The Contractor Qa Program And Certificate Of Authorization And Requirements For Opg Receipt Inspection Is Not Warranted. Only Maintenance Spared Are Tuned Over To Opg Where Opg May Perform Receipt Inspection If Required.	G.Paterson	Complete
28146471	3	The Manager Of Security Is To Confirm Whether Site Deliveries Related To The Refurbishment Project Which Are Pre-Cleared Can Be Processed In 30 Minutes Or Less.	The physical processing of vehicles and personnel can be accomplished within 30 minutes. As discussed this is solely contingent upon sponsorship issues being worked out by the responsible sponsor (i.e. timings; completion of sponsorship forms) as well as a pre-screen location determined by the project and supporting security staffing and equipment requirements being met. This action is complete. Inputted by Rebecca Kelly. No Change September 2013 CARB.	C.April	Complete
28146471	4	The Manager Of Security Is To Confirm That No Guardhouse Stops Will Be In Effect At The Holt Road And Park Road Entrances, And That The Bill Gearing Guardhouse Will Not Be Utilized. All Site Deliveries Will Access The Site Through The Asb Security Post.	Holt Rd And Park Rd Ingress / Egress Will Only Be Staffed In The Event Of An Emergent Situation. Normal Security Operations Will Remain In Effect. This Action Is Complete	C.April	Complete
28146471	5	It Is Recommended That All Work Orders Being Written To Address Balance Of Plant Valve Maintenance Scope Assume Cutting And Replacing Of Valves As Opposed To Inspection And Repairing Them. Inspecting And Repairing Valves Requires Having Appropriate Lead Times For Parts. Relief Valves Are Intended To Follow The Existing Program For Maintenance.	All Bop Dtrs That Require Overhaul Or Replacement Of Valves Will Also Be Reviewed To Confirm The Applicable Cyclic Maintenance Predefine Can Be Closed To The Wo Generated By The Bop Dsr.	S.Guthrie	Complete
28146471	6	It Is Recommended That Improvements Be Made Once The Asb Delivery Strategy Is Confirmed So That The Location Can Better Accommodate A Staging Lane For Refurbishment Delivery Vehicle Shipments. The Intent Of This Staging Lane Is To Ensure The Exploranium Does Not Back Up With Delivery Vehicles.	The Conceptual Design Report Of The In-Station Facilities Project Will Investigate And Recommend Options For Road Work And Parking Lot Realignment (In The Vicinity Of The Existing Weigh Scale) To Permit Security Pre-Cleared Vehicles To Advance To The Asb Monitoring Station For Priority Entry Ahead Of Other Vehicles.	P.Gorys	Complete
28146471	7	It Is Recommended That Security Review And Recommends An Appropriate Opg Off-Site Location To Pre-Clear Refurbishment Site Delivery Shipments Prior To On-Site Arrival, To Prevent Bottlenecks.	The WSOB has been set up for search requirements. It will require the funding of a pallet x-ray. This action is complete inputted by Rebecca Kelly. Space has been allocated at the DEC for an x-ray machine. Security is able to make arrangements with vendors for pre-screening of materials and shipping when warehousing/manufacturing locations is confirmed by vendors. 18Sep2013 Gorys P.	C.April	Complete
28146471	8	It Is Recommended That A Deliveries Strategy Be Reviewed Using The Bill Gearing Guardhouse For Scheduled Concrete Deliveries, Small Truck Deliveries And Pre-Cleared Shipments, If Deemed Appropriate To Provide Site Delivery Efficiencies To The Refurbishment Project	This Option Has Been Reviewed And Is Not Feasible	C.April	Complete
28146471	9	It Is Recommended That All Site Deliveries Related To The Refurbishment Project Be Just In Time (jit) Deliveries, No More Than 48 Hours In Advance. Regular Deliveries Are Not Pre-Cleared For The Asb Entrance During Normal Activities. Low Volume Off-Peak Times (4-8Pm) Could Be Used To Expedite Refurbishment Deliveries. No Refurbishment Deliveries After 8:00 Pm.	Refurbishment has indicated that the sally port and ASB will be required 24/7 to support deliveries into the PA and work related to Refurbishment Projects. Staffing support to be reviewed to support this request. This action is complete inputted by Rebecca Kelly. 01OCT2013 Stenhou S.	C.April	Complete

28146471	10	It Is Recommended That A Contract Strategy Be Developed For Refurbishment That Includes Direction For Vendors To De -Package Materials Off Site (At The Vendor'S Facility) Where Practical To Improve Efficiencies. If This Is Not Practical, It Will Occur At The West Delivery Entrance, So That It Remains With The Delivery Truck.	Complete. Already Part Of Each Contract To Manage Reduction Of On Site Waste. Also Security Required To Support Off Site Inspections Included In Their Forecast.**	M.Arrone	Complete
28146471	11	It Is Recommended That The Contract Strategy For Refurbishment Vendors Ensure A Logistics Person Is Available, Or Forms Part Of Their Respective Teams, For Deliveries And Any Coordinated On-Site Repair/Replace Efforts That Maybe Required During The Pre -Planning/Execution Phase.	Action Complete. Part Of Each Project Team Supplied By Vendor.**	M.Arrone	Complete
28146471	12	It Is Recommended That A Contract Strategy Be Developed For Refurbishment That Includes Vendors Providing Security Cleared/Orange Badged Delivery Drivers For Site Refurbishment Deliveries Which Would Reduce The Need For Radiation Protection/Security Escorts On Site.	Complete. Part Of Contract Requirments To Provide Cleared Trained Staff.**	M.Arrone	Complete
28146471	13	Since Radio Frequency Identification (Rfid) Can Serve Multi-Purposes, It Is Recommended That This Technology (Or An Equivalent One) Be Explored For Use In Tracking All Material, People & Equipment Related To The Refurbishment Project So That Accurate Real Time Information Can Exist. Additional Review/Testing Will Be Required With The Appropriate Stakeholders.	The Reactor & Feeder Replacement (R&FR) Project Team and their Joint Venture Contractor are analyzing the use of RFID's for multiple uses including people, material and equipment movement. Additionally, an IT review is being conducted on the use of bio-metrics for accounting purposes during the Refurbishment Project. This initiative is not in the scope of the CP0410 In-Plant Facilities Project. The Darlington Refurbishment Construction Manager has the lead on the tracking strategy for the overall Darlington Refurbishment Project. Reviewed and entered by C. Mackenzie 12-11-22.	C.Mackenzie	Complete

Pre-requisite Projects

Facilities and Infrastructure Improvements

Safety Improvement Opportunities

Pre-requisite Projects Summary

- Total of 18 major projects estimated at around \$950 million.
- Pre-requisite projects scope:
 - Site Facilities and Infrastructure (“campus plan”) projects entail a number of facility and infrastructure projects required to support the execution of the unit by unit refurbishment activities.
 - Safety Improvement Opportunity projects address the environmental assessment regulatory commitments and increase safety margins for the continued station operation.
- 11 projects completed and in-service ahead of the need dates.
- Life to date safely executed over \$700 million.
- Construction started in 2013 Q2, and peaked in Q3 2015 with over 1000 trades supporting the pre-requisite projects.
- Out of 7 remaining projects, 2 projects remain at risk – D2O and EPG#3

Pre-requisite Projects Summary

- *Site Facilities and Infrastructure (“campus plan”) projects:*
 1. DEC and Mockup
 2. Operations Services Building (OSB) Refurbishment
 3. R&FR Support Annex
 4. Refurbishment Project Office
 5. Vehicle Screening Facility
 6. Holt Rd. Interchange
 7. Electrical Power Distribution
 8. Auxiliary heating plant/system
 9. Site Water and Sewer Upgrades
 10. D2O Storage Building
 11. Retube Waste Processing Building

Pre-requisite Projects Summary

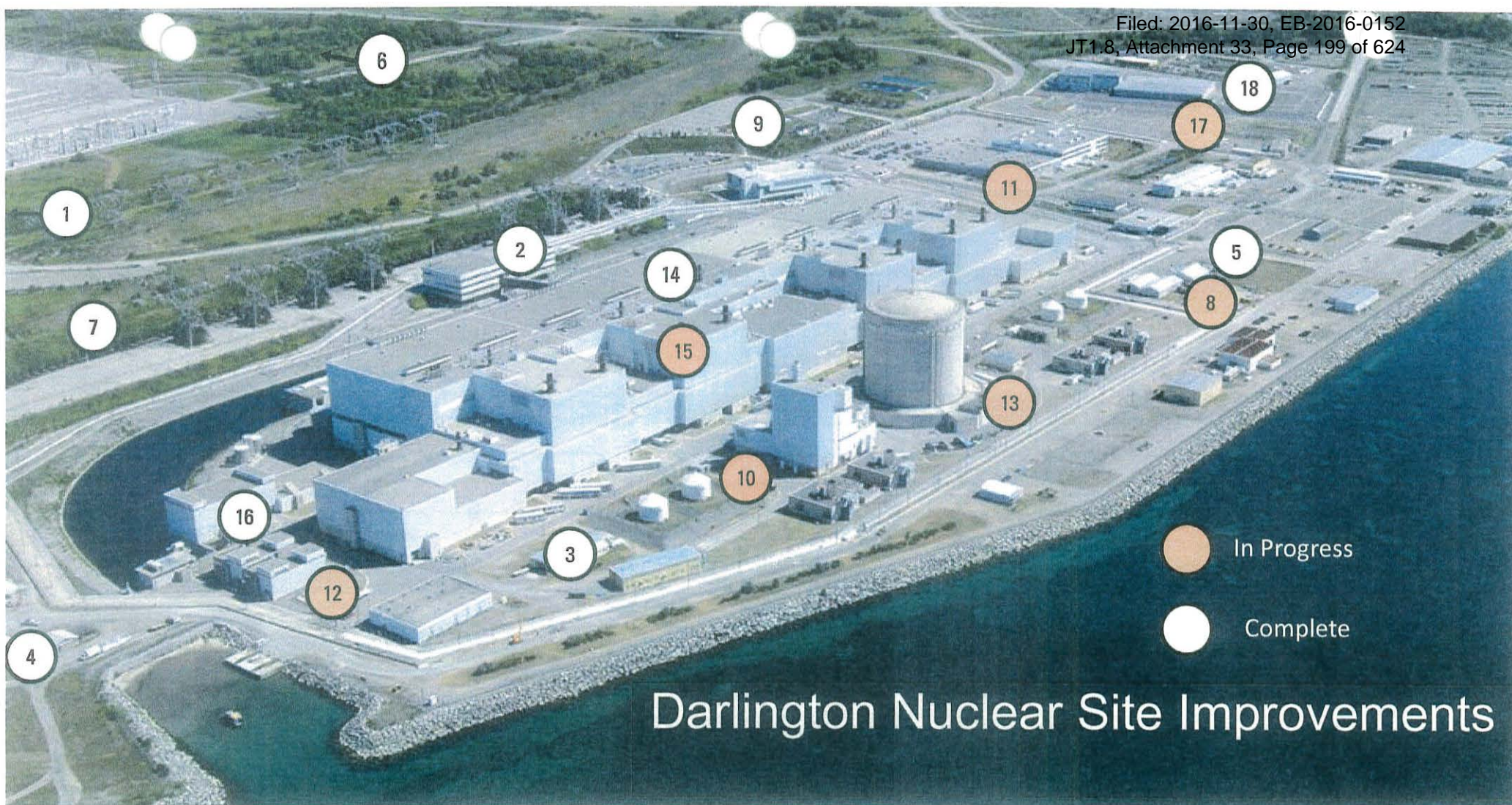
Pre Refurbishment Projects:

Safety Improvement Opportunities:

- 12. New Emergency Power Generator (EPG-3)
- 13. Containment Filtered Venting System
- 14. Powerhouse Steam Venting System Upgrades
- 15. Shield Tank Overpressure Protection
- 16. Emergency Water System Pipe Replacement

Nuclear Waste Projects:

- 16. Refurbishment Waste Storage Building
- 17. Used Fuel Dry Storage



Safety Improvement Projects

- 12 3rd Emergency Power Generator
- 13 Containment Filtered Venting System
- 14 Power House Steam Venting System
- 15 Shield Tank Overpressure Protection
- 16 Fire Water and Emergency Cooling

Refurbishment Projects

- 1 Darlington Energy Complex (DEC)
- 3 Re-tube & Feeder Replacement Island Support Annex
- 4 Refurbishment Project Office (RPO)
- 10 Heavy Water Storage
- 11 Retube Waste Processing Building
- 17 Retube Waste Storage Building

Site infrastructure Projects

- 2 Operations Support Building Refurbishment
- 5 Vehicle Screening Facility
- 6 Holt Road Interchange Improvements
- 7 Electrical Power Distribution
- 8 Auxiliary Heating System
- 9 Water and Sewer
- 18 Used Fuel Dry Storage Building

Pre-requisite Projects Summary

No	Project Description	Contractor	Need Date	Current Forecast Date	
				2016	2017
1	Darlington Energy Complex	McKay Cocker	In-Service		
2	Operations Support Building Refurbishment	B&M	In-Service		
3	Re-tube & Feeder Replacement Island Support Annex	ES-FOX	In-Service		
4	Refurbishment Project Office	ES-FOX	In-Service		
5	Vehicle Screening Facility	ES-FOX	In-Service		
6	Holt Road Interchange Improvements	MTO	In-Service		
7	Electrical Power Distribution	B&M	In-Service		
8	Auxiliary Heating System	ES-FOX	Note 1	May	
9	Water and Sewer	B&M	In-Service		
10	Heavy Water Storage & Drum Handling Facility	SLN-AECON	Feb 2017 (Unit 2)	Sept (Unit 2)	May (Full)
11	Re-tube Waste Processing Building	SLN- AECON	Jul 2017	Dec	
12	3 rd Emergency Power Generator	ES-FOX	Oct 2016	Sept	
13	Containment Filtered Venting System	ES-FOX	Oct 2016	May	
14	Power House Steam Venting System	B&M	In-Service		
15	Shield Tank Overpressure Protection	B&M	Note 2	Apr (Unit 4) Oct (Unit 3)	Feb (Unit 1)
16	Emergency Service Water	ES-FOX	In-Service		
17	Re-tube Waste Storage Building (Note 3)	ES-FOX	Jul 2017		Jun
18	Used Fuel Dry Storage Building (Note 3)	ES-FOX	In-Service		

Notes: (1) Project is not required for Refurbishment. (2) Project will be installed on Units 1, 3 and 4 during planned Unit outages and on Unit 2 during Refurbishment. (3) Project is Provision funded.

Safety Opportunity Improvements

-3rd Emergency Power Generator:

- Installation of a 3rd Emergency Power Generator (EPG) and supporting infrastructure.
- New building including the tie-in structure to the existing tunnels.

Current Status:

- Building foundation complete
- 1st lift exterior building wall complete
- Targeting end of May to complete the main building civil works.
- The generator has been tested and delivered to the warehouse
- Project is tracking to have the 3rd EPG in service by Sep 30th, 2016



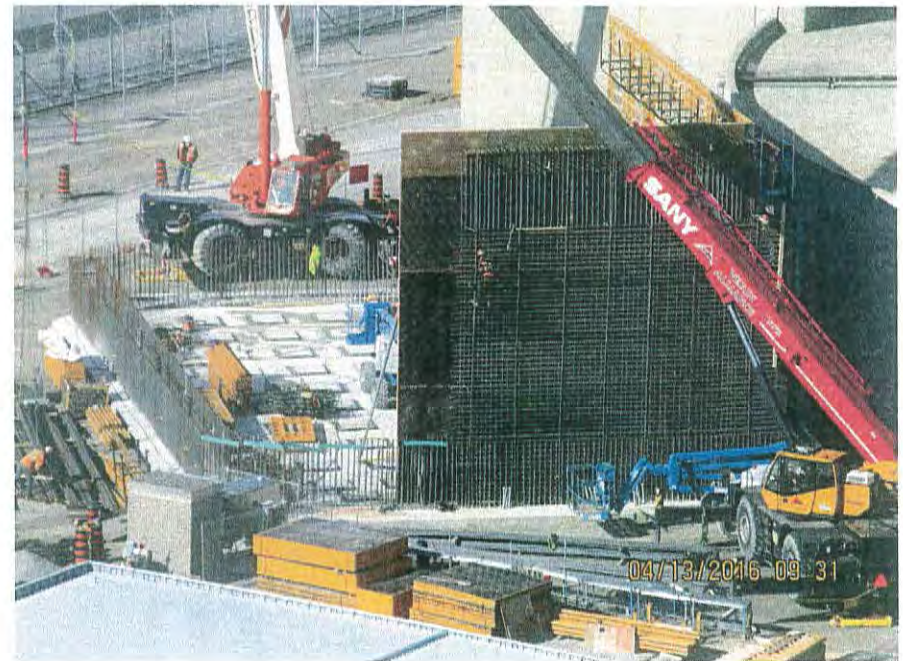
Safety Opportunity Improvements

-Containment Filtered Venting System:

- Installation of new, manually initiated, filtered, containment venting system for Beyond Design Basis events of containing boundary.
- System is designed in combination with Shield Tank Overpressure Protection project to protect containment from overpressure and to filter any releases from containment if required.

Current Status:

- Tie-ins to the containment system are complete
- The filter assemblies are on site
- Building foundation and the main slab are complete
- Containment isolation valve maintenance platforms and handrail installation are in progress.
- Project is tracking to be in service by Sept 2016



Safety Opportunity Improvements

-Emergency Service Water Header Replacement:

- 36" underground header replacement
- The tie-ins completed inside the emergency service water pumphouse and the station during the VBO



Refurbishment Projects

-Heavy Water Storage Project:

- Construct a Heavy Water Storage Facility to combine expected D2O storage needs for Refurbishment, Tritium Removal Facility (TRF) and Darlington Operational Improvement of D2O Storage and Drum Handling
- Facility has to provide sufficient heavy water storage capacity at the Darlington site during simultaneous overhaul of two reactors, a capacity of 1700 m³

Current Status:

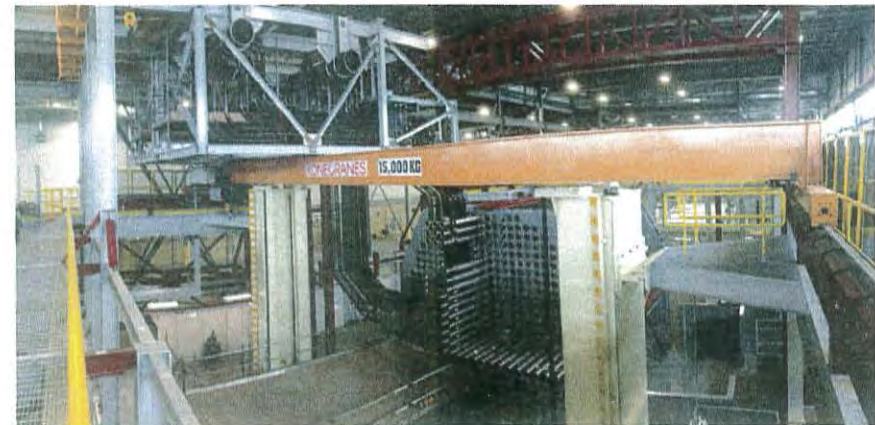
- All services relocated
- Seismic dyke completed
- Installation of mechanical /electrical systems in progress.
- Project is tracking to have tanks ready by Nov 2016 to support the first unit dewatering and the building turnover by May 2017.



Refurbishment Projects

- *Darlington Energy Complex:*

- 310,000 square foot multi-purpose facility
- Facility houses:
 - Training and mock-up facility
 - Tooling and tool testing facility
 - Information centre
 - Security processing centre
 - Warehousing



Refurbishment Projects

- Refurbishment Project Office:

- Provide a West Security, Office and Lunchroom/Change room facility that will meet the Refurbishment Project needs for the duration of the Refurbishment activities
- Provide 300 offices and supporting amenities for OPG and Contractor's Project Management staff during the Refurbishment Project
- Provide additional parking lots for the refurbishment needs



Refurbishment Projects

-Re-tube & Feeder Replacement Island Support Annex:

- Project office for RF&R EPC contractor
- Shop space
- Office and conference rooms in support of the retube and feeders replacements operations



Refurbishment Projects

- ***Refurb Waste Storage Building:***
- Construction of an on-site facility required to house the intermediate-level waste (ILW) produced as a result of refurbishment activities.

Current Status:

- Design Engineering is complete
- Building foundation is complete
- Erection of structural steel is in progress and approx 75% complete
- Project is tracking to be in service by Q2 2017



Site infrastructure Projects

- *Operation Services Building:*

- Building rehabilitation and life extension
- All new electrical and mechanical systems
- Roof and walls replacement
- Replacement and upgrades of station systems running through the building (Domestic Water, Electrical Power)



Site infrastructure Projects

-Aux Heating Systems Project:

- Provides back-up heating for DNGS.
- Replacing existing system
- Includes new boiler house, boilers, auxiliary process equipment and upgrades to heating distribution system within plant

Current Status:

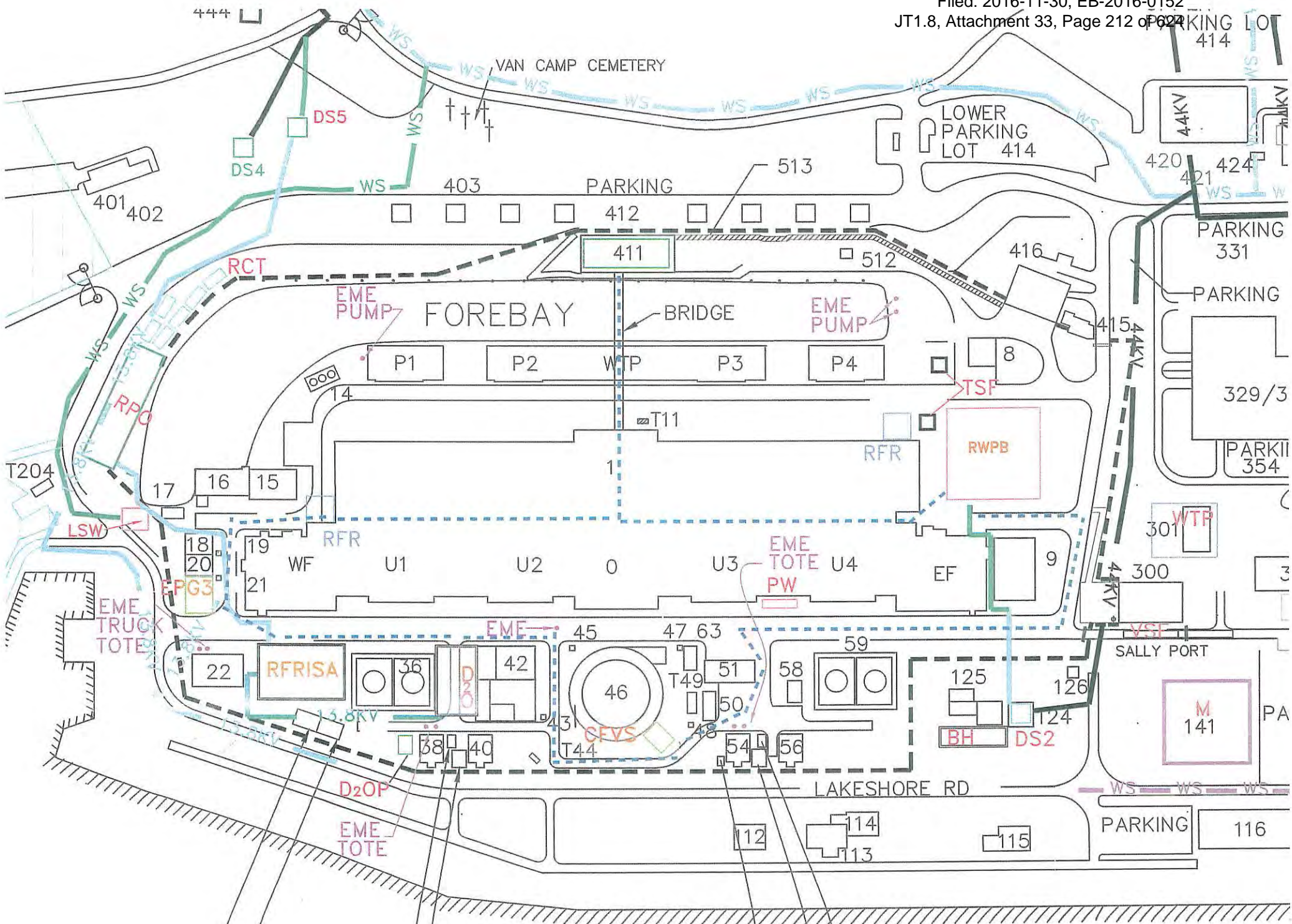
- Construction is complete
- Final commissioning is in progress
- In service date May 2016



Site infrastructure Projects

- *Used Fuel Dry Storage Building #2:*
 - New building provides additional space for used fuel containers.







Pre-Req Manager Cindy Sawyer 703x9763, Cell: 289-355-0610

PCC Manager Scott Goodwin, Cell 289-355-9307 (Email "RefurbPCCMgr@opg.com")

DNRP Daily "T0" Schedule Update Agenda for Tuesday April 26/2016

Conference Call: Toll-free dial-in number (Canada/US): 1 855-342-6455 Local dial-in number: 416-933-3853 Conference ID: 9021395
Virtual Video Conferencing, call 8744

Item	Presenters	Start Time	Dur (min)	Meeting Purpose and Expectations: Alignment of all work groups and support departments in support of safe and timely execution of the Refurbishment work week schedule and to address emerging issues. <i>Please silent cell phone before meeting begins.</i>			
1	PCC Mgr/Outage Mgr	09:00	1	Confirm Critique / Review PCC AFI's			
2	Roll Call: Safety/Human Performance Issues by REP's/Contractors <i>Expected response is for example "Cyndy Sawyer for Work Management- no safety or human performance issues to speak to" (unless you are referencing a HULL or SCR that needs to be brought to the attention of the team).</i>	09:01	3	SNC AECON	Steam Gen Rep	Const'n Execution Rep	
				ES FOX	BOP Rep	Rad Prot'n Rep	
				Black & Mac	Islanding Rep	Maintenance Rep	
				Op's Rep	FH & Defuel Rep	Engineering Rep	
				TG Bundle Rep	RFR Rep	Safety Rep	
				SD, LU & Support Facilities Rep	Work Control SM	Quality Mngt Rep	
3	HULL Owner (as required)	09:04	1	HuLL – Human Performance Lessons Learned			
4	PCC Mgr	09:05	1	Nuclear Safety Trait of the Week – Questioning Attitude Principle for Excellence in Nuclear Project Construction of the week: The Plant Is Built As Designed			
5	SMSB Attendee	09:06	3	Station /SMSB Issues/Highlights			
6	PCC Mgr Lead, Execution Resource Provides Status	09:09	10	Review T0 Schedule (including any first of a kind or infrequently performed tasks and who is providing oversight)			
7	HU Trends/Plans	09:19	3	Rotating spot for each PM to review trends, field communication plans & observations.			
8	PCC Manager (Tuesdays)	09:19	2	Close-out List Review			
9	Project Leads/Coord. (Wednesdays)	09:19	2	Weekend Support for any support required which has not been arranged prior (weekend Contacts to be sent to PCC (Refurb PCC Manager) by Thursday 16:00h)			
10	Pre-Reg Mgr (Fridays)	09:19	2	Pre-Reg Level 1 Review			
11	PCC Manager/Pre-Req Mgr	09:21	1	T Meetings of the Day			
12	PCC Mgr/All	09:22	2	Support Needed including Urgent Issues			
13	PCC Action Log	09:24	2	Review Actions which are over-due, as well as new actions.			
14	Strat 4/5 Rotation	09:26	1	PCC Team Performance Critique & Closing Comments	Mon:	Wed:	Fri:
					Tue:	Thur:	



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Refurb T-0 Execution meeting Top Lessons Learned:

- End of Shift Updates
- If no work is on the PCC plan, attendance to the PCC Update meeting is optional for those representatives, except on Friday where the attendance is required for PCC Lessons Learned. (unless you have a HULL to present, or an action to address and in those cases, attendance is required)

Extract from Darlington Refurb PCC Roles & Responsibilities

Schedule Progress Updates:

Communications are crisp and 3-way for actions or important operational information transfer.

The only acceptable schedule progress updates are as follows:

- **Ahead of Schedule** (and TCD for 1 hour heads up as required)
- **Complete** (work is complete)
- **As Scheduled** (work will be completed as scheduled)
- **Off Schedule** (Work will not be completed as scheduled, and the following must be specified:
 - When work will be completed. (TCD)
 - What help is needed
 - Who "OWNS" the issue
 - SCR #

Unacceptable Schedule Updates include:

- We are waiting for upstream task without a TCD for handover.
- We should be able to support.
- We hope to get to it this shift.
- We may be starting next shift, without facts to support the delay and help needed.
- I will get the status after the meeting.
- The schedule is wrong, without providing facts.

Weekly Refurbishment Message

Week of April 25

Business Focus: Nuclear Safety Culture

Our recent Nuclear Safety Culture assessment has been completed. Many thanks to everyone who participated. The assessment revealed that overall Nuclear Projects and Refurbishment have a good Nuclear Safety Culture. The team saw clear indications that we are firmly committed to safety, feel empowered to ask questions and escalate our concerns to our supervisors

The team also identified opportunities which will require follow up actions:

1. Ensuring we do not lower our standards when faced with time and schedule constraints.
2. Ensuring we take action to quickly resolve issues and lessons learned.
3. Ensuring our Nuclear Safety traits and expected behaviours are well understood by everyone on the Project such that we understand how our actions and behaviours impact nuclear safety.
4. Ensuring we always work collaboratively and respectfully, that regardless of employer or department we are all equally important.

The next phase in this assessment is to work together (OPG and Vendor Partners) to develop a corrective action plan to address these findings.

A healthy Nuclear Safety Culture goes hand in hand with ensuring our projects are executed safely and with quality.

The assessment team noted that our team has a strong sense of pride to accomplish our mission at Darlington, let's continue to strengthen our Nuclear Safety Culture through our daily communications and interactions with each other recognizing there is only one team here with a common goal.

Thank You for
Participating



**NUCLEAR
SAFETY
CULTURE
ASSESSMENT**

Where are we
functioning well?
What areas need
improvement?

**Improving Nuclear Safety
Culture Depends on YOU**

NUCLEAR PROJECTS ► **HAVE YOUR SAY**
March 7 – April 1

Nuclear Safety **OUR OVERRIDING PRIORITY**



Nuclear Safety Principles

#2 Questioning Attitude

Individuals avoid complacency and continuously challenge existing conditions, assumptions, anomalies, and activities in order to identify discrepancies that might result in error or inappropriate action.



Project Excellence Principles

#4 Schedules are Realistic and Understood

Effective project controls and detailed planning are key factors in the success of any large construction projects.

Nuclear Safety OUR OVERRIDING PRIORITY



Questioning Attitude

Individuals avoid complacency and continuously challenge existing conditions and activities in order to identify discrepancies that might result in error or inappropriate action. All employees are watchful for assumptions, anomalies, values, conditions, or activities that can have an undesirable effect on plant safety.

- **Nuclear is Recognized as Special and Unique:** Individuals understand that complex technologies can fail in unpredictable ways.
- **Challenge the Unknown:** Individuals stop when faced with uncertain conditions. Risks are evaluated and managed before work proceeds.
- **Challenge Assumptions:** Individuals challenge assumptions and offer opposing views when they believe something is not correct.
- **Avoid Complacency:** Individuals recognize and plan for the possibility of mistakes, latent issues, and inherent risk, even while expecting successful outcomes.

INPO Principles for Excellence in Nuclear Project Construction

7. The Plant Is Built As Designed

Personnel are systematic and rigorous in building the plant as designed. Decisions regarding deviations from design or specifications, as well as any reduction in design margins, are made carefully, with involvement of the design authority. Managers and supervisors understand the expectation, when faced with unexpected or uncertain conditions, to take actions that preclude unauthorized changes, deficient construction quality, or risk to workers. When faced with unusual or uncertain conditions, workers stop and seek clarification before proceeding. Senior leaders support and reinforce conservative decision-making.

Attributes:

- ☐ Individuals do not proceed in the face of uncertainty; they stop and seek clarification.
- ☐ Individuals demonstrate a questioning attitude by challenging assumptions, investigating anomalies, and considering potential adverse consequences of their actions prior to work; for example, deviations from design documents, quality of workmanship, and personnel safety.
- ☐ When deviations from design or specifications are needed or recognized, the condition is promptly brought to the attention of the design authority. The condition is then carefully evaluated and is addressed through a formal design-change process before personnel proceed, thereby minimizing the potential for rework or nonconformance with the COL.
- ☐ Potential reductions in design margin for systems, structures, and components important to safety or reliability are rigorously evaluated by the design authority and are avoided, except in unusual circumstances. Compliance with codes and standards is always maintained.
- ☐ Decision-makers ensure they possess full knowledge of the problem through personal observation of physical conditions, when applicable.
- ☐ A formal decision-making process is followed when conditions change or project changes are proposed that could affect construction quality or personnel safety.
 - Reasons for important decisions are widely communicated, and worker understanding is periodically verified.

HARD HAT SPRING CLEAN IS YOUR HARD HAT FIT FOR DUTY?



HARD HAT HAT-TRICK

1. You must perform an integrity check of your hard hat.
2. Your hard hat must be free of paint, marker and metallics.
3. Stickers on your hard hat must not hinder the quality of the integrity check.

**ALL HARD HATS WORN ON SITE ARE REQUIRED TO COMPLY
WITH SPECIFIC EXPECTATIONS.**

[D-EXP-MAINT-A-015-R000 - Hard Hat Expectations](#) can be found on the *Darlington Maintenance Website* under the *Maintenance Managers Mandatories* link.

HARD HAT EXCHANGE DAY – THURSDAY APRIL 28TH

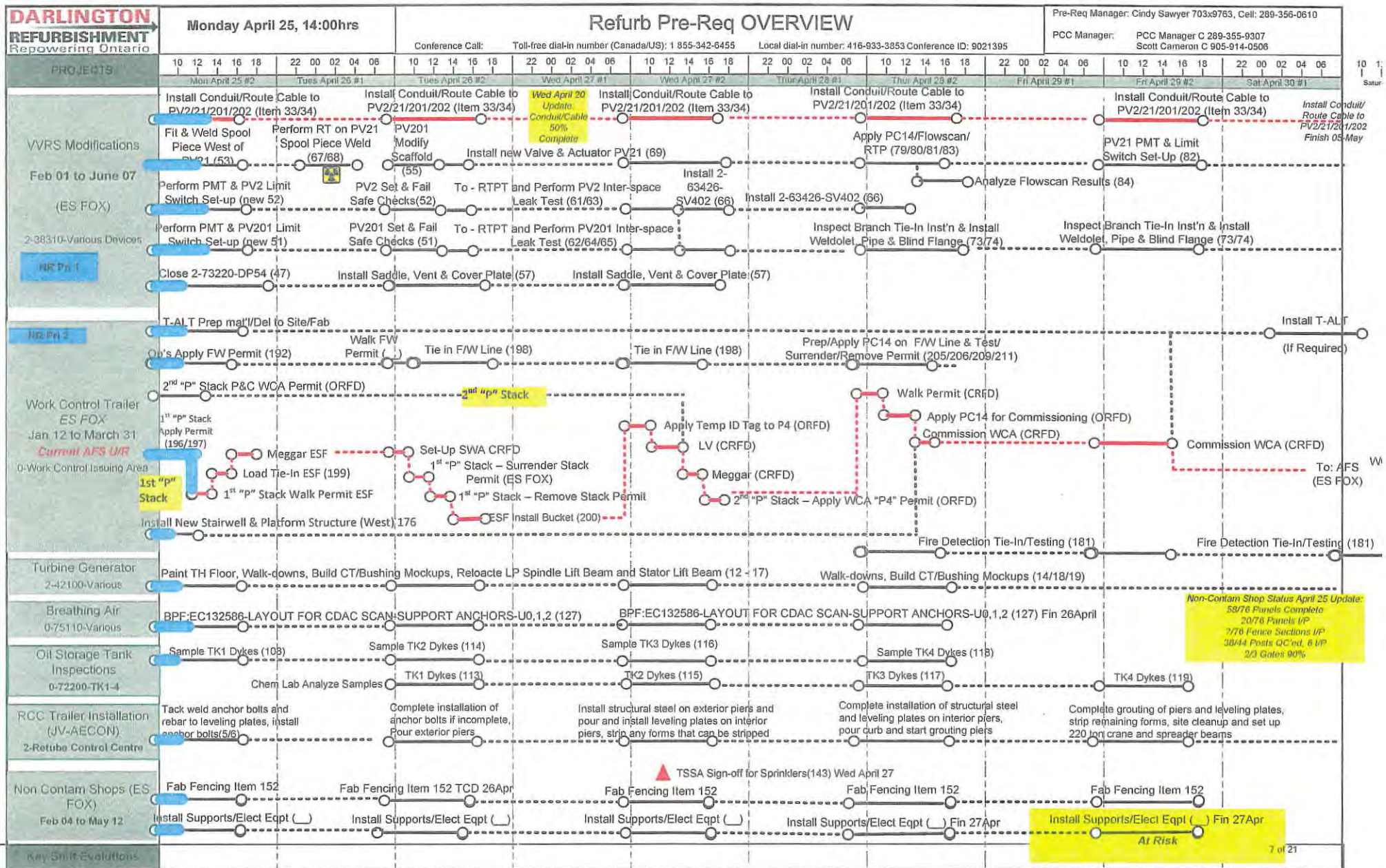
NEW & USED HARD HAT BINS @ UNIT 0 107 ELEVATION JUST SOUTH OF THE LOADING BAY

TEAMWORK

HUMAN PERFORMANCE

FIX THE PLANT

ONTARIOPOWER
GENERATION



ITEM #	G R D	WW	T Y P	WORK ORDER TASK	P R J	P A W	RISK ASSMT	I R	R M I	CR EQ	WORK AGAINST	WO ATTRIB	START	FINISH	2016														
															Apr 23					Apr 30					May 07				
															M	Tue	W	Thr	Fri	Sat	Sun	M	Tue	W	Thr	Fri	Sat	Sun	M
UNIT 0 / COMMON TO SITE																													
2760	C	16W17	OD	04760068D1	I		LOW	T		2	0-49100-SG4	3:12P-27, 52W, DP-P	04-Jan-16 08:00 A	30-Apr-16 16:00	OPS COMMISSIONING SG4 CONTROLS														
2040	B	16W17	OA	02771735X1	I		MNI	B		2	0-73750-MV13	1:12P-32	18-Apr-16 20:00 A	26-Apr-16 12:00	0-73750-MV13 EFADS ROM Slip # 507951														
2105	C	16W17	OA	03155839X1	I		MNI	T		1	0-73980-ACU2	3:12P-57, 52W, DP-P	20-Apr-16 12:00 A	28-Apr-16 17:00	INSTALL ESW LOW PRESSURE TRIP LOGIC 0-73980-ACU2 COMPRE USCAROMS Slip # 507956														
1185	C	OPRER	OA	03248414X2					T		0-WORK CONTROL ISSUING AREA-COLUMNS SF7.9, SE7.9 TO	3:12P-56, 52W, DP-P, NBR, NR-SL	22-Apr-16 08:00 A	27-Apr-16 10:00	Fire Suppression REFURB W507 Work Control Area Mike Naguib 905 809-5860														
945	B	16W17	PM	02789390X1	I		MNI	T			0-U0/U1-53230-7CB11	3:12P-63, MP-M, 52W	25-Apr-16 08:00	25-Apr-16 17:00	1-53230-7CB11 (T21) 6 YR BREAKER & RELAY MAINTENANCE														
1030	B	16W16		00475189D1	I		MGI				Bowmanville H4L543 & H4A	MP-M	25-Apr-16 08:00*	23-May-16 08:00	Hydro One - Perform Routine Gas compartment maintenance (DS421, D Hydro One - Perform Routine Gas compartment maintenance (DS421, D														
1035	B	16W16		00508721D1	I		MGI				Bowmanville R56-X526B & X526B	MP-M	25-Apr-16 08:00	29-Apr-16 10:00	Hydro One - IESO Voltage control requiring X526B Out of Service (O/S)														
990		OPRER	OA	03248412X2					T	4	0-53340-MCC502	3:12P-56, 52W, DP-P, NBR, NR-SL	25-Apr-16 08:00	26-Apr-16 10:00	0-53340-MCC502-P STACK Work REFURB W507 Work Control Area														
1040	B	16W17		00506349D1	I		MGI				Darlington NGSA H4A	MP-M	25-Apr-16 10:00*	25-Apr-16 14:00	Hydro One - Bowmanville H4A Breaker Failure Protection Mtce. H4A op														
825	B	16W17	PM	02811058X1	I		MNI	A		2	0-34230-PV37	2:12P-47, MP-4	26-Apr-16 02:00	02-May-16 17:00	0-34230-PV37 VALVE AND ACTUATOR OVERHAUL Bundle WO#2811058, WO#2811061 & WO#2989354														
960	B	16W17	PM	02783561X1	I		MNI	T			0-U0/U3-53230-7CB3	3:12P-63, MP-M, 52W	26-Apr-16 10:00	26-Apr-16 16:00	3-53230-7CB3 (BU7) 6YR TRANSFER BREAKER														
1045	B	16W17		00506389D1	I		MGI				Darlington NGSA H4L543	MP-M	26-Apr-16 10:00*	26-Apr-16 14:00	Hydro One - Bowmanville H4L543 Breaker Failure Protection Mtce.														

DNGD
V17 2016

POW SHEET - TUESDAY #2
25 APRIL @ 08:00 T 9 APRIL @ 20:00

Data Date: 25-Apr-16
Run Date: 25-Apr-16
Run Time: 11:41

8 of 2

ITEM #	G R D	V W W	T Y P	WORK ORDER TASK	P R J	P A W	RISK ASSMT	I R	R M I	C R EQ	WORK AGAINST	WO ATTRIB	START	FINISH	2016													
															Apr 23					Apr 30					May 07			
															M	Tue	W	Th	Fri	Sat	Sun	M	Tue	W	Th	Fri	Sat	Sun
1025	B	16W16		00506788D1	I		MGI				Bowmanville X520B R56-X520B	MP-M	26-Apr-16 10:00*	29-Apr-16 16:00	Circuit X520B switched Out of Service for IESO Voltage Control													
2710	B	16W17		02858295X1	I		MNI	X		1	0-SRST 8.3 ON SG2-U0	2:12P-63, 52W	28-Apr-16 10:00	29-Apr-16 11:00	0-49110-SG2 24HR RUN USING SRST 8.3 24 Hr Test - ROM Slip# 508258													
670	B	16W17	PM	0489326702	I		MNI	X			0-SRST 3.2.15-U0&U1	1:12P-22	29-Apr-16 02:00	29-Apr-16 05:00	OP (U0-CRO) PERFORM SRST 3.02.015 ECI LOG 3.2.15.1, Initiate U1, Stop P1 1st													
WFFAA																												
3430	B	16W17	CN	03265392X1	I		LOW				012-73730-ACU5		06-Mar-16 04:00 A	13-May-16 18:00	012-73730-ACU5 COOLING WATER LEAK IN CONTAINMENT													
3345	B	16W17	PM	04778997X1	I		LOW	B		3	012-38350-DR2	1:12P-54	24-Apr-16 08:00 A	10-May-16 18:00	012-38350-DR2 DESICCANT CHANGE Bundle WO#4778997 & WO#4777163													
3320	B	16W17	PM	0489326903	I		LOW	X			012-SRST 4.2.15 012-AL2	1:12P-22	28-Apr-16 20:00*	28-Apr-16 23:00	OP (U0-CRO/CSCA) PERFORM SRST 04.02.015 012-21620-AL2													
COMMON TO UNITS 1,2,3,4																												
3455	B	16W17	PM	03135357X1	I		LOW	\$		3	014-014-CLN CCW FORBAY	3:12P-31, MP-B, 52W	25-Apr-16 08:00	16-May-16 09:00	()TWD DIVERS CLEAN OUT SHELLS AT FOREBAY BEND Diver FLM Richard Hayward 905-424-3711													
Unit 1																												
4640	B	16W17	PM	04818342X1	I		MNI	S		2	1-1-73220 FR8/9 INST	4:12P-54, MP-M, MP-I, 52W	25-Apr-16 08:00	25-Apr-16 13:00	1-73220-FR9 RE-CONNECT FR MEDIA Quiet Mode U1/U2													
4125	B	16W17	PM	02789390X2	I		MNI	T		1	1-53230-7CB11	3:12P-63, MP-M, 52W	25-Apr-16 08:00	25-Apr-16 18:00	1-53230-7CB11 (T21) 6 YR BREAKER & RELAY MAINTENANCE													
4695	B	16W17	PM	04818342X2	I		MNI	S		2	1-1-73220 FR8/9 INST	4:12P-54, MP-M, MP-I, 52W	25-Apr-16 12:00	25-Apr-16 16:00	1-73220-FR8 RE-CONNECT FR MEDIA Quiet Mode U1/U2													
3705	B	16W17	CN	04927255X1	I		MNI	T	Y	3	1-34810-CPM2	6:12P-76, SPOC, OPS CRITICAL	26-Apr-16 04:00	29-Jun-16 14:00	U1 LZCS CP2 Maintenance													
4805	B	16W17	PM	03143919D1	I		MNI	S		3	2-73220-FR9	4:12P-54, MP-M, MP-I, 52W	26-Apr-16 08:00	26-Apr-16 13:00	2-73220-FR9 RE-CONNECT FR MEDIA QUIET MODE in U1/U2													

ITEM #	GRD	WW	TYP	WORK ORDER TASK	PRJ	PAW	RISK ASSMT	IR	RMI	CREQ	WORK AGAINST	WO ATTRIB	START	FINISH	2016															
															Apr 23							Apr 30							May 07	
															M	Tue	W	Th	Fri	Sat	Sun	M	Tue	W	Th	Fri	Sat	Sun	M	
4810	B	16W17	PM	03147964D1	I		MNI	S		3	2-73220-FR8	4:12P-54, MP-M, MP-I, 52W	26-Apr-16 12:00	26-Apr-16 17:00	2-73220-FR8 RE-CONNECT FR MEDIA QUIET MODE in U1/U2															
4155	B	16W17	PM	03175503X1	I		MNI	L		2	1-53590-RGA143-1	3:12P, MP-M, 52W	27-Apr-16 04:00	27-Apr-16 18:00	E1-53590-RGA143-1 CLEAN & TEST REGULATOR															
3875	B	16W17	PM	02576265X1	I		MGI	A		1	1-1-OVH SDS PWS'S CH-D	1:12P-63	27-Apr-16 04:00*	27-Apr-16 16:00	NO FUEL WINDOW (4 HR STEADY STATE) CSHD: 2X8, CH D - 1-68231 CH"D" PWS REFURBISHMENT															
3805	B	16W17	PM	04893286X1	I		LOW	X			1-SRST 3.01.033 - 03.01.036	1:12P-22	27-Apr-16 08:00	27-Apr-16 13:00	1-SRST 3.01.033 - 03.01.036															
4735	B	16W17	PM	03152267X1	I		MNI	M		1	1-1 INSP USCA ACU2	3:12P-71, 52W, MP-5	28-Apr-16 04:00	28-Apr-16 17:00	1-73980-ACU2 MAINTENANCE & FREON LEAK CHECK															
3770	B	16W17	PM	0489326703	I		MNI	X			1-SRST 3.2.15 U1	1:12P-22	29-Apr-16 02:00*	29-Apr-16 04:00	OP (MCR) *U1* INITIATE LOCA SIGNAL FOR SRST 3.2.15.1, Initiate U1, Stop P1 1st															
Unit 2																														
5065	B	OPRER	OD	04725043D4			LOW	T		1	2-38310-PV2,21,201 & 202	4:12P-49, JNR-DSF NBR, NR	05-Feb-16 08:00 A	06-May-16 19:00	VVR5 BUTTON UP MODIFICATION WORK REFURB W501 7012 VVR5 Mods Work															
5515	B	16W17	CN	04830251X1	I		LOW	T		3	2-72200-PM3	4:12P-76, OPS CRITICAL MP-4,	29-Mar-16 12:00 A	27-Oct-16 17:00	2-72200-PM3 RCW PUMP TRIPPED. MOTOR SPARKED RCW 2-72200-PM3															
4970	C	16W17	OA	04886448X1	I		MRI				2-34510-TK2		22-Apr-16 08:00 A	02-May-16 11:00	2-34510-TK2 SLURRY TO TTP. INITIAL & FINAL SHIPMENT															
5375	B	16W17	PM	03062427X1	I		MNI	L		3	2-53520-INB1	4:12P, MP-M, 52W, NISP	25-Apr-16 08:00	27-Apr-16 20:00	2-53520-INB1 INV/RCT/ATS MTCE & TESTING ROM Slip# 508887															
5925	B	16W17		04818342D2	I		MNI	S		2	1-1-73220 FR8/9 INST	4:12P-54, MP-M, MP-I, 52W	25-Apr-16 08:00	25-Apr-16 16:00	1-73220-FR8 & FR9 RE-CONNECT FR MEDIA Quiet Mode U1/U2															
5180	C	OPRER	OA	0472504393			LOW	T		2	2-38310-PV21	5:12P-27, 52W, JNR-DSF NBR,	25-Apr-16 22:00*	26-Apr-16 02:00	CMT: PERFORM RADIOGRAPHY ON PV21 SPOOL PIECE WELD REFURB W501 7012 VVR5 Mods Work															
6170	B	16W17	PM	03143919X1	I		MNI	S		3	2-73220-FR9	4:12P-54, MP-M, MP-I, 52W	26-Apr-16 08:00	26-Apr-16 12:00	2-73220-FR9 RE-CONNECT FR MEDIA QUIET MODE in U1/U2															

2-73220-FR8 RE-CONNECT FR MEDIA
QUIET MODE in U1/U2

E1-53590-RGA143-1 CLEAN & TEST REGULATOR

NO FUEL WINDOW (4 HR STEADY STATE)
CSHD: 2X8, CH D - 1-68231 CH"D" PWS REFURBISHMENT

1-SRST 3.01.033 - 03.01.036

1-73980-ACU2 MAINTENANCE & FREON LEAK CHECK

OP (MCR) *U1* INITIATE LOCA SIGNAL FOR SRST
3.2.15.1, Initiate U1, Stop P1 1st

VVRS BUTTON UP MODIFICATION WORK

REFURB W501 7012 VVRS Mods Work

2-72200-PM3 RCW PUMP TRIPPED. MOTOR SPARKED

RCW 2-72200-PM3

2-34510-TK2 SLURRY TO TTP. INITIAL & FINAL SHIPMENT

2-53520-INB1 INV/RCT/ATS MTCE & TESTING

ROM Slip# 508887

1-73220-FR8 & FR9 RE-CONNECT FR MEDIA
Quiet Mode U1/U2

CNT: PERFORM RADIOGRAPHY ON PV21 SPOOL PIECE WELD

REFURB W501 7012 VVRS Mods Work

2-73220-FR9 RE-CONNECT FR MEDIA
QUIET MODE in U1/U2

ITEM #	G R D	VW	T Y P	WORK ORDER TASK	P R J	P A W	RISK ASSMT	I R	R M I	CR EQ	WORK AGAINST	WO ATTRIB	START	FINISH	2016															
															Apr 23							Apr 30							May 07	
															M	Tue	W	Th	Fri	Sat	Sun	M	Tue	W	Th	Fri	Sat	Sun	M	
6190	B	16W17	PM	03147964X1	I		LOW	S		3	2-73220-FR8	4:I2P-54, MP-M, MP-I, 52W	26-Apr-16 12:00	26-Apr-16 16:00	2-73220-FR8 RE-CONNECT FR MEDIA															
5530	B	16W17	PM	0489331201	I		MNI	X			2-SRST 11.27 UNIT 2	1:I2P-22	28-Apr-16 08:00*	28-Apr-16 11:00	OP (MCR) PERFORM SRST 11.27 (PV134 AIR LEAK RA															
5915	B	16W17	PM	0314393101	I			T		4	2-2-69100X/XY FILTERS	1:I2P-31	28-Apr-16 09:00	28-Apr-16 15:00	MC CLEAN 69100X/XY,CHECK AIR FILTERS/FANS/FLOW															
4840	B	16W17	PM	04893267X1	I		MNI				2-SRST 3.2.15 U2	1:I2P-22	29-Apr-16 02:00	29-Apr-16 03:00	NO FUEL WINDOW 2-SRST 3.2.15 U2															
5555		OPRER	OB	0308255510				T			2-RETUBE CONTROL CENTRE-100 EL OUTSIDE S 16.5	5:I2P-23, MP-V, JNR-DSF NBR,	29-Apr-16 07:00*	29-Apr-16 17:00	CNT- SETUP CRANES REFURB W536 Referb Control Center															
Unit 3																														
6935	B	16W16	PM	02517156X1	I		LOW				3-64453-PCV92		18-Apr-16 18:00 A	25-Apr-16 22:00	3-64453-PCV92 OVERHAUL															
6990	B	16W17	DN	02861452X1	I		MGI	N		3	3-64820-LCV21#1	1:I2P-36	24-Apr-16 11:00 A	04-May-16 17:00	3-64820-LCV21#1 - REQUIRES COMPLETE VALVE OVERHAUL															
6420	B	16W17	DN	04967487X1	I		MRI	T	Y	3	3-34710-P2	4:I2P-71, SPOC, OPS CRITICAL	25-Apr-16 09:00	29-Apr-16 01:00	3-34710-P2 GLAND LEAK LISS P2															
7120	B	16W17	PM	02660038X1	I		MGI	A		3	3-65550-PS1G	1:I2P-47	26-Apr-16 04:00*	26-Apr-16 17:00	NO FUEL WINDOW (4 HR STEADY STATE) CCID: 2X8, CH G - 3-65550-PS1G (68348 CH "G") 48V CTS P/S RE															
7100	B	16W17	PM	02783561X2	I		MNI	T		1	3-53230-7CB3	3:I2P-63, MP-M, 52W	26-Apr-16 10:00	26-Apr-16 15:00	3-53230-7CB3 (BU7) 6YR TRANSFER BREAKER															
7710	B	16W17	PM	02934743X1	I		MNI	B		1	3-73980-ACU1	4:I2P-72, 52W, MP-5, MP-I	26-Apr-16 20:00	28-Apr-16 18:00	3-73980-ACU1 MNTCE. (USCA)															
6330	B	16W17	PM	02949083X1	I		MNI	L		2	3-3 CAL ECI PS 127/135	2:I2P-71, NISP	26-Apr-16 22:00	27-Apr-16 13:00	3-63432-PS127#1-4 & PS135#1-4 (HPU3)															
7170	B	16W17	PM	03062428X1	I		MNI	L		2	3-53520-RGB3	3:I2P-63, MP-M, 52W	28-Apr-16 02:00	28-Apr-16 17:00	3-53520-RGB3 CLEAN/TEST REGULATOR															

2-73220-FR8 RE-CONNECT FR MEDIA

OP (MCR) PERFORM SRST 11.27 (PV134 AIR LEAK RA

MC CLEAN 69100X/XY,CHECK AIR FILTERS/FANS/FLOW

NO FUEL WINDOW 2-SRST 3.2.15 U2

CNT- SETUP CRANES

REFURB W536 Referb Control Center

3-64453-PCV92 OVERHAUL

3-64820-LCV21#1 - REQUIRES COMPLETE VALVE OVERHAUL

3-34710-P2 GLAND LEAK

LISS P2

NO FUEL WINDOW (4 HR STEADY STATE)

CCID: 2X8, CH G - 3-65550-PS1G (68348 CH "G") 48V CTS P/S RE

3-53230-7CB3 (BU7) 6YR TRANSFER BREAKER

3-73980-ACU1 MNTCE. (USCA)

3-63432-PS127#1-4 & PS135#1-4 (HPU3)

3-53520-RGB3 CLEAN/TEST REGULATOR

ITEM #	G R D	WW	T Y P	WORK ORDER TASK	P R J	P A W	RISK ASSMT	I R	R M I	CR EQ	WORK AGAINST	WO ATTRIB	START	FINISH	2016																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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7700	C	16W17	PM	0490124801	I		LOW	X			3-SRST 9.17C UNIT 3	1:12P-22	28-Apr-16 20:00*	29-Apr-16 01:00																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																</

OP PERFORM SRST 9.17 SLB MULTI UNIT COMMUN

NO FUEL WINDOW (4 HR STEADY STATE)

CCID: 2X3 - 3-68346-TEM1J-WDM SDS2 DISPLAY/T

5451 - BYA1 CAPACITY TEST POW

ROMS # 506823

POW FOR TEMPORAY POWER INSTALLATION 4-53340-MCC102

POW FOR 4-73990-ACU1 TEMPORARY POWER REMOVAL

4-55310-BYB1 CAPACITY TEST POW

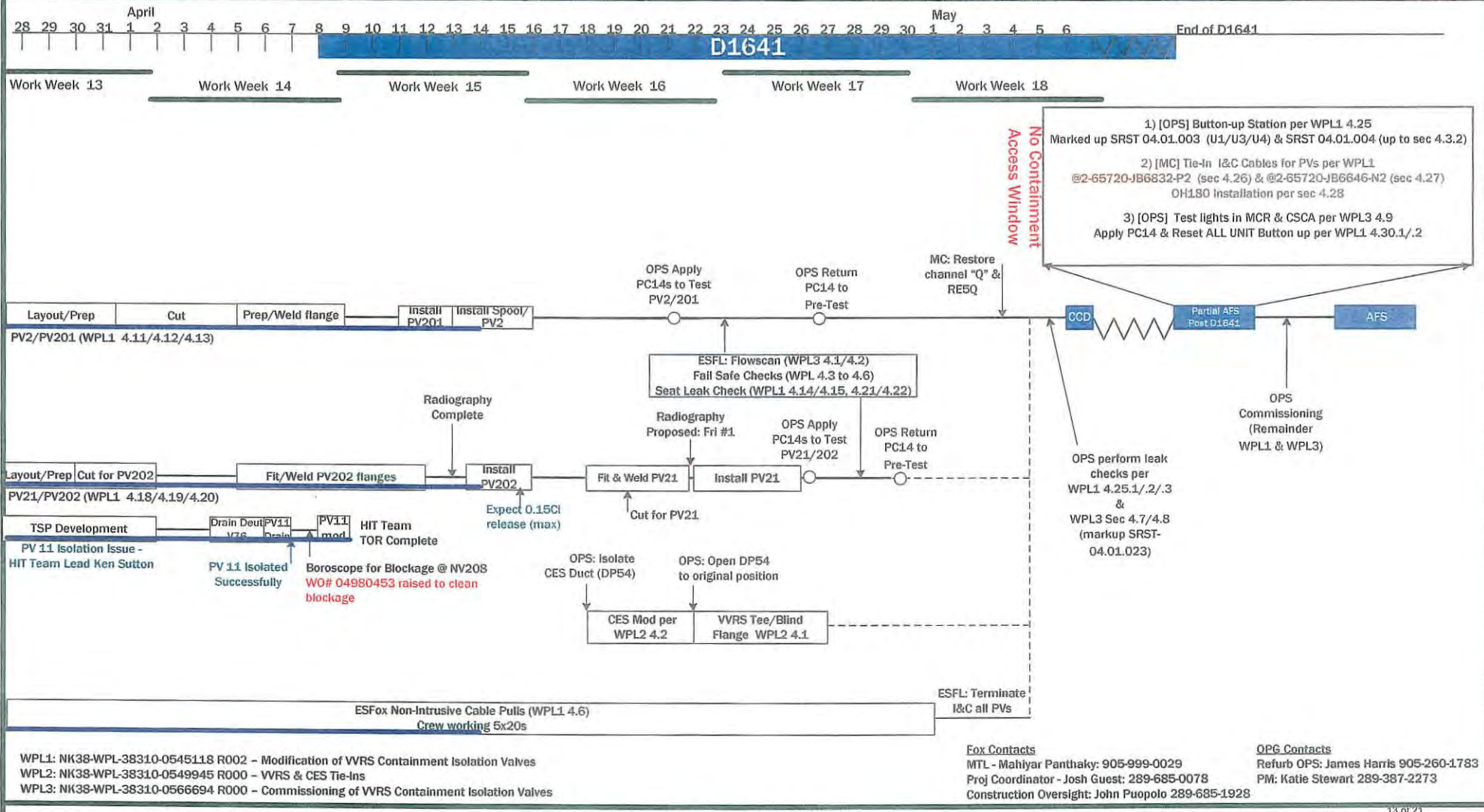
ROMS # 506824

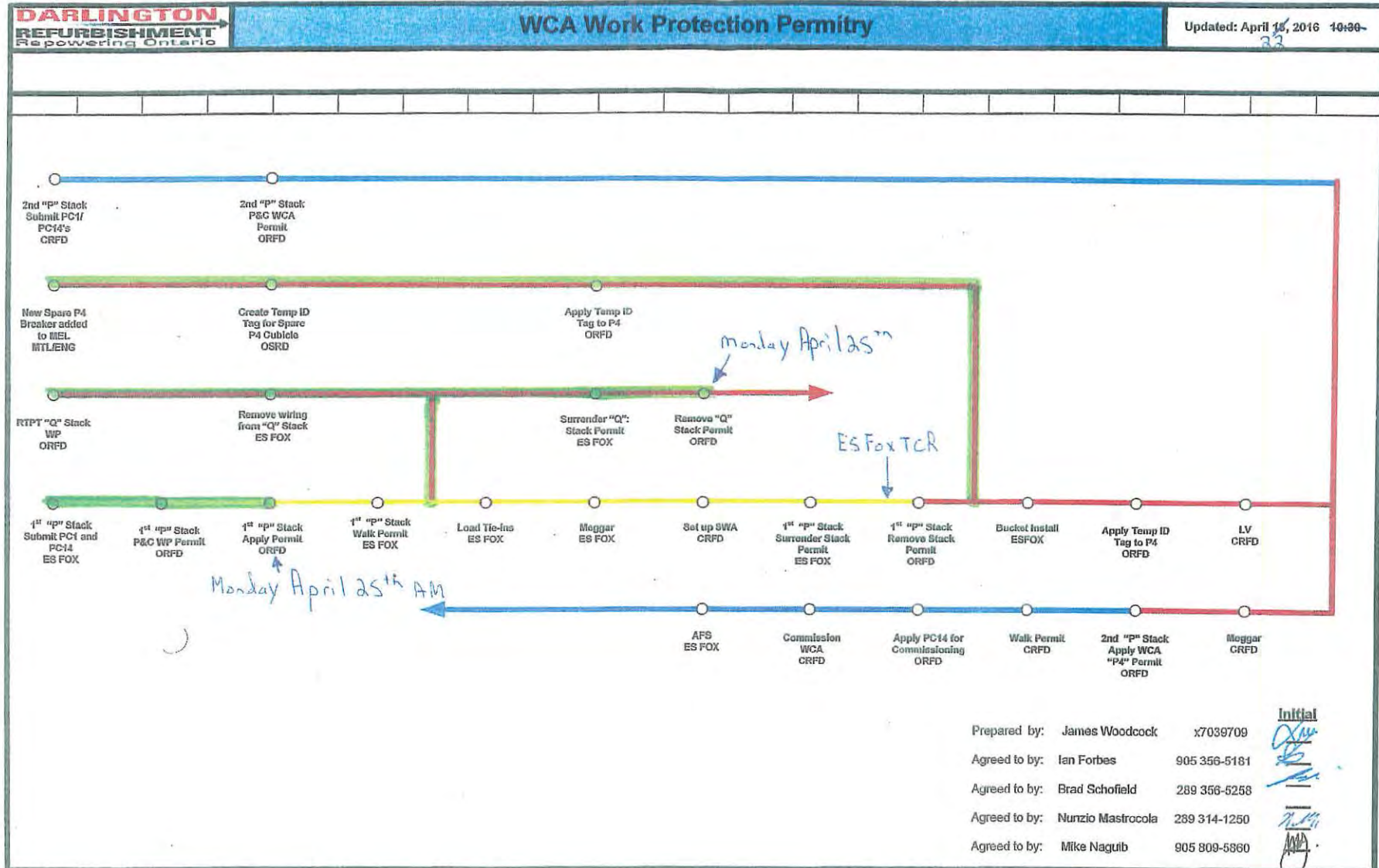
OPS F19/F20 NOTIFY MTCE HOLD OFF CONDITIONS ARE
QUIET MODE UNITS 3/4

OPS F15/F16 NOTIFY MTCE HOLD OFF CONDITIONS AF

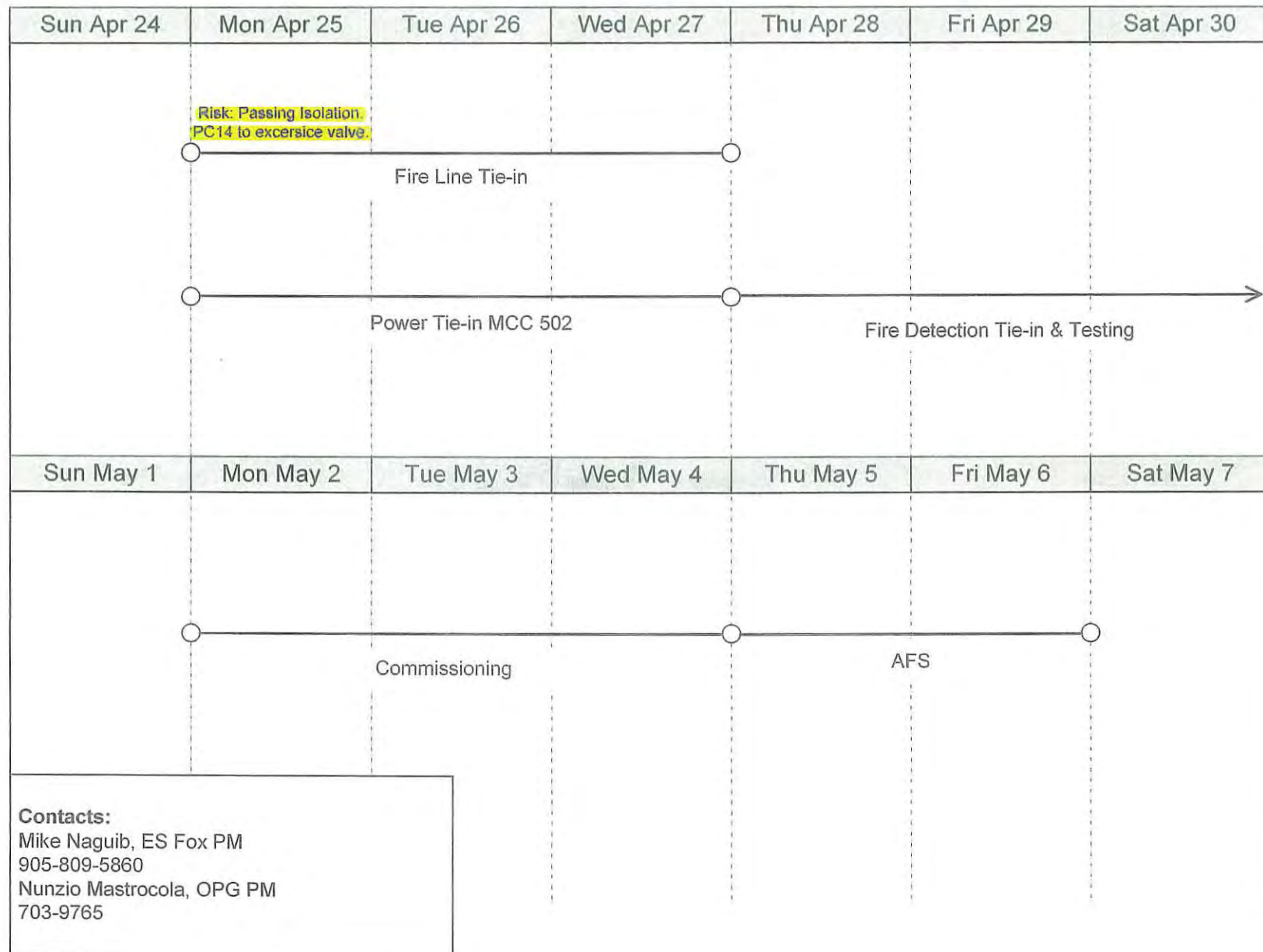
5416 - BU16 BREAKER & RELAY MTCE POW

VVRS Containment Boundary Modification





Work Control Area Project 73711



Unit 2

RFR Project Pre-requisites Level 2 Logic

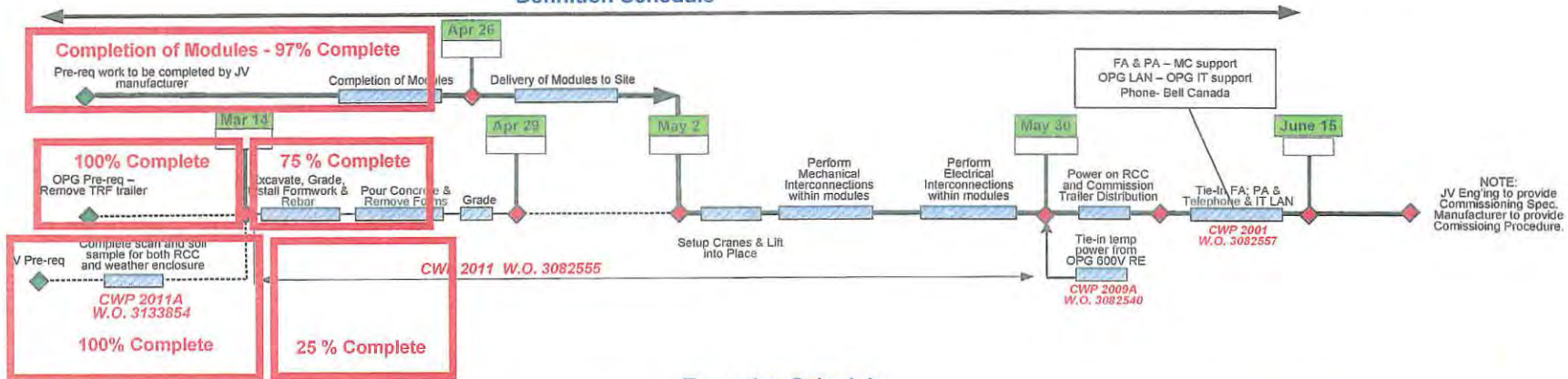
Window 536 RCC Trailers

OPG Project Co-ord: Kevin Hill
JV RFR Lead: Fred Milko

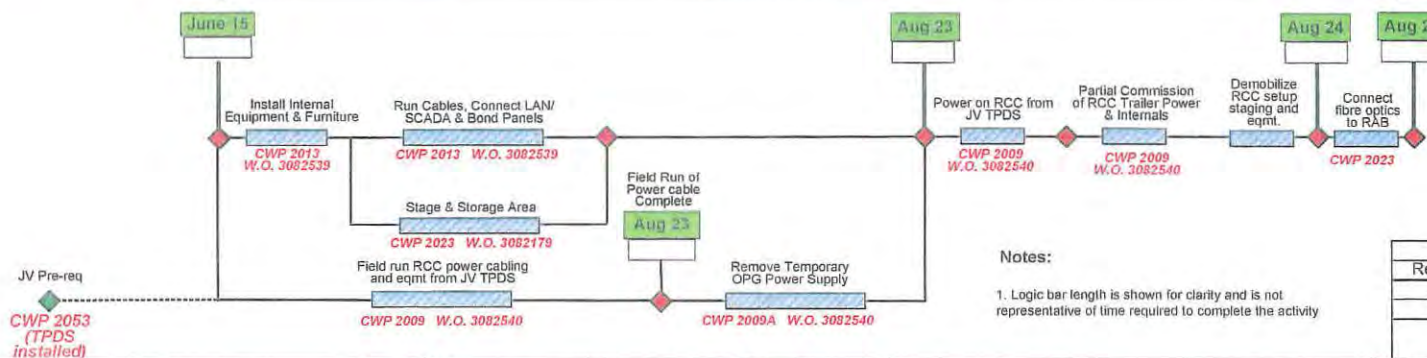
Updated April 22, 2016

DEC #	CWP #	CWP Titles	WO	WO Desc	WP or CWP	Issuing Auth.	Permitry	TCD
123313	2001	Tie-In of RCC to OPG Systems (Fire Alarm, Phone, PA and LAN)	03082560	NR-TS0010-4-2-60215-TIE-IN OF RCC TO PA EQUIPMENT	WP	OPG WA	TBD	Complete
123325	2011	Civil Installation of RCC Trailer	03082555	NR-TS0010-4-2-28200-CIVIL INSTALL OF RCC TRAILER	WP	OPG WA	None	Complete
123326	2013	RCC Internals (RCS Panels, Workstations, Server) Installation	03082539	NR-TS0010-4-2- RCC INTERNALS INSTALLATION	CWP	JV WA	None	01-May-16
123340	2023	Install VOS and VCS in the RAB Staging and Storage Areas	03082179	NR-TS0010-4-2-60200- PROVIDE COMM WITH RCC & VAULT	CWP	JV WA	None	01-May-16
123311	2009a	Temporary power tie-in via OPG 600V RE	03082540	NR-TS0010-4-2-53340-TIE-IN OF RCC to 600 VAC CLASS IV POWER 2009	TBD	OPG WA	PPT	17-Apr-16
123325	2011a	Civil Installation of RCC Trailer/Weather Enclosure - Soil Sampling/Daylighting			WP	OPG WA	None	Complete
123311	2009	RCC power tie-in via JV TPDS	03082540	NR-TS0010-4-2-53340-TIE-IN OF RCC to 600 VAC JV TPDS system	TBD	JV WA	LOTO	17-Apr-16

Definition Schedule



Execution Schedule



01	April 14 2016	
Rev. No.	Date	Description
Prepared by:	Reviewed by:	Approved by:
Dave Worton	Fred Milko	Todd Hamilton
RFR Project Pre-requisite Window L2 Logic		

Upcoming Pre-req schedule review meetings for 2016 MAR 30.xlsx

<div> <div> DARLINGTON REFURBISHMENT Repowering Ontario </div> <div> Prepared by : Cyndy Sawyer Initial issue: MAR 30,2016 </div> </div>					
	Monday	Tuesday	Wednesday	Thursday	Friday
06:45-07:00					
07:00-07:15					
07:30-08:00	SMSB PRE MEETING	SMSB PRE MEETING	SMSB PRE MEETING	SMSB PRE MEETING	SMSB PRE MEETING
08:00-08:30	SMSB	SMSB	SMSB	SMSB	SMSB
08:20-08:40	Line by Line Schedule Review	Line by Line Schedule Review	Line by Line Schedule Review	Line by Line Schedule Review	Line by Line Schedule Review
09:00-09:30	DAILY REFURB PCC SCHEDULE UPDATE (T0)	DAILY REFURB PCC SCHEDULE UPDATE (T0)	DAILY REFURB PCC SCHEDULE UPDATE (T0)	DAILY REFURB PCC SCHEDULE UPDATE (T0)	DAILY REFURB PCC SCHEDULE UPDATE (T0)
09:30-10:00		T-19 Scope Commitment ESSB Rm 114 (Station Schedule)		T-1 Final Schedule Review, before Publishing on Friday	T-0 Schedule Approval Meeting, before publishing
10:00 - 10:30			T-9 Scope Freeze Meeting (Station Schedule)	HOLDS Review meeting	T-2 Meeting Room 114 (Station Schedule)
	Send station NRP2 Refurb Schedule Numbers and POW activities	Send station NRP2 Refurb Schedule Numbers and POW activities	Send station NRP2 Refurb Schedule Numbers and POW activities	Send station NRP2 Refurb Schedule Numbers and POW activities	Send station NRP2 Refurb Schedule Numbers and POW activities
10:30-11:00	Send to station T-16 product	Send to station T-2 and T-5 Reactor Safety product	Send to station T-3 product	Send to station T-9 advance product	T-19 Excel product

Upcoming Pre-req schedule review meetings for 2016 MAR 30.xlsx

	Monday	Tuesday	Wednesday	Thursday	Friday
11:00 - 12:00			T-1 POW and SM Advanced Meeting 11:00-12:00 (2025 x3913) call in (Station Schedule)	HOLDS meeting in room 325 at RPO	
11:30-11:45	PCC manager 6 shift / action review	PCC manager 6 shift / action review	PCC manager 6 shift / action review	PCC manager 6 shift / action review	PCC manager 6 shift / action review
12:00-12:30	CNO Call	CNO Call	CNO Call	CNO Call	CNO Call
12:30 - 13:00		Reactor Safety Review (Station Scehdule)	Walkdowns completed and updated in walkdown toolkit (Station Scehdule)	T-16 Scope Rationalization ESSB Rm 114 (Station Schedule)	
13:00 - 14:00	T8-TO ADVANCE SCHEDULE REVIEW (with POW) (Note 2) (Note 1)	T15-T9 ADVANCE SCHEDULE REVIEW (with POW) (Note 2)(Note1)	T-21 TO T-16 ADVANCE SCHEDULE REVIEW (Note 1) (with POW)	HOLDS Review meeting	Refurb PCC pre-weekend communication meeting Call in to PCC
13:30 - 13:55	POND PRE MEETING	POND PRE MEETING	POND PRE MEETING	POND PRE MEETING	POND PRE MEETING
14:00 - 14:30	POND	POND	POND	POND	POND
			T-2 Schedule Review meeting for our pre-req projects. T-2 is sponsored by Op's.		
14:10 - 14:25	Final Status Update of Refurb Overview (Teleconference)	Final Status Update of Refurb Overview (Teleconference)	Final Status Update of Refurb Overview (Teleconference)	Final Status Update of Refurb Overview (Teleconference)	Final Status Update of Refurb Overview (Teleconference)
14:30 - 15:30					
16:15-16:30					
Notes					
1	Identify POW items, Turbine Hall Crane usage. Review schedule and deliverables.				
2	Review all NR tasks on NR Schedule. Ensure compliance with Station requirements for POW and risk reviews				
3	Review schedule and ensure walk downs accepted. Verify all reactor safety issues have been resolved.				
4					
			CNO Call		
			station meeting		
			refurb meeting		
			products sent to IPG		

Refurb PCC Action Log.xlsx

Item	Date Assigned	Issue and Action Required	Owner	Date Required	Date Committed / Update Req'd	Date Completed	Status/Comments/ Completion Notes
1	17-Dec-15	Set up PCC with work stations, PC's, video-conferencing, polycoms, additional monitors to display key Refurb info, moveable partition etc.	A Toohey	30/5/2016	Update May 15		2) PCC Manager phone 3) printer installation (AVAIS through CIO) (In progress) 11) Elmo Document Viewer Installation (AVAIS through CIO) 12) SMART Board(s) Installation (AVAIS through CIO) 13) Additional 6 monitors to be installed (AVAIS through CIO) 14) Additional Monitors, Elmo, projector and SMART Board to be tied into master controls. (AVAIS through CIO) 15) Training session on new IT equipment. (AVAIS through CIO) As of 22April: <i>Room 307 - the equipment has been ordered per Radu, I will follow up with vendor on Monday when they are on site - I've left message and no response as yet today, but we are targeting completion by end of May based on 9 week equipment delivery from order date.</i>
60	3/23/2016	1) Clear up process to allow ES FOX to deliver PV19/Pv2 to Stores including a contact name. (otherwise, valves will be scrapped) 2) Also need to address SATM Area Ownership, once field work is complete and if PV's are still in SATM area.	1) Eng 2) PM/SATM SPOC	8-May-16	Update 5/01/16		Valves to be stored @ MROD Storage Area @ U4 92.5 el. Col S9. for 1 month, until May 8/2016. Alex Perez (SRE Vapour Recovery Systems 703-1282) chasing permanent solution with Supply Chain.
65	4-Apr-16	Require plan and support for WB and SAM monitor PM's or repairs till the fall (staffing) SCR N-2016-08555 (RPO & RFRISA @ Risk of maintaining Zone 1 Levels due to Control Mtnce not able support WB or SAM monitor PM's or repairs till the fall (staffing))	Robin Granger/ Tom Carvin	TBD			Construction Manager owns the building. Robin Granger is looking into obtaining BTU Trades to maintain the monitors as the buildings belong to the trades, RPO, RFRISA and RWPB. <i>The Maintenance Contract RFP is I/P, which will include this support. Refurb/Station Control Maint. have committed to support until Contract in place.</i>
67	7-Apr-16	Review FIC Process for AFI's. Current FIC process is taking too long.	Refurb Eng'g	22-Apr-16	25-Apr-16		Did the review get distributed? Action plan?
70	12-Apr-16	a) 2-38500-PV11 - Require path forward on dessicant issue and EOC. (SCR D-2016-09294) B) Require 2-38310-PV104 Repaired before commissioning	Alex Perez	TBD	Update April 26		Will impact VVRS commissioning/AFS. Meeting scheduled Friday April 22. Update @ PONG April 25
72	13-Apr-16	Obtain CNSC code case acceptance for HG7.	R Laurich/CNSC	AFS (Post D1641)	Update May 15		Submitted to CNSC April 15. Turn-around ~ 1 month
73	13-Apr-16	1) Ensure correct MCC buckets are ordered for any future elctrical mods/new construction. 2) Ensure walk-downs are completed to verify electrical components ordered and/or delivered are appropriate for each installation situation.	1) Eng'g (R Waldo) 2) PM with Const'n Oversight	TBD			
76	14-Apr-16	Team to roll out SCR P1681 (P-2016-09472) FME event-wrench fell into condensor.	ALL	20-Apr-16			Engineering Rep TG Bundle Rep
77	20-Apr-16	Repeat roll-out Food and Drink slides to your work group including reference to SCR's N-2016-09974 and D-2016-10004 and D-2016-10063.	ALL PCC REP's	22-Apr-16			Black & Mac Islanding Rep TG Bundle Rep RFR Rep

Refurb PCC Action Log.xlsx

Item	Date Assigned	Issue and Action Required	Owner	Date Required	Date Committed / Update Req'd	Date Completed	Status/Comments/ Completion Notes
78	21-Apr-16	D-2016-09809 (D1641- RPD Near Miss Dropped Lead Blanket) investigation has been completed. Once MRPH rating has been established, provide a roll-out/communciation to Refurb Organization.	Safety (Lawrence Francisco)	26-Apr-16			
79	21-Apr-16	VVRS - Concern raised regarding VVRS cables running through Steam/Fire Barrier (ie Cable Riser) Eng'g to review requirements and communciate back to team.	Refurb Eng (C Alexander)	TBD	Daily		
80	21-Apr-16	Some confusion regarding Contractor Safety reporting. Conv Safety to review and feed back to the team.	Conv Saafety (Lawrence Francisco)	27-Apr-16			
81							
82							
83							
84							
85							

Darlington Teamwork Behaviours -Critique Form

Meeting: _____

Critiqued By: _____

Date: _____

Email completed form to Hu Manager










	Meets	AFI
1) The entire team must vote - Did the team meet the Darlington behaviour expectations both inside and outside this meeting? (Why or Why Not?): Explain why the team either met or did not meet behaviour expectations. <div style="border-bottom: 1px solid black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 15px;"></div>	<input style="width: 40px; height: 40px;" type="checkbox"/>	<input style="width: 40px; height: 40px;" type="checkbox"/>
2) Say it do it (Demonstrate personal accountability to deliver results and hold others accountable) <ul style="list-style-type: none"> a. Clear ownership demonstrated ("I've got it") b. Bias for action ("we can", not "we can't") c. Commitments met d. Recovery plan with TCD presented for commitments at risk <div style="border-bottom: 1px solid black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 15px;"></div>	<input style="width: 40px; height: 40px;" type="checkbox"/>	<input style="width: 40px; height: 40px;" type="checkbox"/>
3) Tell it as it is (Open & direct Communication with intent of making things better) <ul style="list-style-type: none"> a. "Straight talk" (results match reported progress) b. Conflicts/lack of support/lack of progress identified early c. Issues raised without prompting d. Immediate feedback (+ or -) was provided during discussions (don't wait until the end) e. Challenges/feedback accepted and encouraged <div style="border-bottom: 1px solid black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 15px;"></div>	<input style="width: 40px; height: 40px;" type="checkbox"/>	<input style="width: 40px; height: 40px;" type="checkbox"/>
4) Integrate & Collaborate (Breaking down silos , co-ordinated approach to address business issues) <ul style="list-style-type: none"> a. The team offers solutions or help without prompting b. Involved individuals and stakeholders are aware and aligned (no surprises) c. Support organizations are involved as appropriate (CFAM, HR, Refurb, PNGD etc.) d. Department issues and impact are considered for applicability across the departments <div style="border-bottom: 1px solid black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 15px;"></div>	<input style="width: 40px; height: 40px;" type="checkbox"/>	<input style="width: 40px; height: 40px;" type="checkbox"/>

April 26 (DAY 2)	Presenter/Lead	Time
Arrival/Coffee	RCRB Members	07:00-07:30
Tour of Mock Up	Roy Brown	07:30-09:30
Break		09:30-09:45
Release Quality Estimate (RQE)	Gary Rose	09:45-12:15
Lunch		12:15-12:45
Readiness To Execute (RTE) Plan	Roy Martin	12:45-13:45
Engineering	Gregg McCabe	13:45-14:45
Procurement	Sean Toohey	14:45-15:45
Break		15:45-16:00
Construction and Safety	Ken Hobbs and Bill Owens	16:00-18:00
Member Discussion	RCRB Members	18:00-18:30

Development of the Release Quality Estimate (RQE)
Presentation to the RCRB
April 26, 2016

Attendees:

Gary Rose, Vice President Project Planning and Controls
Ian Sansom, RQE Project Manager
Barb Reuber, Regulatory Affairs
Carla Carmichael, Vice President, Nuclear Finance

Agenda Item	Presenter & Duration
<p>1. Overview of RQE</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>RQE Summary.pptx RQE Road Map REV15.pdf</p>	<p>Gary Rose (60 Minutes)</p>
<p>2. Walkthrough of Sample "Project Bundle Package" and "RQE Total Cost Report"</p> <div style="display: flex; justify-content: space-around; align-items: center;">    </div> <p>RQE 12.8B - Overall Cost Summary Page.pdf RQE 12.8B Contingency Page.pdf RFR Sample NPET Review Package.pdf</p>	<p>Ian Sansom (30 mins)</p>
<p>3. Open Discussion - RQE</p>	<p>All</p>
<p>4. Supplementary Information</p> <p style="margin-left: 20px;">a. RQE Board Submission and Business Case</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>FINAL - Board memo-RQE Approved FINAL Signed DR RQE BCS-Nov 2015</p> <p style="margin-left: 20px;">b. RQE Plan</p>  <p>NK38-NR-PLAN-09701-10004.pdf</p> <p style="margin-left: 20px;">c. Program Basis of Estimate</p>  <p>NK38-REP-09701-0548257 - RQE Basis of Estimate</p>	

Darlington Nuclear Refurbishment Project Release Quality Estimate Overview

April 26, 2016

Gary Rose
VP, Project Planning and Control

BEHAVIOURS

- Say It, Do It
- Simplify It
- Think Top and Bottom Line
- Integrate and Collaborate
- Be Accountable



VALUES ▪ SAFETY ▪ INTEGRITY ▪ EXCELLENCE ▪ PEOPLE & CITIZENSHIP ▪



OPG CONFIDENTIAL

ONTARIOPOWER
GENERATION

What is RQE?



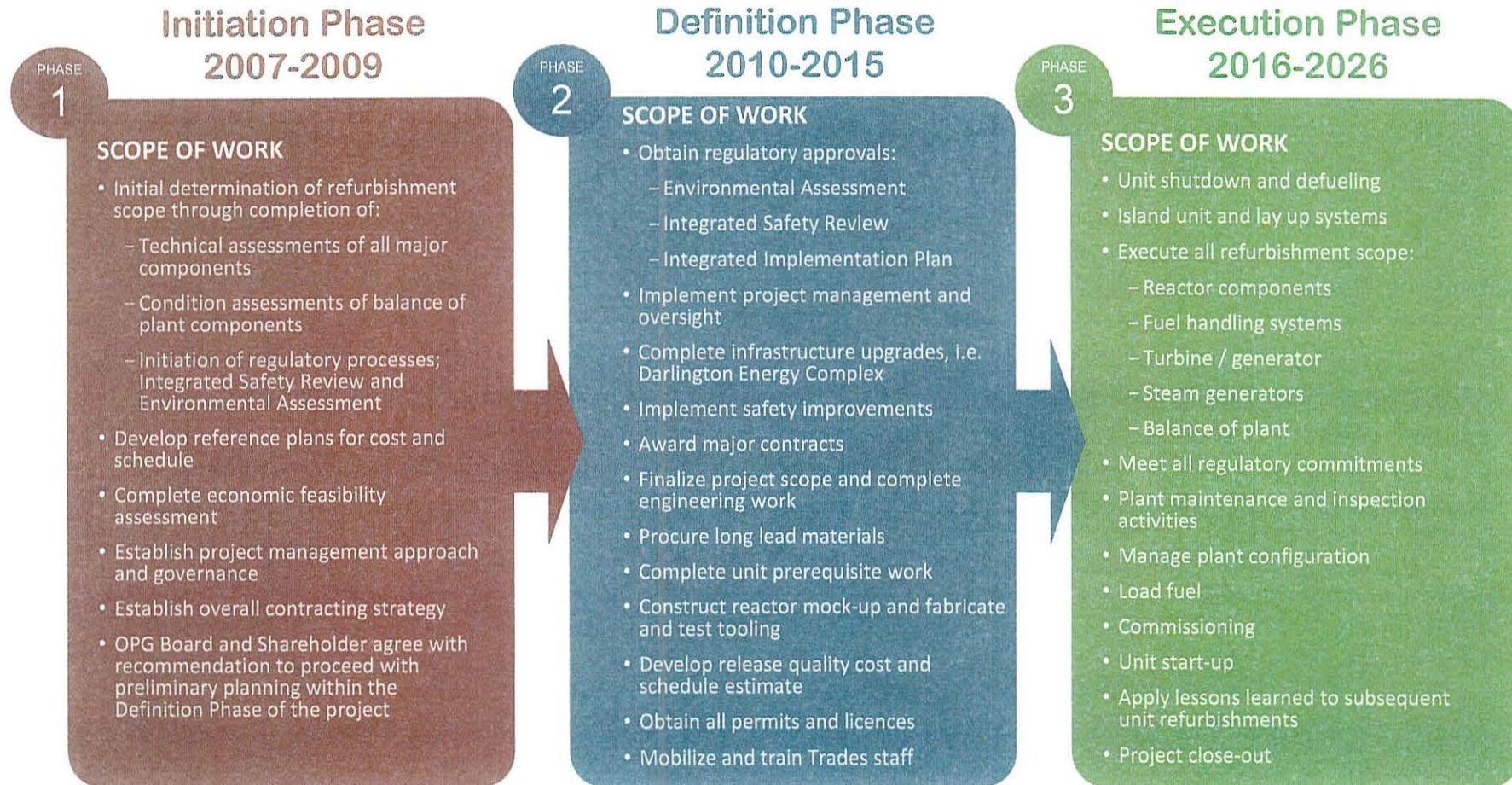
- RQE, “Release Quality Estimate”, is the 4-unit cost and schedule estimate for the purposes of obtaining execution phase approval of the Darlington Refurbishment Project.
- RQE is based on AACE’s estimate classification process, modified to meet OPG’s needs, with a goal to have all projects estimated to Class 3 or better, prior to approval to execute the project.
- The RQE is a culmination of many years of planning, and incorporates;
 - Scope
 - Engineering Design
 - Contracting Strategy
 - Cost Estimates
 - Schedule
 - Owner’s Costs
 - Contingency for Risk
 - Interest and Inflation
- The purpose of this presentation is to overview how RQE was prepared and to summarize the results.



DRP Phased Approach



The funding strategy followed a phased approach, with significant investments being made in upfront, early planning.



Investment in Planning



Planning Deliverables included a multi-faceted approach to ensure that OPG has confidence in the 4-Unit cost and schedule for the Refurbishment of Darlington.

Planning

- Province directed OPG to begin refurbishment feasibility study in 2006.
- OPG has completed detailed design prior to the start of construction.

Supporting Infrastructure

- Creation of full scale mock-up reactor to train staff, test tools, better anticipate project scope / cost / schedule.
- Other prerequisite projects either complete or underway to facilitate execution.

Contracting

- Contracts for all major work packages have been awarded.
- OPG has been working in close collaboration with contractors to improve accuracy of design / engineering / scoping / cost estimating / scheduling.

Budgeting

- Definition phase funding was put in place to select contractors early and fully define scope and develop a detailed cost and schedule baseline and risk register.

Resourcing

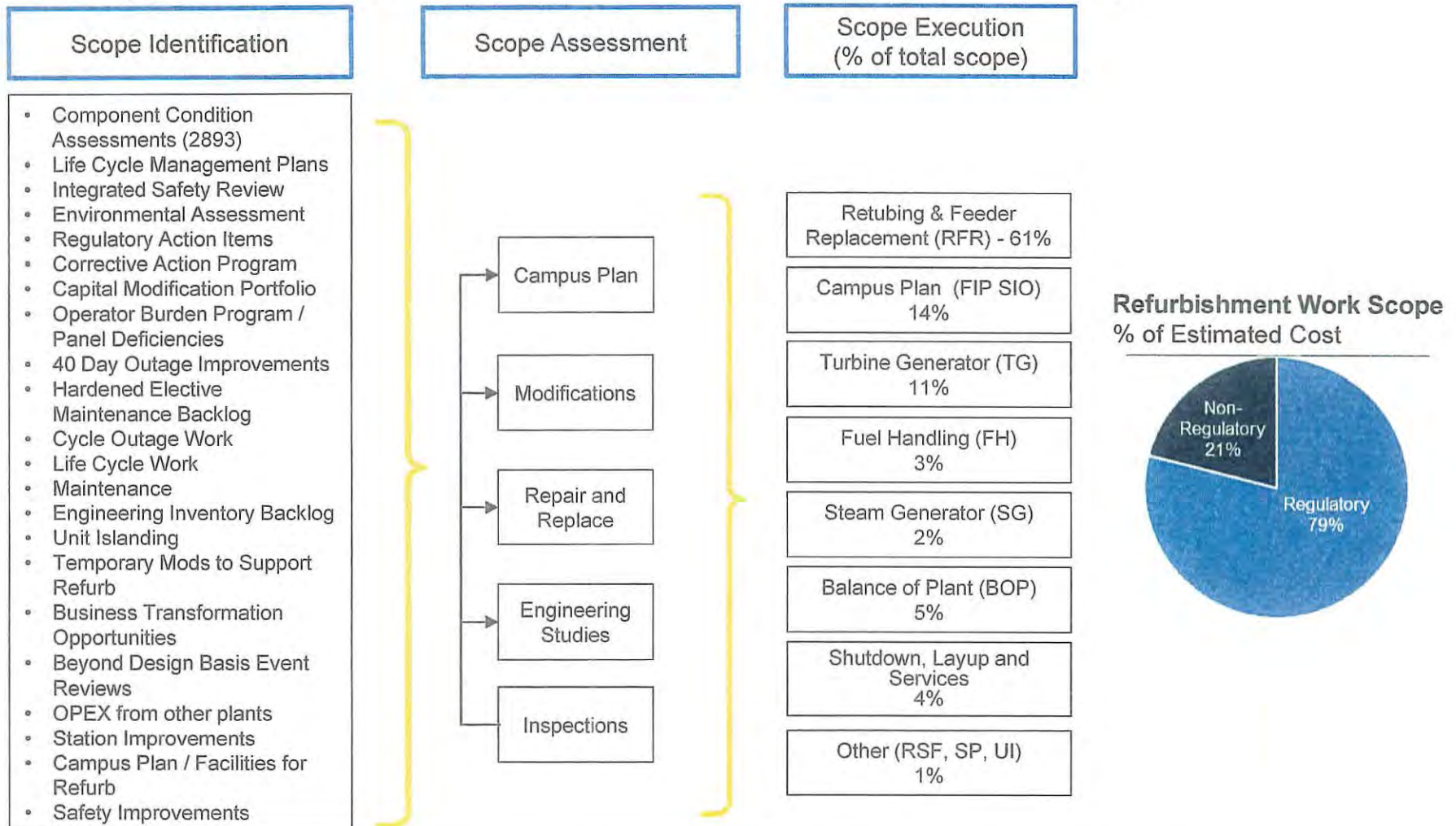
- OPG built a leadership team with extensive nuclear refurbishment and mega-project experience.
- Succession planning as well as initiatives to collaborate with Bruce Power on the overlap of refurbishment projects will ensure supply of resources through to the end of project life.



Scoping Process



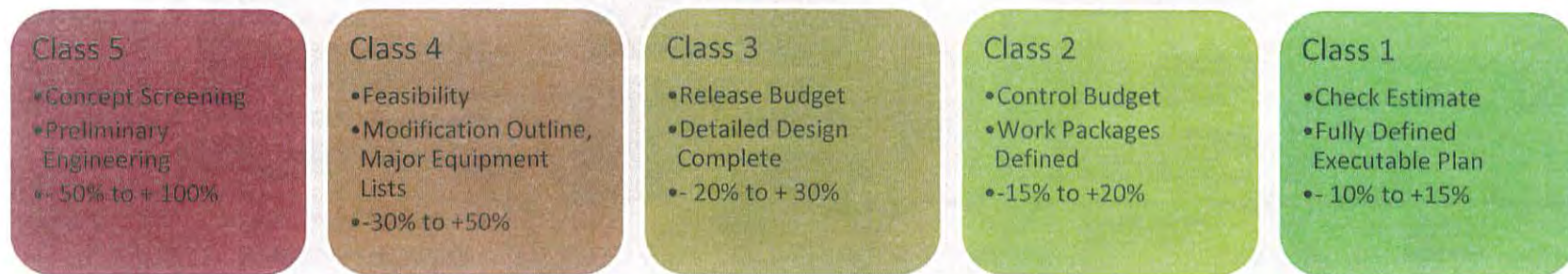
OPG applied a robust scoping process to evaluate investments.



Estimating Process



OPG developed the DRP project estimate in accordance with the Association for the Advancement of Cost Engineering (AACE) estimating recommended practices as shown below.



OPG integrated its approach to Engineering and Work planning with the AACE recommended practice.



ONTARIO POWER
GENERATION

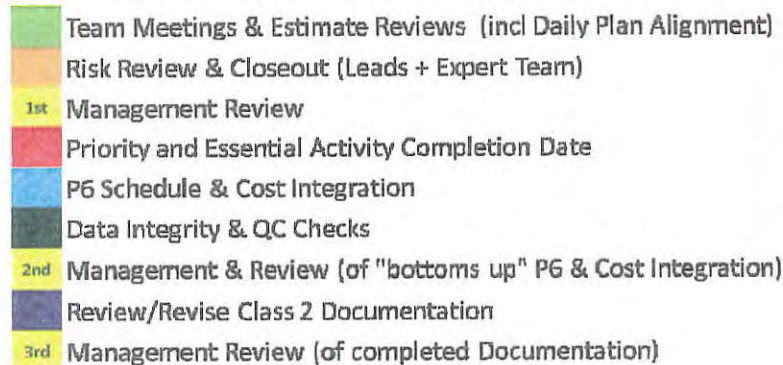
Example: RFR Class 2 Review & Result



- Planned and methodical implementation process to progress estimate
- Internal & External Peer Reviews and Quality Checks
- Inputs from Mock-Up and Tool Proving Results
- Reconciliations from past estimates and OPEX



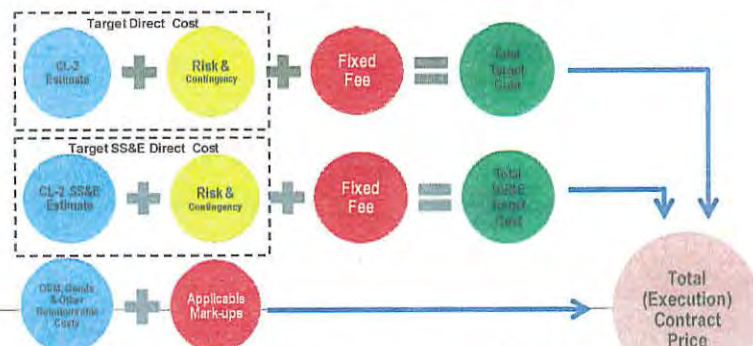
- Rigorous Bottoms up Review Workflow
- Full team engagement & integrated



ESTIMATE CLASS	Delivery Date to OPG	Expected Accuracy Range	Maturity Level of Project Deliverables
Class 5	2012	L: -20% to -50% H: +30% to +100%	0% to 2% OPEX Based
Class 4	2013	L: -15% to -30% H: +20% to +50%	
Class 3	2014	L: -10% to -20% H: +10% to +30%	
Class 2	2015	L: -5% to -15% H: +5% to +20%	

Estimate Component	Class 2 Revision 0 Submission April 24, 2016	Class 2 Final Total Cost (including Late Changes)
Base Cost	\$ 1,488,127,951	\$1,220,555,767
Contingency	\$ 616,299,674	\$371,155,750
Base Cost Fixed Fee	\$ 432,884,008	\$480,061,017
SubTotal Base Target Cost	\$ 2,537,311,633	\$2,071,772,533
SS&E (Base Schedule)	\$ 76,183,822	\$55,406,764
SS&E (due to Contingency on Base Schedule)	\$ 31,496,107	\$12,275,415
SS&E Fixed Fee	\$ 19,130,416	\$12,024,416
SubTotal SS&E Target Cost	\$ 126,810,345	\$79,706,595
OSM, Goods, Reimbursable with Markup and Commissioning Support not part of the target	\$ 428,745,417	\$433,535,311
Reimbursable with Markup and Fixed Fee as applicable	\$ 100,887,822	\$42,309,534
Reimbursable Costs - No mark-up	\$ 138,081,115	\$122,676,026
SubTotal Reimbursable Target Cost	\$ 667,714,354	\$598,520,871
Total Project Cost including Contingency and Fee	\$ 3,331,836,332	\$2,750,000,000

Cost Change based on Estimating Review & Refinement Process \$ 581,836,332



OPG CONFIDENTIAL

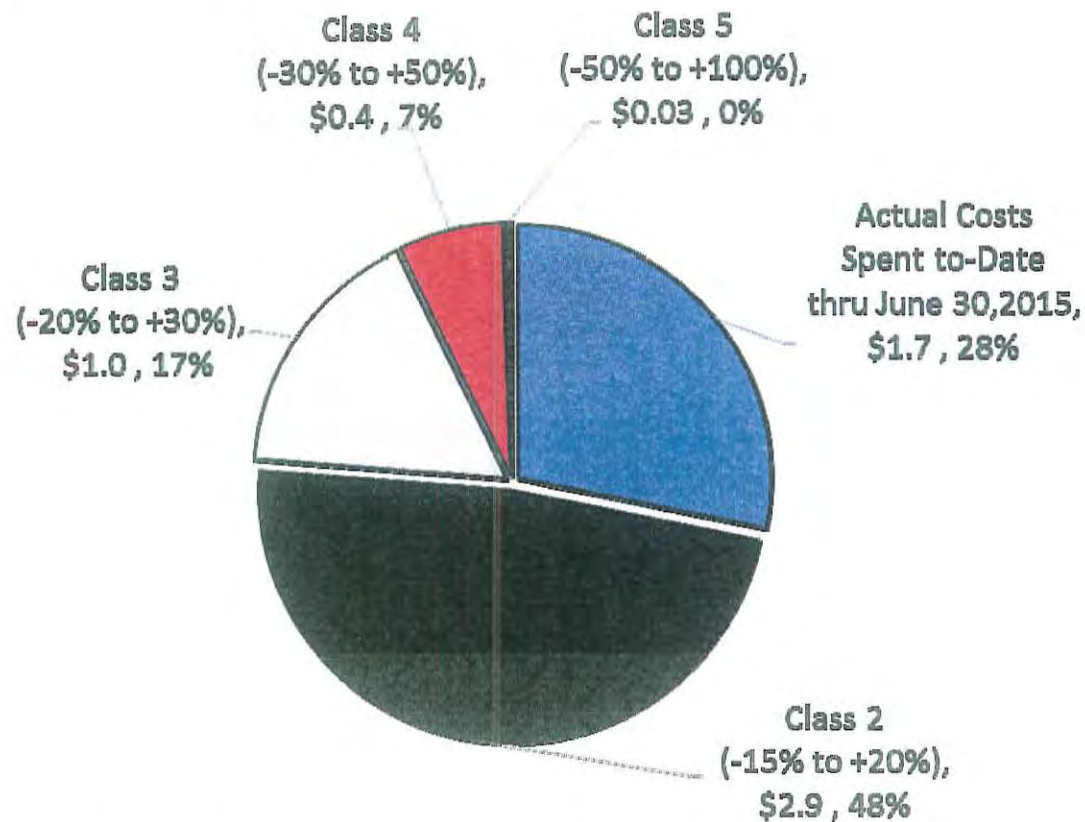
VALUES • SAFETY • INTEGRITY • EXCELLENCE • PEOPLE & CITIZENSHIP •

ONTARIO POWER GENERATION

Estimate Classification



Greater than 90% of the \$6.1B of external vendor / EPC costs meets or exceeds AACE Class 3

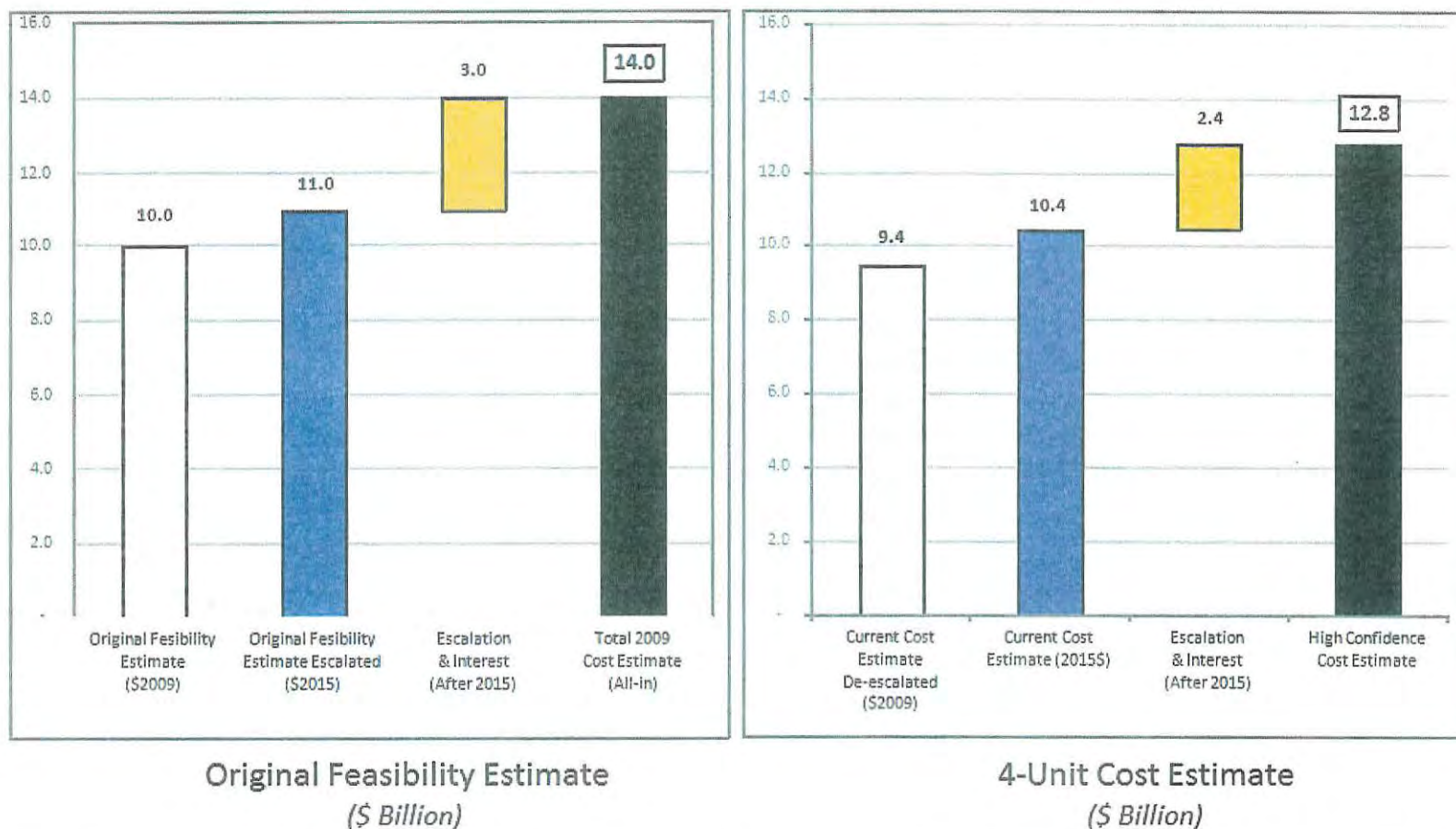


Note: Includes actual costs including interest to-date through June 30, 2015 and Facility and Infrastructure and Safety Improvement projects currently in execution.

4-Unit Cost Estimate



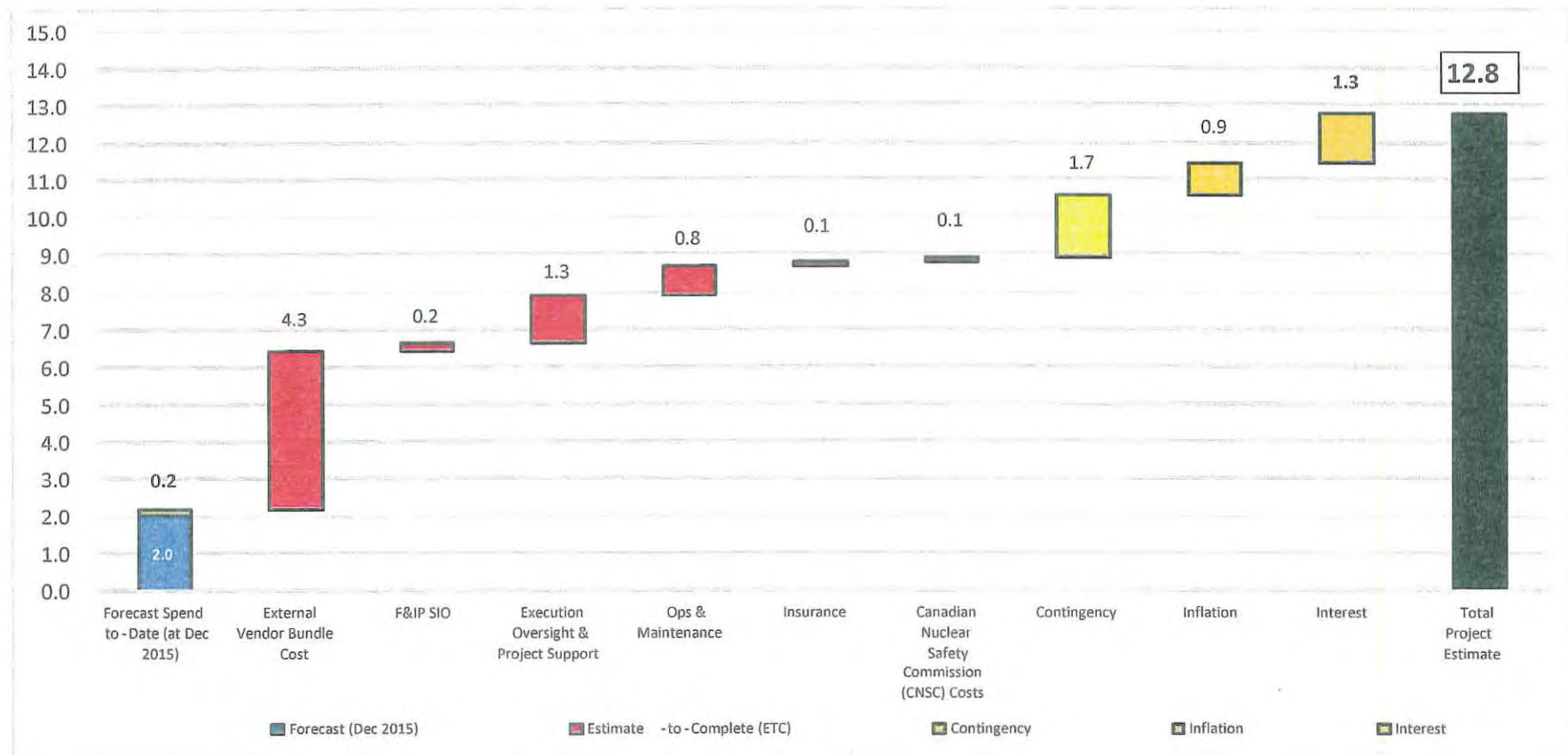
The High Confidence, 4-Unit Cost Estimate, is \$12.8 Billion, a reduction of \$1.2 Billion from the estimate communicated in 2010.



4-unit Cost Estimate Build-up



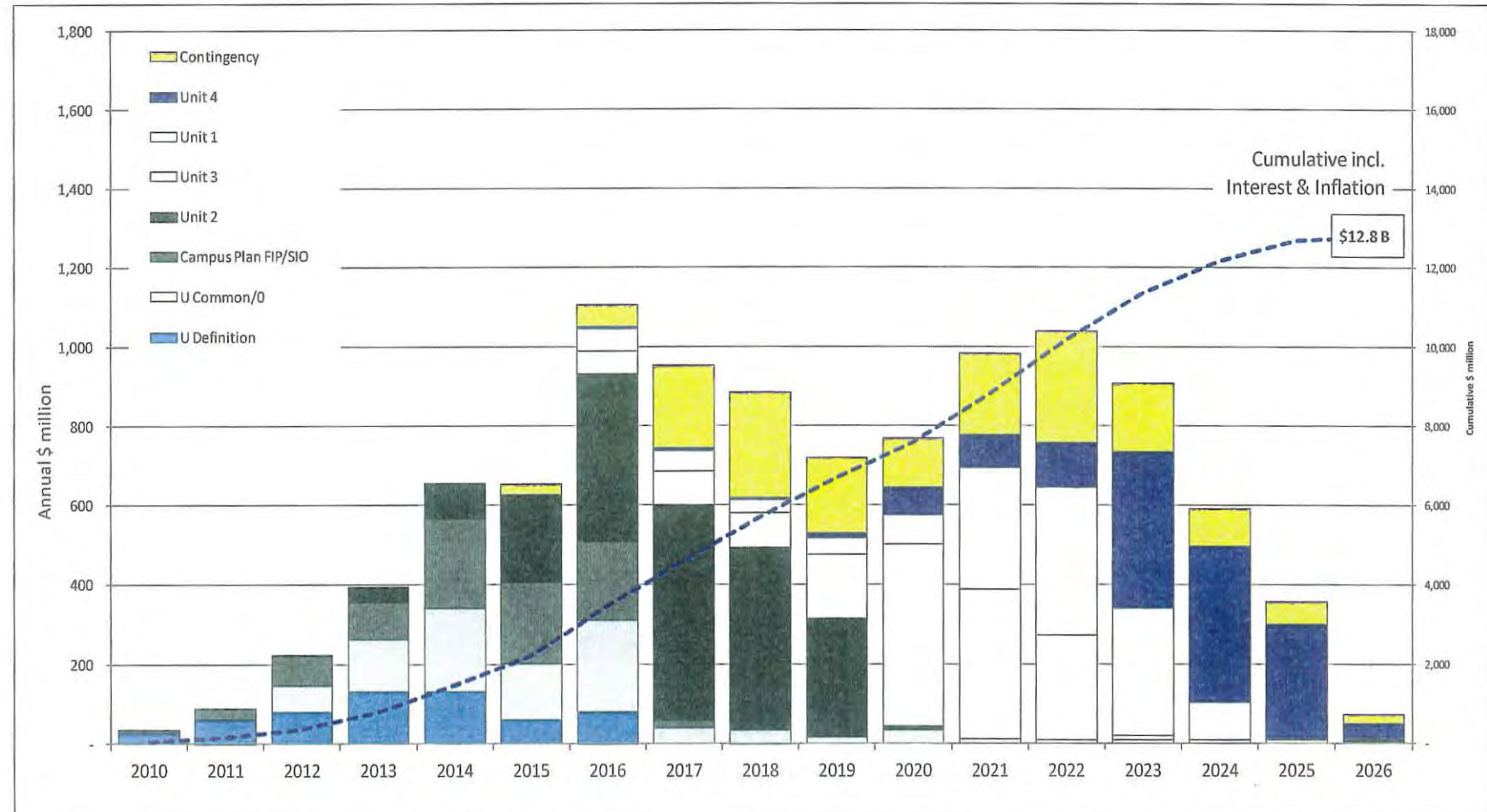
The 4-unit cost estimate to complete the refurbishment is \$12.8 Billion.



Overall Cash Flow



The total \$12.8 B DRP estimate is cost flowed over a 17 year life cycle from 2010 through 2026.



Refurbishment Scope and Vendor Partners



Approx. \$6.1 Billion is Vendor EPC Work. Main Contractors and Scope is as follows:

Project	Vendor Partners	High Level Scope
Facilities and Infrastructure and Safety Improvement Projects	ES Fox , Black & McDonald, SNC Lavalin/Aecon JV	Installation of required infrastructure to facilitate refurbishment and extended operations including the completion of regulatory safety improvement scope.
Re-tube & Feeder Replacement	SNC Lavalin/Aecon JV	Installation of the training reactor mock-up and replacement of reactor tubes and feeders.
Turbine Generators	GE Power (Alstom), SNC Lavalin/Aecon JV	Inspections, repairs and/or replacements of turbine and generator components and auxiliaries, including control system on certain units.
Steam Generators	BWXT, SNC Lavalin (Candu Energy)	Primary and Secondary Side Cleaning of heat exchangers.
Defueling & Fuel Handling	GE – Hitachi, ES Fox	Defuel the core and replace/ refurbish and replace select fuelling systems and components.
Balance of Plant	ES Fox , Areva, B&W and others	Repair or replace select valves, piping, and systems to accommodate new life expectancy of station.

Contract Breakdown

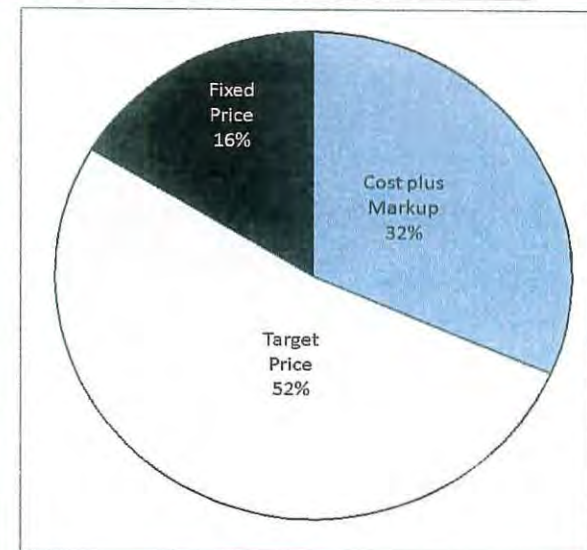


The process for selecting experienced contract partners was extensive.

- Of the \$12.8B high confidence estimate, \$6.1B represents external vendor / EPC contracts which employ a combination of fixed / target / cost + markup pricing.
- Procurement started early to improve accuracy in planning - contractors have sufficient time / access to mock-up facility to develop confidence in estimates and reduce risk.
- Contracts are structured so that OPG has off ramps at the end of Definition Phase.

Project	EPC Vendor (s)	Definition Phase	Execution Phase	Total Estimate
Re-tube & Feeder Replacement	SNC Lavalin/Aecon JV	\$0.7	\$2.8	\$3.5
Turbine Generator	Alstom (Parts) and SNC Lavalin/Aecon JV (Execution)	0.1	0.5	0.6
Steam Generators	Babcock & Wilcox / CANDU Energy JV	< 0.1	0.1	0.1
Fuel Handling and Defueling	General Electric / SNC Lavalin/Aecon JV / ES Fox	< 0.1	0.1	0.2
Balance of Plant	ES Fox / Babcock & Wilcox / SNC Lavalin/Aecon JV	0.2	0.7	0.8
Facilities, Infrastructure, and Safety Improvement Projects	ES Fox / SNC Lavalin/Aecon JV	0.6	0.3	0.9
Total EPC Vendor Contract Costs <i>Note: Numbers may not add due to rounding.</i>		\$1.6 Billion	\$4.5 Billion	\$6.1 Billion

Percentage Breakdown of DRP Budget by Pricing Model¹



1. Costs exclude interest, and are before inflation



OPG's Role



OPG has ultimate accountability for the safe delivery of the project on time, on budget, and to the required level of quality.

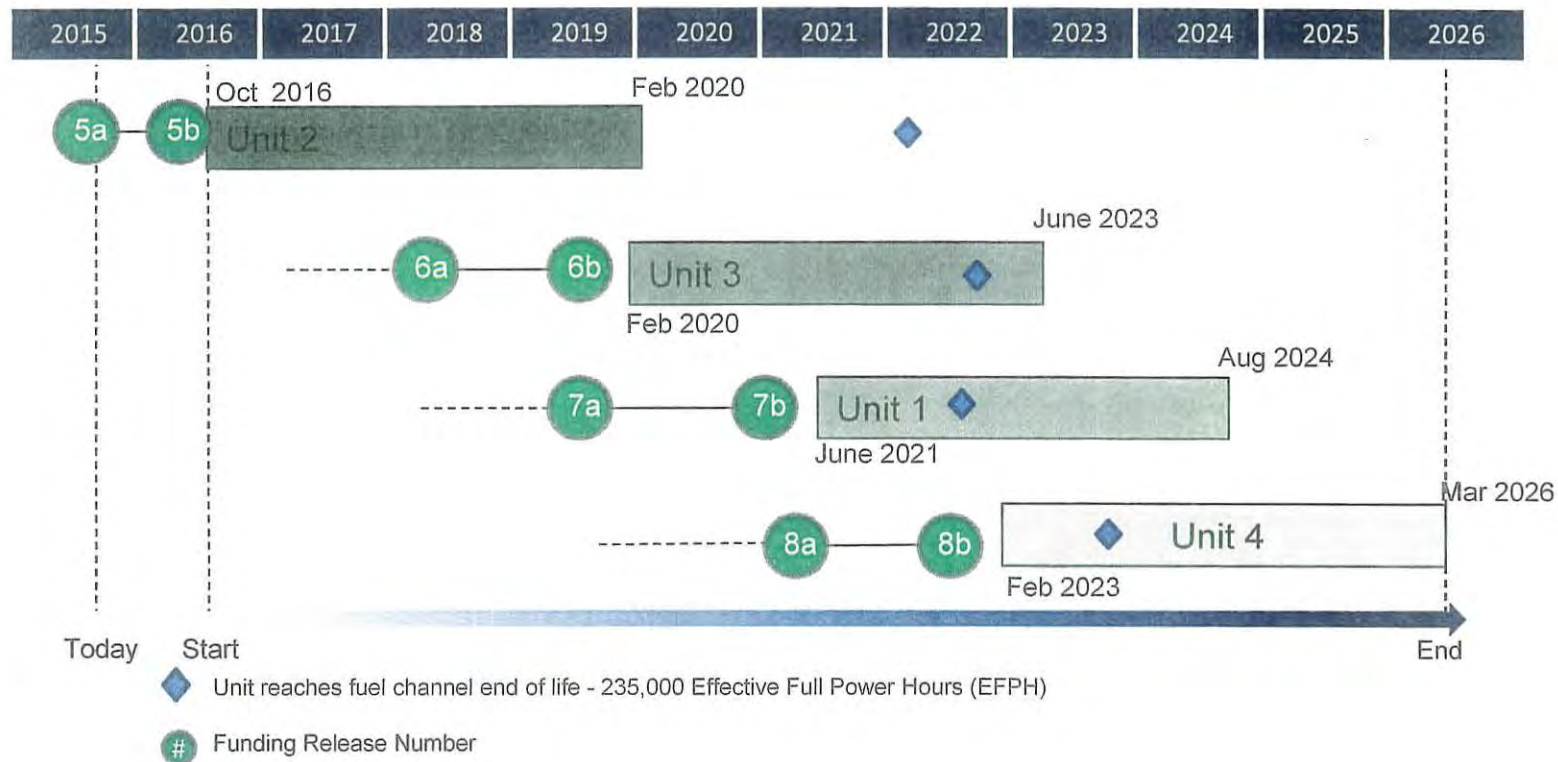
OPG is responsible to:

- Execute the project management role for the refurbishment program. This includes daily management of the integrated safety, cost, schedule, and quality objectives for each project and mitigation of their associated risks.
- Perform as the design authority for all refurbishment projects, ensuring nuclear safety standards and requirements are met throughout the development, integration, and implementation of multiple vendor designs.
- Perform design and construction oversight of vendor deliverables, ensuring quality and value for money in the execution of their duties.
- Perform the contract management function to ensure both OPG and its vendor partners are performing duties in line with defined accountabilities.
- Ensure safe and efficient integration with the operating units during the execution of the refurbishment project.
- Interface, communicate, and coordinate with internal and external stakeholders such as the Canadian Nuclear Safety Commission.

Schedule and Release Strategy



The schedule assumes the first unit outage will commence in Oct. 2016 with each unit lasting 37 to 40 months. Funding for each unit will be released in phases.

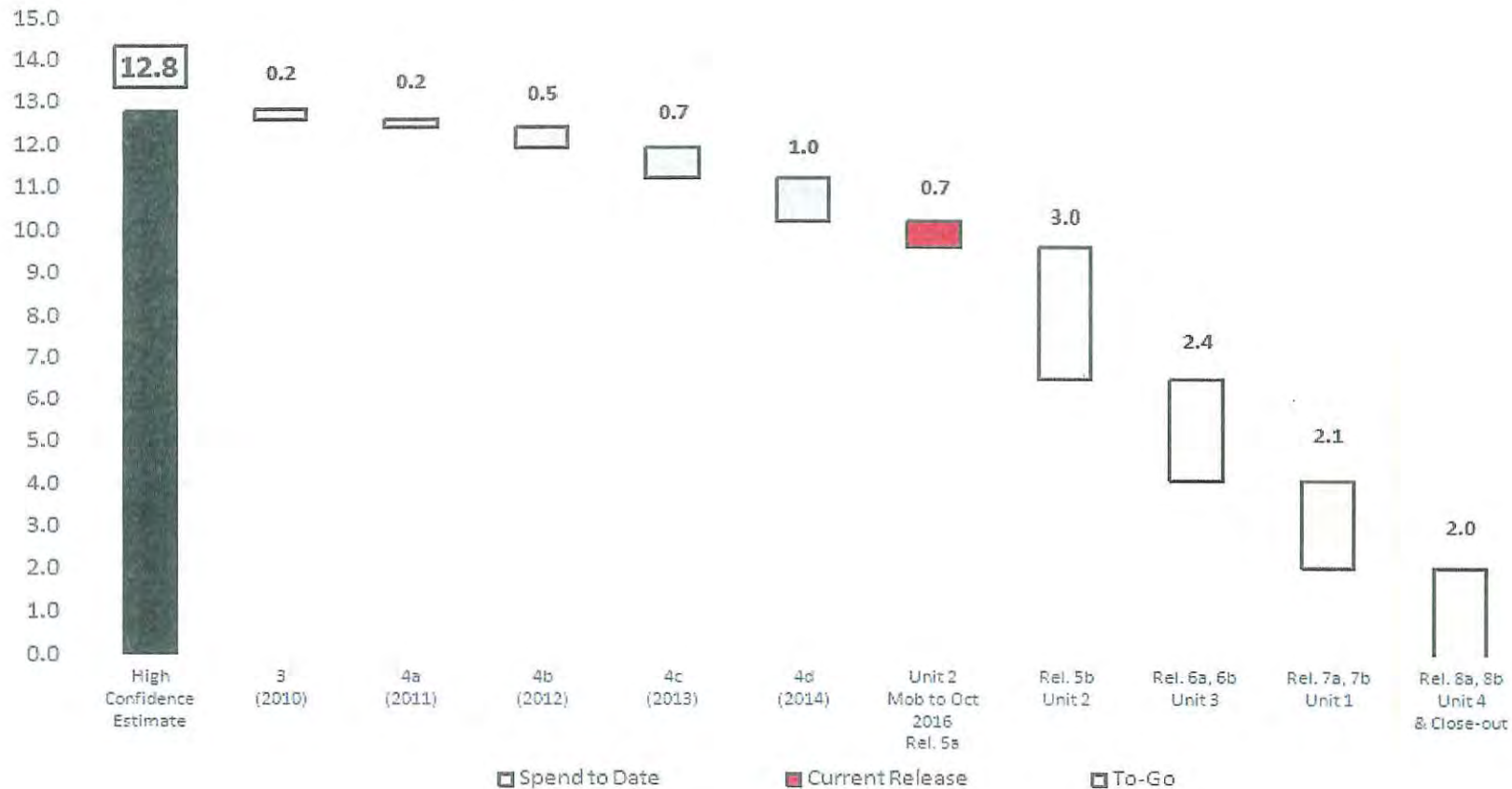


Project Approvals and Off-Ramps



While this is a \$12.8B program, funds are structured for release unit by unit.

- The project release strategy will provide the Board with many opportunities to review project performance prior to allowing the project to proceed to the next phase.



Contingency Breakdown



A contingency of \$1.7 Billion represents 28% of the Execution Phase estimate (\$6.5 Billion), or 40% of the external vendors' estimate (\$4.5 Billion). With 90% of the estimates well defined at Class 3 or better, Management believes that the contingency amount is sufficient.

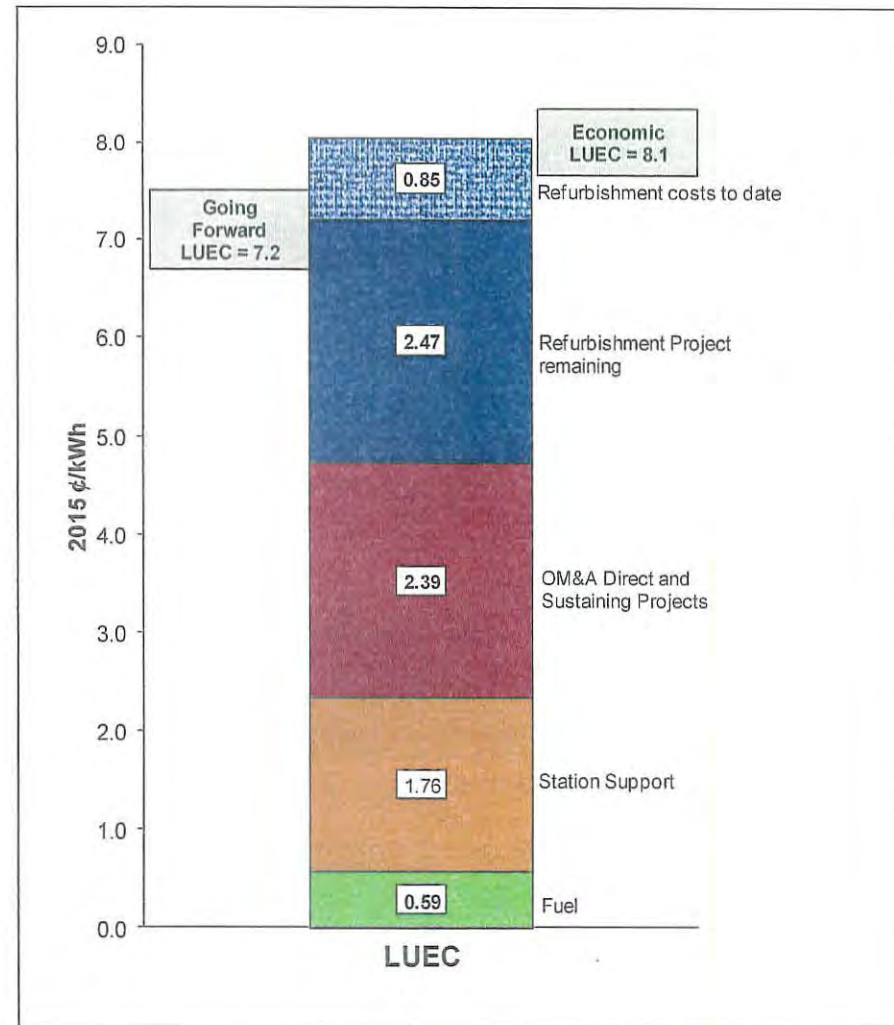
Project	Estimate Class	Project Contingency (\$M)	Program Contingency (\$M)	Total Contingency (\$M)	% of Project Estimate to Complete
Re-tube & Feeder Replacement	Class 2	236	381	617	26%
Turbine Generator	Class 2 - 3	195	23	218	50%
Steam Generators	Class 2	20	-	20	20%
Fuel Handling and Defueling	Class 3	25	38	63	52%
Balance of Plant	Class 3 - 5	230	-	230	34%
Facilities, Infrastructure, and Safety Improvement Projects	Class 1 - 3	42	34	76	35%
Project Execution and Operations and Maintenance	Not Applicable	58	222	280	
Unallocated Program Contingency	Not Applicable	-	202	202	
Total Contingency (\$B)		\$0.8 Billion	\$0.9 Billion	\$1.7 Billion	

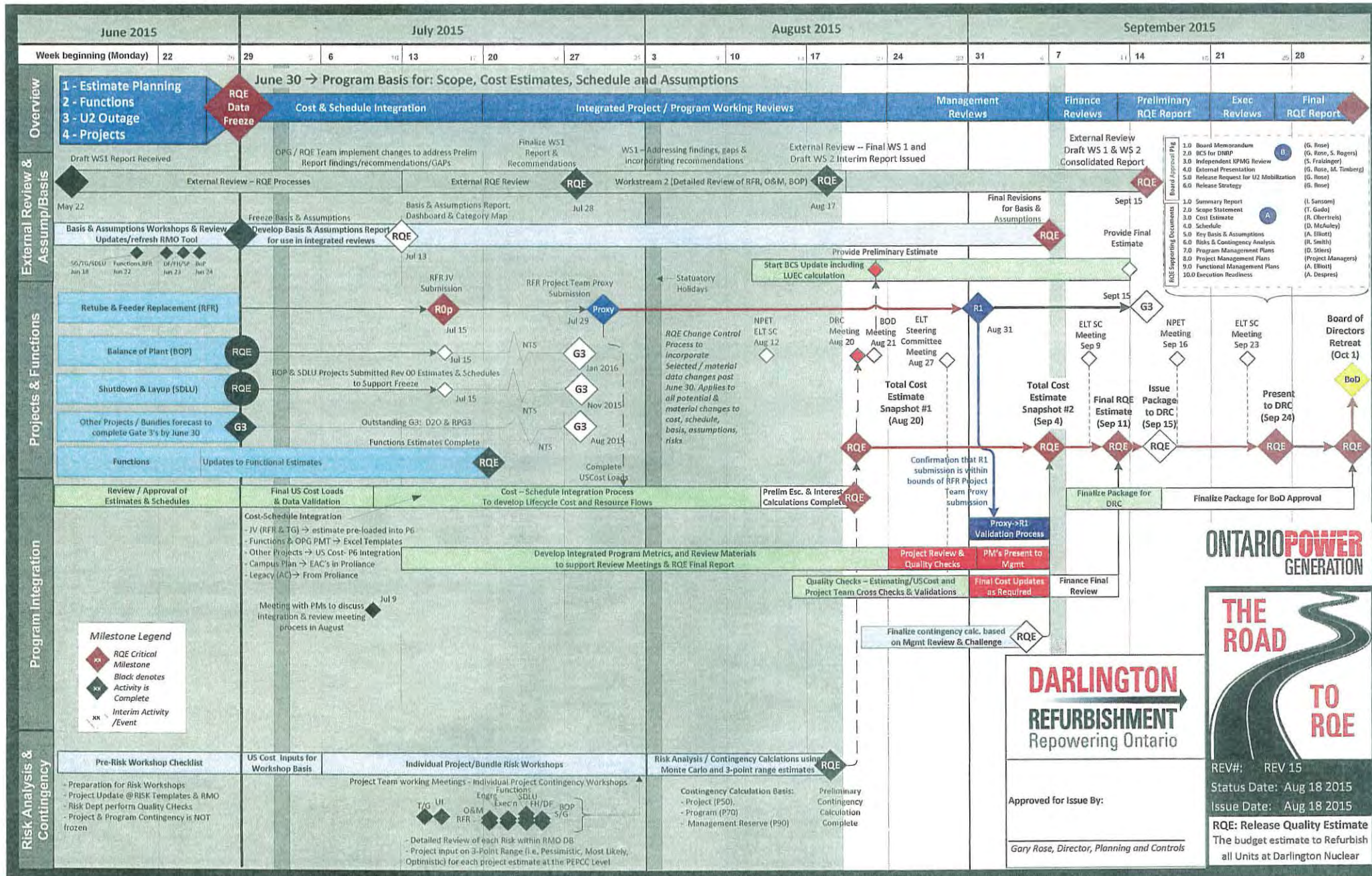


Levelized Unit Energy Cost (LUEC)



- Utilizing the Release Quality Estimate of \$12.8 Billion (including interest and inflation), the high confidence durations, and robust estimates of the future operating costs and performance of the station, the Levelized Unit Energy Cost (LUEC) of Darlington Refurbishment is estimated at 8.1 ¢/kWh, making it low cost, low emissions, stably-priced generation option.
- In 2010, Management communicated that the LUEC for the DRP would be less than 8 ¢/kWh in \$2009, which is equivalent to 9.0 ¢/kWh in \$2015; therefore Management's current estimate is well within the LUEC estimate announced in 2010.





30-Oct-15
Snapshot
4.vFINAL
Sheet 7

Darlington Nuclear Refurbishment Program
Release Quality Estimate (RQE)

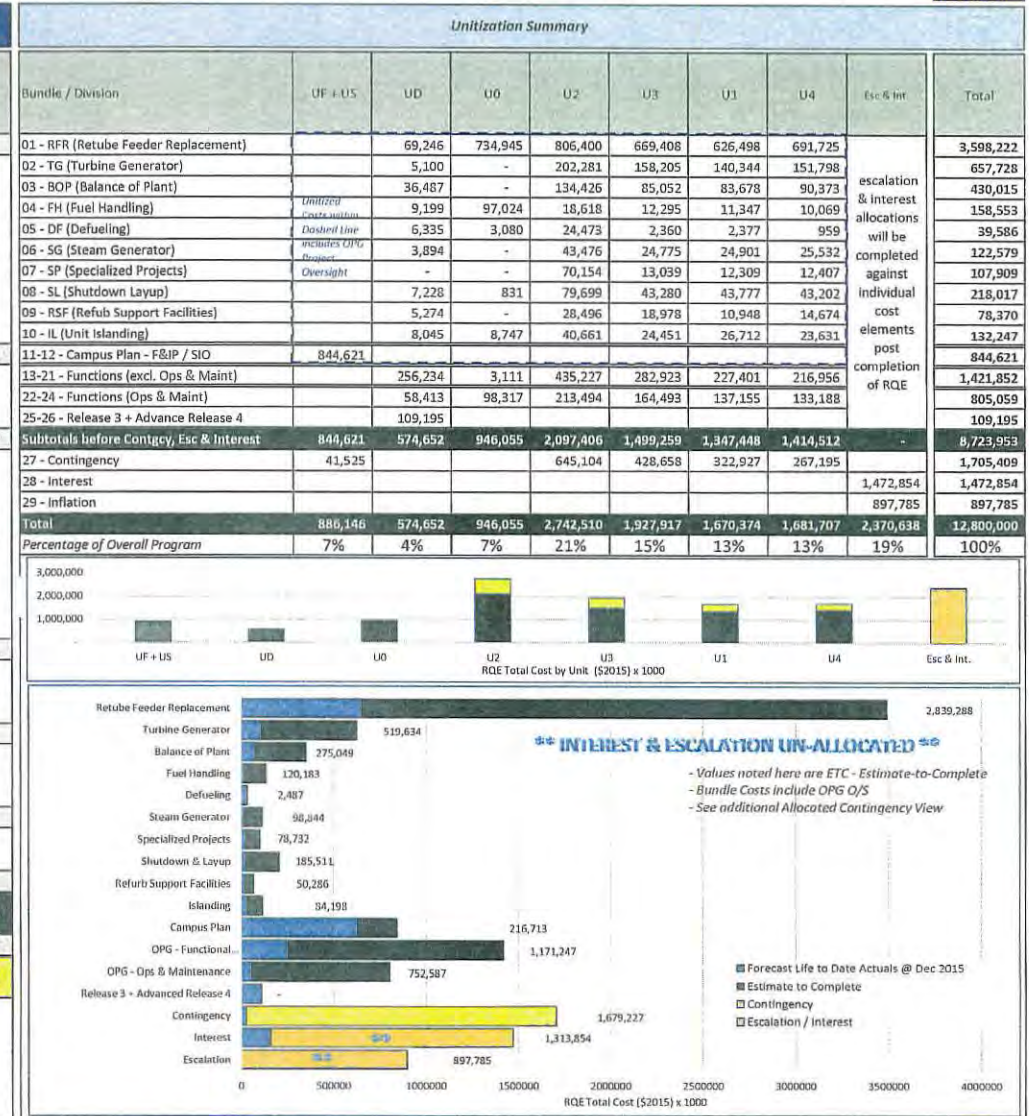
TOTAL COST ESTIMATE BUNDLE/DIVISION LEVEL DETAIL

VIEW WITH INTEREST & INFLATION UN-ALLOCATED

RQE Total Cost						Subtotals by Grouping		
Bundle Name	% of Total Cost * (1)	Forecast Spend, Life-to-Date @ Dec 2015, \$ x 1000	Estimate-to-Complete Vendor / EPC, \$ x 1000	Estimate-to-Complete OPG O/S, \$ x 1000	RQE Total Cost, \$ x 1000			
01 - RFR (Retube Feeder Replacement)	28%	651,651	2,839,288	107,283	3,598,222	1.0 4.6 5.5		
02 - TG (Turbine Generator)	5%	106,525	519,634	31,569	657,728			
03 - BOP (Balance of Plant)	3%	76,436	275,049	78,531	430,015			
04 - FH (Fuel Handling)	1%	13,811	120,183	24,558	158,553			
05 - DF (Defueling)	0%	28,983	2,487	8,116	39,586			
06 - SG (Steam Generator)	1%	13,990	98,844	9,745	122,579			
07 - SP (Specialized Projects)	1%	22,365	78,732	6,812	107,909			
08 - SL (Shutdown Layout)	2%	21,203	185,511	11,303	218,017			
09 - RSF (Refub Support Facilities)	1%	16,721	50,286	11,363	78,370			
10 - IL (Unit Islanding)	1%	30,829	84,198	17,220	132,247			
Subtotal Bundles	43%	982,515	4,254,212	306,498	5,543,225	0.6 0.2 0.8		
11 - Campus Plan - F&IP	5%	484,045	155,765	incl	639,811			
12 - Campus Plan - SIO	2%	143,862	60,948	incl	204,810			
Subtotal Campus Plan F&IP, SIO	7%	627,908	216,713	incl	844,621			
Subtotal Bundles & Campus Plan	50%	1,610,423	4,470,925	308,498	6,389,846			
13 - Functions (excl O&M) - Project Execution	3%	9,513		312,042	321,555			
14 - Functions (excl O&M) - Contract Management	0%	9,510		42,241	51,751			
15 - Functions (excl O&M) - Engineering	2%	76,046		206,460	282,506			
16 - Functions (excl O&M) - Managed Systems Oversight	0%	14,265		26,660	40,925			
17 - Functions (excl O&M) - Planning & Controls	1%	62,140		74,021	136,161			
18 - Functions (excl O&M) - Nuclear Safety	1%	35,232		47,880	83,112			
19 - Functions (excl O&M) - Program Fees & Other Support	3%	21,178		319,597	340,775			
20 - Functions (excl O&M) - Supply Chain	1%	14,104		71,458	85,562			
21 - Functions (excl O&M) - Work Control	1%	8,617		70,890	79,507			
Subtotal Functions (excl O&M)	11%	250,605		1,171,247	1,421,852			
22 - Functions (O&M) - OMA Training Program	0%	10,981		-	10,981			
23 - Functions (O&M) - Waste Disposal	0%	-		38,054	38,054			
24 - Functions (O&M) - Ops & Maintenance	6%	41,492		714,533	756,025			
Subtotal Functions - Ops & Mice	6%	52,473		752,587	805,059			
25 - Functional - Release 3	1%	101,728		-	101,728			
26 - Functional - Advance Release 4 (incl Eng'g Reactor)	0%	7,467		-	7,467			
Subtotal Functions - Early Release Funds	1%	109,196		-	109,196			
Subtotal Before Contingency	68%	2,022,696	4,470,925	2,230,332	8,723,953	0.4 1.2 1.5		
27 - Project & Program Contingency *(2) (3)	13%	26,182	1,679,227	<= incl	1,705,409			
Subtotal Contingency	13%	26,182	1,679,227	<= incl	1,705,409			
Subtotal before Interest & Inflation	81%	2,048,878	6,150,152	2,230,332	10,429,361			
28 - Interest	12%	159,000	1,313,854	<= incl	1,472,854			
29 - Inflation	7%	-	897,785	<= incl	897,785			
Subtotal Interest & Inflation	19%	159,000	2,211,638	-	2,370,638			
Total Cost Estimate (Expressed as Nominal \$)	100%	2,207,878	8,361,790	2,230,332	12,800,000			
		2,207,878	10,592,122		12,800,000			
		Actuals	Estimate-to-Complete	@ Completion				
EAC less interest = 11,327,146						Contingency % / ETC = 25%		

Notes:

- 1 - % of Program EAC relative to Total High Confidence Estimate (\$DOV) of \$13.8B
- 2 - Contingency, Escalation and Interest have not been allocated between Vendor + OPG in this Cost Summary View
- 3 - \$26M Contingency thru Dec 2015 is for Campus Plan F&IP/SIO



Confidential

Darlington Nuclear Refurbishment Program
Release Quality Estimate (RQE)

TOTAL RESERVES SUMMARY PAGE INCLUDING PROJECT BUNDLE + PROGRAM CONTINGENCIES

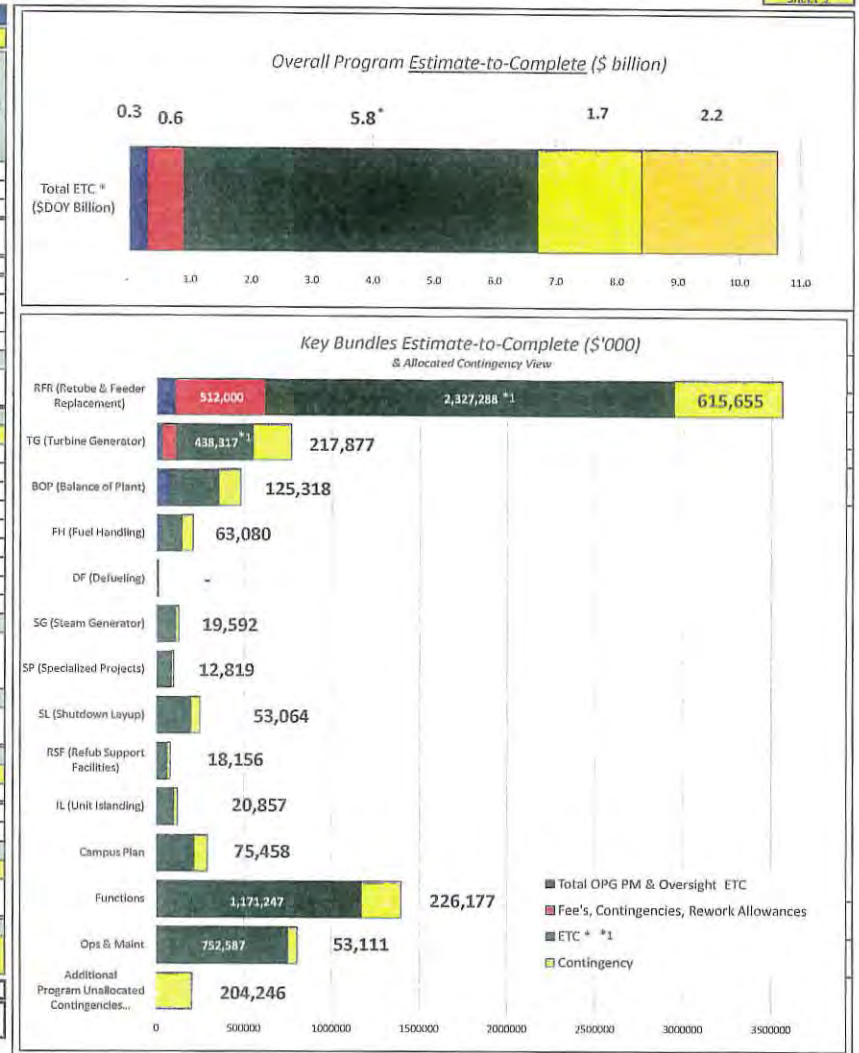
30-Oct-15
Snapshot
4.vFINAL
Sheet 9

Bundle Name	Total Reserves View **2									
	Breakout of RQE Base Costs					Allocated Contingency View				
	Forecast LTO Def Phase (9 Dec 2015)	ETC Cost O&M Oversight	ETC Fees, IV Contingency & Rework Allowances	Adjusted ETC *1 Less Fixed Fees Contingency Rework Allowances	Total Cost	Project Level Bundle Contingency	Program Level Schedule Contingency	Program Level Discrete Risk Contingency	Total Reserves	% of ETC
01 - RFR (Retube Feeder Replacement)	651,651	107,283	512,000	2,327,288	3,598,222	235,071	380,584	-	615,655	26%
02 - TG (Turbine Generator)	106,525	31,569	81,317	438,317	657,728	194,855	23,022	-	217,877	50%
03 - BOP (Balance of Plant)	76,436	78,531	-	275,049	430,015	125,318	-	-	125,318	46%
04 - FH (Fuel Handling)	13,811	24,558	-	120,183	158,553	19,625	-	-	63,080	51%
05 - DF (Defueling)	28,983	8,116	-	2,487	39,586	5,398	38,057	-	-	-
06 - SG (Steam Generator)	13,990	9,745	-	98,844	122,579	19,592	-	-	19,592	20%
07 - SP (Specialized Projects)	22,365	6,812	-	78,732	107,909	12,819	-	-	12,819	16%
08 - SL (Shutdown Layout)	21,203	11,303	-	185,511	218,017	53,064	-	-	53,064	29%
09 - RSF (Refub Support Facilities)	16,721	11,363	-	50,286	78,370	18,156	-	-	18,156	36%
10 - IL (Unit Islanding)	30,829	17,220	-	84,198	132,247	20,857	-	-	20,857	25%
Subtotal Bundles	982,515	306,498	593,317	3,660,895	5,543,225	704,754	441,662	-	1,146,417	31%
11 - Campus Plan - F&IP	484,045	incl	-	155,765	639,811	41,525	-	33,933	75,458	35%
12 - Campus Plan - SIO	143,862	incl	-	60,948	204,810	-	-	-	-	-
Subtotal Campus Plan F&IP, SIO	627,908	-	-	216,713	844,621	41,525	-	33,933	75,458	35%
Subtotal Bundles & Campus Plan	1,610,423	306,498	593,317	3,877,608	6,387,846	746,280	441,662	33,933	1,221,875	32%
13 - Functions (excl O&M) - Project Execution	9,513	-	-	312,042	321,555	8,506	-	158,021	166,527	53%
14 - Functions (excl O&M) - Contract Management	9,510	-	-	42,241	51,751	1,507	-	1,819	3,326	8%
15 - Functions (excl O&M) - Engineering	76,046	-	-	206,460	282,506	6,467	-	5,148	11,615	6%
16 - Functions (excl O&M) - Managed Systems Oversight	14,265	-	-	26,660	40,925	1,035	-	1,685	2,720	10%
17 - Functions (excl O&M) - Planning & Controls	62,140	-	-	74,021	136,161	1,950	-	3,387	5,336	7%
18 - Functions (excl O&M) - Nuclear Safety	35,232	-	-	47,880	83,112	-	-	-	-	0%
19 - Functions (excl O&M) - Program Fees & Other Support	21,178	-	-	319,597	340,775	14,343	-	17,752	32,094	10%
20 - Functions (excl O&M) - Supply Chain	14,104	-	-	71,458	85,562	2,222	-	-	2,222	3%
21 - Functions (excl O&M) - Work Control	8,617	-	-	70,890	79,507	2,336	-	-	2,336	3%
Subtotal Functions (excl O&M)	250,605	-	-	1,171,247	1,421,852	38,365	-	187,812	226,177	19%
22 - Functions (O&M) - OMA Training Program	10,981	-	-	-	10,981	-	-	-	-	-
23 - Functions (O&M) - Waste Disposal	-	-	-	38,054	38,054	19,290	-	33,822	53,111	7%
24 - Functions (O&M) - Ops & Maintenance	41,492	-	-	714,533	756,025	-	-	-	-	-
Subtotal Functions - Ops & Maint	52,473	-	-	752,587	805,059	19,290	-	33,822	53,111	7%
25 - Functional - Release 3	101,728	-	-	-	101,728	-	-	-	-	-
26 - Functional - Advance Release 4 (incl Eng'g Reactor)	7,467	-	-	-	7,467	-	-	-	-	-
Subtotal Functions - Early Release Funds	109,196	-	-	-	109,196	-	-	-	-	-
Subtotal Before Contingency	2,022,696	306,498	593,317	5,801,441	8,723,953	803,935	441,662	255,967	1,501,164	26%
27 - Project Bundle Contingency	26,182	-	-	-	-	-	-	-	-	-
28 - Schedule Contingency (Unallocated)	-	-	-	-	1,705,409	-	107,906	-	107,906	2%
29 - Program Level Discrete Risks (Unallocated)	-	-	-	-	-	-	-	96,340	96,340	2%
Subtotal Program Level Contingency	26,182	-	-	-	1,705,409	-	107,906	96,340	204,246	-
Subtotal before Interest & Escalation	2,048,878	306,498	593,317	5,801,441	10,429,361	803,935	549,568	351,907	1,705,409	29%
28 - Interest	159,000	-	-	-	1,472,854	-	-	-	-	-
29 - Inflation / Escalation	-	-	-	-	897,785	-	-	-	-	-
Subtotal Interest, Inflation / Escalation	159,000	-	-	-	2,370,639	-	-	-	-	-
Grand Total (\$DOY)	2,207,878	306,498	593,317	5,801,441	12,799,999	803,935	549,568	351,907	1,705,409	29%

Other Notes:

- 1 - * ETC = ETC Costs, less fixed Fees, contingency & rework allowances already contained within Bundles (TG + RFR)
2 - ** Total Reserves = Bundle Contingency (Discrete Risks, Cost Uncertainty) + Program Level Contingency

Total Contingency Reserves
1,705,409



This NPET FINAL REVIEW package includes the key Estimate-at-Completion ("EAC") cost information submitted for RQE in support of OPG Milestone RL030

Table of Contents:

1. RQE Bundle Certification
2. Bundle Summary & RQE Actions
3. Executive Dashboard(s)
4. Contingency Analysis Summary
5. OPG PM/Oversight Cost

Note: Additional information forming the basis of RQE, but not presented here → DNR Scope Reports / Bundle Scope Summaries

Release Quality Estimate Retube & Feeder Replacement (RFR)

FINAL NPET APPROVAL DOCUMENT

PROJECT DIRECTOR: ROY BROWN

DATE: October 19, 2015

RQE Final Project/Bundle Certification

For the purposes of Release Quality Estimate ("RQE") I certify, to the best of my knowledge, that the Estimate-at-Completion ("EAC") of \$ 3,799,456,724 for projects listed in the attached Retube and Feeder Replacement Project / Bundle Review - Summary & RQE Actions sheet as of October 15, 2015 represents the project team's current best estimate, after careful consideration of all known scope, developments, changes, allowances and or provisions required for our projects.

I certify the following have been performed:

1. The estimate has been prepared consistent with DNR governance and processes;
2. A comprehensive review has been performed to ensure there is clear and comprehensive understanding of scope inclusions and exclusions forming the basis of the EAC cost estimates, and furthermore:
 - o Project schedules represent the expected timing and duration to which the work will be performed, and that all critical path work is supported by a Level 3 (or better) schedule. Any non-critical path work is confirmed to fit within the allotted work window, or, risks noted where relevant.
 - o Projected Cash/Cost flow profiles reasonably align with the project schedule;
 - o The OPG Project Management / Oversight team is appropriate for the scope of work, and;
 - o An appropriate classification of the estimate quality has been completed;
3. The Project / Bundle risk and uncertainty inputs provided have been reviewed and adequately represent all those reasonably foreseen. The project contingency analyses and contingency estimates have been evaluated in light of the project status including: life-to-date actual costs, estimates-to-completed ("ETC"), assumptions used in preparing the cost estimates and the current and projected project risks. We believe the project contingency balance is reasonable to cover the project risks.

Notes/Clarifications: contingent on Oct 15/2015 date
remaining unchanged associated with
Target Price discussions -

Based on the foregoing, I recommend and request NPET's endorsement of this submission.

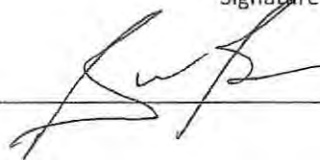
Submitted By:

Printed Name

Signature

Project Manager

Roy Brown

 Oct 15/2015

Acceptance:

Based on information provided and reviews and challenge meetings conducted, the NPET members reasonably believe that the scope, cost estimates and schedules are complete, reasonable and appropriate for the purposes of Release Quality Estimate.

NPET Quorum:

Printed Name

Signature

1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____

Darlington Nuclear Refurbishment Program

RQE - Release Quality Estimate

RFR - Retube & Feeder Replacement
Project / Bundle Reviews - Summary & RQE Actions



Project Cost Summary \$2015					Tier 1 Actions		Summary of Potential Opportunities	
Direct Work					Actions / Priorities needed to complete RQE		Status	
#	Project	Project Description	Unit	NR Org	Direct Work			
01	73110	RFR - Definition Phase - Target Cost (RFR Major Retubing Common	U0	EPC	\$ 168,308,790	- Remove PMT support services for U2 Waste Containers and mark up adjustment for all units (Complete	- Potential savings from resulting from estimate review / negotiation re RWPB estimate
02	73111	RFR - Definition Phase - Mock Ups	U0	EPC	\$ 38,235,815	- Costs from Special Initiates/commissions list from Aug 31 submission to be incorporated	Complete	-
03	73112	RFR - Definition Phase - Tooling	U0	EPC	\$ 361,025,492	- OPG PMT for Engineering may need re assessment since OPG is performing MEC engineering for subsequent units	Complete	-
04	73118	Retube Waste Processing Building (RWPB)	U0	EPC	\$ 160,204,000	- Update the P50 analysis post Aug 31 submission	Complete	-
05	73113	RFR - Major Retubing	U2	EPC	\$ 560,595,700	-		Other Notes
06	73113	RFR - Major Retubing (Definition Phase Procurement)	UD	EPC	\$ 196,368,199	-		Basin
07	73115	RFR - Major Retubing	U3	EPC	\$ 650,310,609	-		- Definition Phase costs are based on actuals spent to June 2015 + current forecast including potential PCD's
08	73114	RFR - Major Retubing	U1	EPC	\$ 609,595,994	-		- Definition Phase costs include RWPB current estimate which is under review by OPG
09	73116	RFR - Major Retubing	U4	EPC	\$ 866,815,108	-		- Execution Phase costs are result of P50 analysis and include Fixed Fee and contingency applied.
10					-			- Execution Phase costs include RWPB Demolition costs
11					-			- Execution Phase costs excludes other bundle costs (FH,BH,SDLU,)
12					-			- OPG O/S costs for Definition phase are based on definition phase organization chart and current spent rate.
13					-			- OPG O/S for Exec Phase costs are based on RFR Execution Oversight org chart and roles & resp planning
14					-			Scope
15					-			- 077 - Retube Waste Processing Building (RWPB) -Design, Construct, commission RWPB
16					-			- 078 - Major Retubing - Definition includes Design , build Mock Up facility, Design, Build Test RFR Tools and integrate at Mock up; Execution Phase Estimates, Unit 2 Engineering and procurement of Reactor
17					-			- 079 - Major Retubing - Execution Phase : The scope includes the retubing of 480 pressure tubes and calandria tubes and the replacement of all feeder piping an associated components
18					-			Cost
19					-			- Other Bundle Costs excluded from RFR and included in IL, SDLU, PHDF (executed by JV)
20					-			Bulk Head - DFL - \$43,634,227
21					-			Bulk Head - Engineering - \$ 7,735,264
22					-			Bulk Head - Materials - \$ 9,862,000
23					-			RA Bridge & ACU Replacement - \$17,752,076
24					-			PHT Vacuum Dry - \$11,663,734
25					-			PHT Vacuum Dry - Eng - \$ 2,582,349
26					-			- Unit 2 - includes \$196 million of Procurement of Reactor Components
27					-			Schedule
28					-			- The Level 5 Schedule has been developed based on:
29					-			a) Timed tool performance testing at the Mock-up;
30					-			b) Validation testing of non-tooling specific work at the Mock-up;
31					-			c) Comprehensive Work Packages (CWP) developed by the JV construction team.
32					-			d) A detailed Logic Flow Diagram (LFD) which illustrates the overall logic flow of the critical path, and non-critical path work for each unit, inclusive of the key interrelationships between the JV work scope and OPG work scope.
33					-			- Overall Critical Path duration for the "Base Case" excluding contingency is 833 days for U2 which includes 133 days of OPG Pre & Post activities
34					-			- Overall Critical Path duration resulting from " P50 Analysis" is 1138 days for unit 2
35					-			Other
36					-			- Engineering
37					-			- Unit 2 Engineering is completed in Definition Phase
38					-			- Engineering for Unit 3, 1 & 4 will performed at the same time during unit 2 execution
39					-			- MEC packages are done by OPG and DEC packages are by JV
40					-			- Procurement :
					-			- Unit 2 procurement is completed in Definition Phase and components are delivered progressively till Sep 20
					-			- Procurement process (to PO award) for Unit 3, 1 & 4 will performed at the same time during unit 2 execution
					-			- Costs included 7 % of spares, freight and documentation costs
					-			- Additional Set of Pressure Tubes are procured in unit 2 as a risk mitigation action
					-			- Pricing Accuracy = 80% of Procurement has PO issued, 10% RFQ, and less than 10% Budget Only
					-			- Procurement costs include 5% bulk purchase benefit assuming all 3 subsequent units are done at same time
					-			- Construction:
					-			- Construction work Critical Path is planned to perform on 24X7 calendar with stat holidays working
					-			- 2015-2016 EPSCA rates are used for the trades estimate Where 2015-2016 EPSCA rates are unavailable,
					-			- Construction assessment : CWP preparation in progress with OPG stakeholder support.
					-			- Integrated Series Execution Plans are complete
					-			- Vault Cranes Preventive maintenance is included in the current estimate
SubTotal Direct Work					100%	\$ 3,431,459,707		
OPG Oversight					Tier 2 Actions			
					Actions / Priorities : Follow-up Items for Check Estimate (July 2016)		Status	
41	73105	OPG Oversight, Integration and Support Work	UD	OPG-O/S	\$ 89,252,814	- Definition Phase EPC costs to be updated once the PCDs in discussion are approved	In Progress	
42	73106	OPG Oversight, Integration and Support Work	U2	OPG-O/S	\$ 29,506,594	- RWPB Estimate to be updated once the OPG team review and acceptance is complete	In Progress	
43	73107	OPG Oversight, Integration and Support Work	U1	OPG-O/S	\$ 16,975,336	-		
44	73108	OPG Oversight, Integration and Support Work	U3	OPG-O/S	\$ 19,178,889	-		
45	73109	OPG Oversight, Integration and Support Work	U4	OPG-O/S	\$ 25,011,507	-		
46	73117	OPG Oversight of the RWPB Project	U0	OPG-O/S	\$ 7,191,861	-		
47					-			
48					-			
49					-			
50					-			
SubTotal OPG O/S					5%	\$ 167,177,001		
Base Cost \$2015 (excluding Contingency)						\$ 3,600,636,708		
Contingency						\$ 200,820,016		
Contingency Scope						\$ -		
Grand Total RQE Cost \$2015 (including Contingency)						\$ 3,700,456,724		



Darlington Nuclear Refurbishment Program
Release Quality Estimate (RQE)
Executive Review Dashboard - RFR Bundle

FINAL NPET Approval
ISSUED: Oct 15, 2015
REV N01

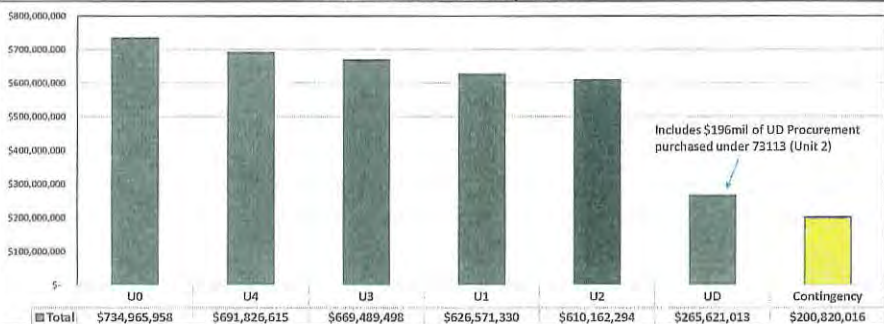
Key Bundle Summary incl. Plan/Plan Comparison (\$2015)

1	Total Base RQE Cost		\$ 3,598,636,708	
2	Contingency		\$ 200,820,016	
2	Contingent Scope		\$ -	
3	Total RQE Incl. Contingency		\$ 3,799,456,724	
4	Forecast Spend-to-Date @ Dec 2015	18%	\$ 660,651,173	
5	Estimate-to-Complete (ETC)	82%	\$ 2,937,985,535	
6	Contingency as % of ETC		7%	
7	Gate 2X/3		n/a	n/a
8	Release 4D (2014)		\$ 2,734,273,767	\$ 864,362,941 24.0%

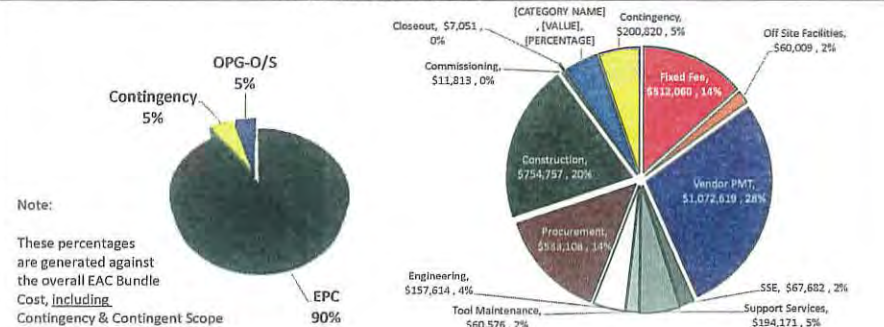
Notes:
- Contingency value based on final Program level Monte Carlo analysis for Snapshot #3.
- There are contingencies held within the Base cost plus at the Program Level for RFR.

Note: Gate & 4D comparisons exclude Contingency, Interest, Escalation

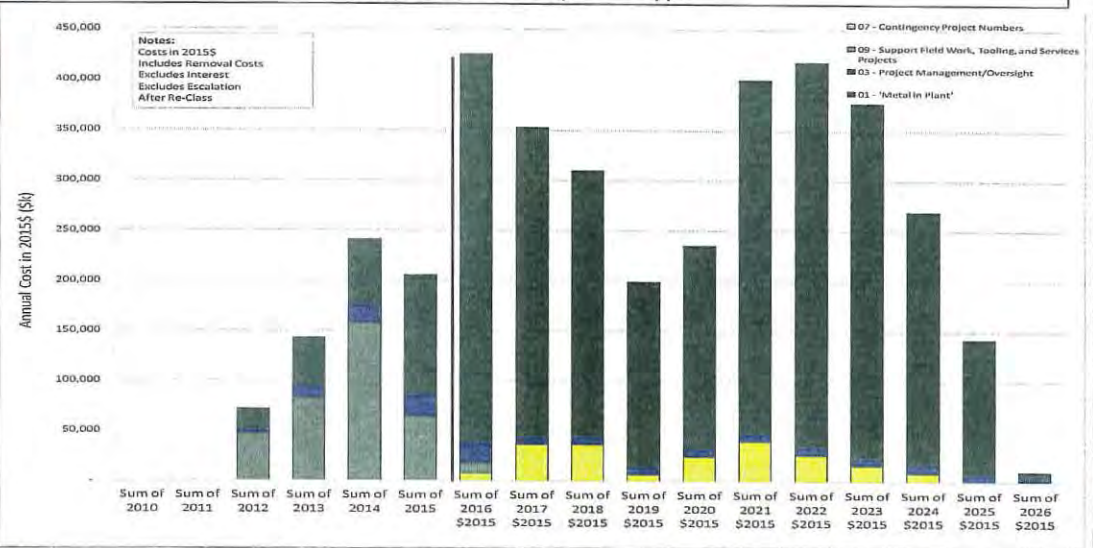
RQE Total Cost by Unit



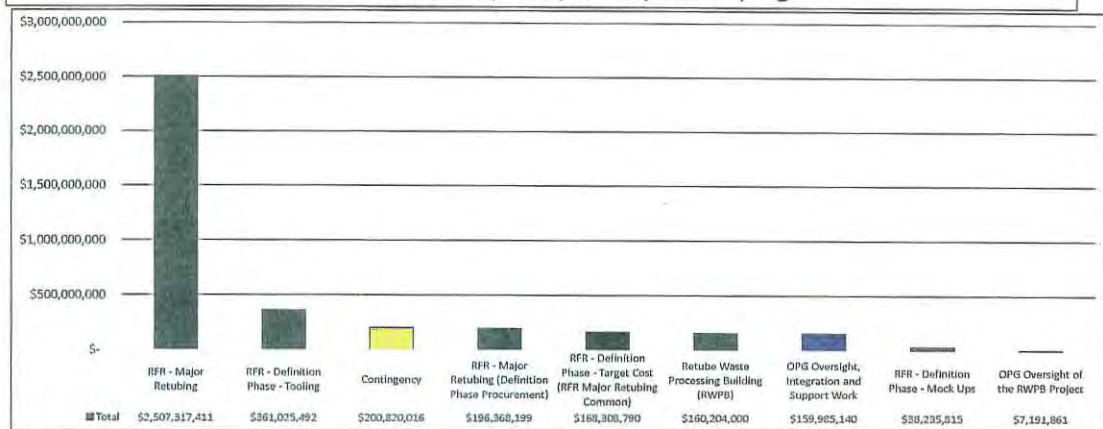
RQE Total Cost by Cost Type



RQE Total Cost by Cost Type



RQE Total Cost by Unique Scope Grouping



Darlington Nuclear Refurbishment Program

079 - RFR

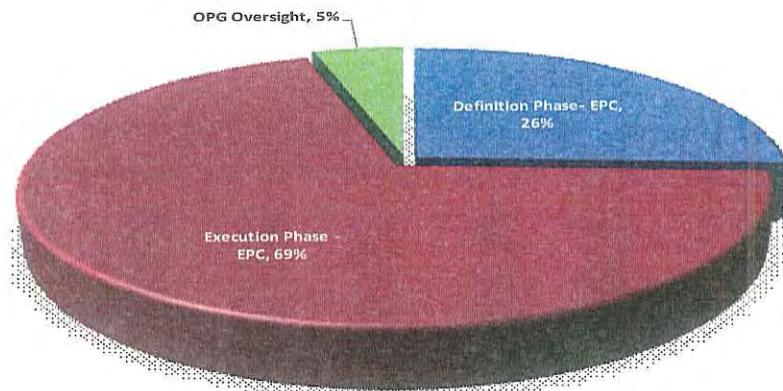
RQE - Release Quality Estimate

ISSUED - OCT 15, 2015

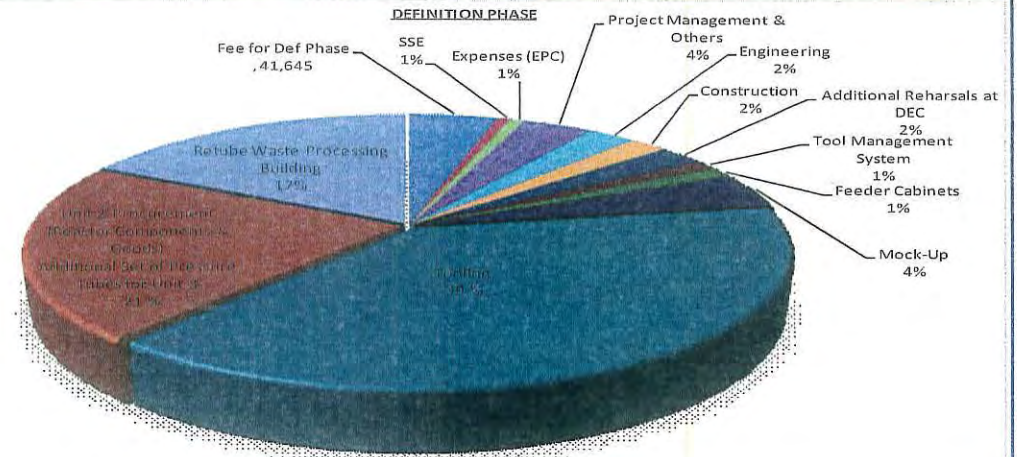
NPET APPROVAL - REV N01

Other Additional Key Cost Ratios / Breakouts

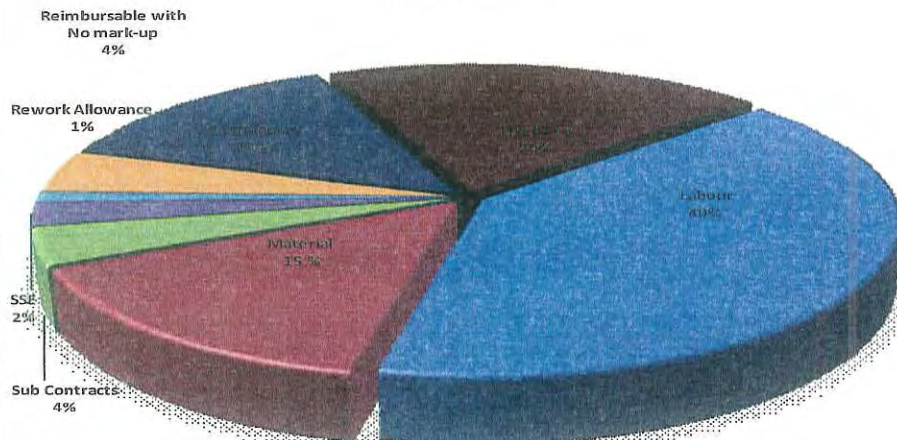
RFR OVERALL COST



DEFINITION PHASE

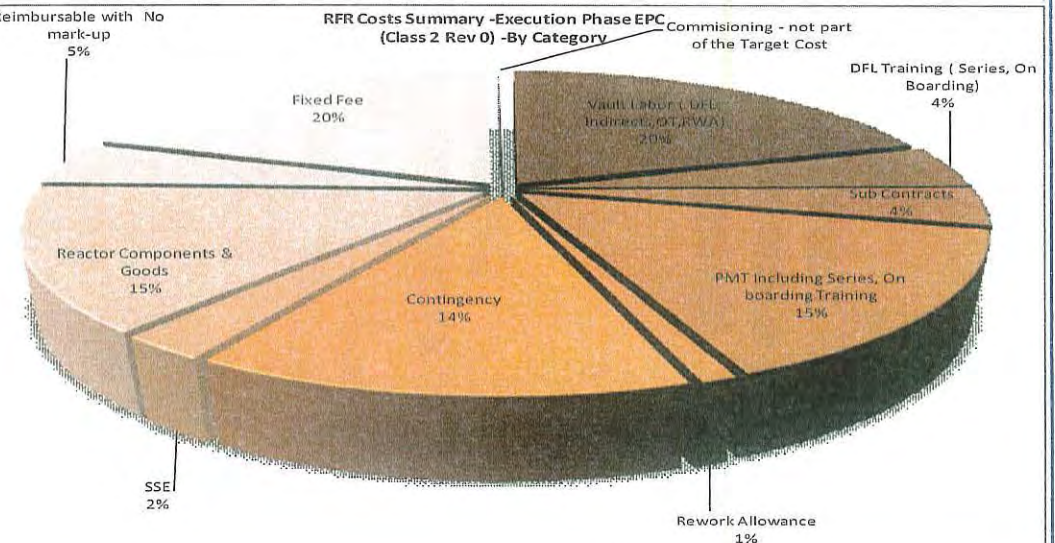


EXECUTION PHASE COSTS



Reimbursable with No mark-up 5%

RFR Costs Summary -Execution Phase EPC (Class 2 Rev 0) -By Category



079 - RFR

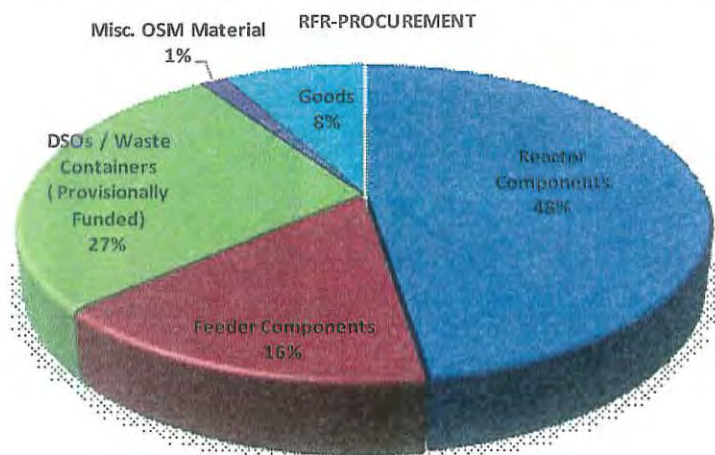
Darlington Nuclear Refurbishment Program

RQE - Release Quality Estimate

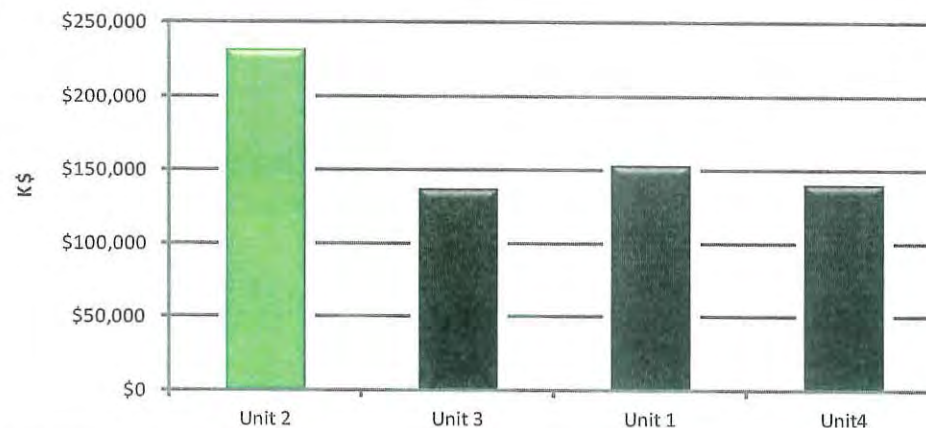
ISSUED - OCT 15, 2015

NPET APPROVAL - REV N01

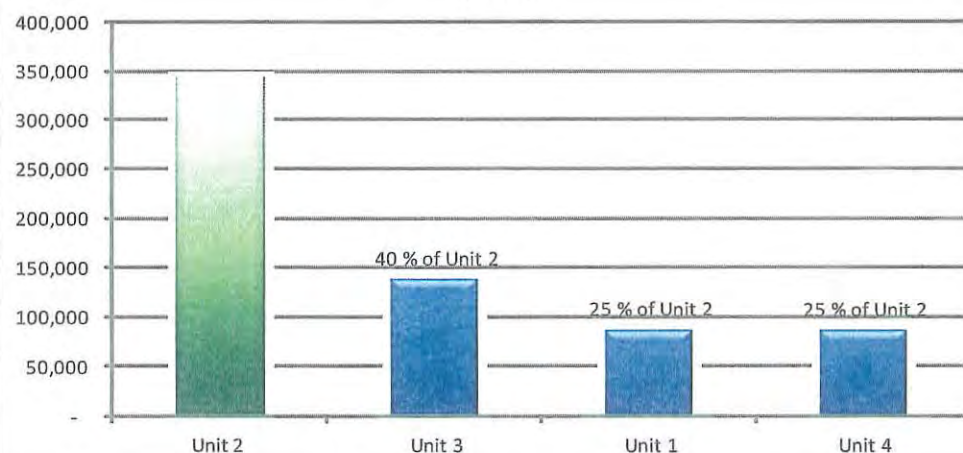
Other Additional Key Cost Ratios / Breakouts



RFR Materials- Procurement Costs



Engineering Estimate (MHrs)



Procurement

Unit 2 procurement is done in Definition Phase

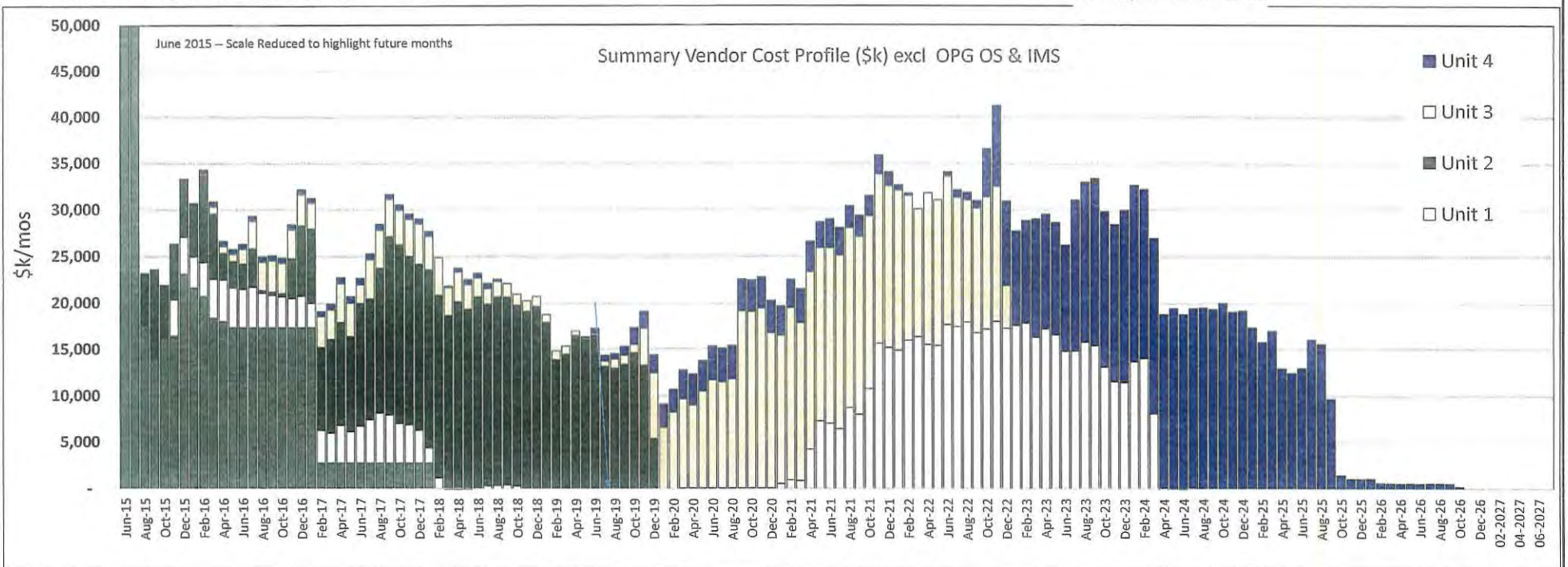
- Additional Set of Pressure tubes are procured in Unit 2
- Design Registration costs are part of unit 2, for the remaining three Design Registration is done at one time, would reduce the overall cost required for design registration for three Units
- 7% spares has been factored during the Definition phase. Spares % is reduced to 5 % for Unit 3, and 3% for Unit 1. If spare quantities for previous units are determined to be sufficient for subsequent units, additional quantities will not be ordered for the final unit
- Pre-Production Qualification process is done in Unit 2 and qualified vendors are used for subsequent units (current assumption)
- Spares Bellows (as contingency)are procured in Unit 2 and no further spares are required for other units.

079 - RFR	RQE - Release Quality Estimate		ISSUED - SEPT 21, 2015 FOR NPET REVIEWS - REV 00	
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Total Cost \$ k											Total \$k	Estimate Class	Schedule Level
Project #	Unit	Description	DP	10000	20000	30000	40000	50000	60000	90000			
			Definition Phase (I) Thru June 30 2015	Proj Mgmt	Inspections	Engineering	Procurement	Construction	Commissioning	Closeout			
				P	I	E	P	C	C	C			
73110	U0	RFR - Definition Phase - Target Cost (RFR Major Retubing Commo	\$ -	\$ -	\$ -	\$ 127,324	\$ -	\$ 40,984	\$ -	\$ -	\$ 168,309	2	Level 3
73111	U0	RFR - Definition Phase - Mock Ups	\$ -				\$ -	\$ 38,236	\$ -	\$ -	\$ 38,236	2	Level 3
73112	U0	RFR - Definition Phase - Tooling	\$ -				\$ -	\$ 29,429	\$ 3,880	\$ -	\$ 361,025	2	Level 3
73118	U0	Retube Waste Processing Building (RWPB)	\$ -	\$ 19,815	\$ -	\$ 5,146	\$ 15,655	\$ 119,588	\$ -	\$ -	\$ 160,204	TBD	pending
73113	U2	RFR - Major Retubing	\$ -	\$ 437,340	\$ -	\$ 9,907	\$ 196,368	\$ 131,365	\$ 1,983	\$ -	\$ 776,964	2	Level 4
73115	U3	RFR - Major Retubing	\$ -	\$ 391,994	\$ -	\$ 20,979	\$ 103,891	\$ 131,464	\$ 1,983	\$ -	\$ 650,311	2	Level 3
73114	U1	RFR - Major Retubing	\$ -	\$ 362,751	\$ -	\$ 15,025	\$ 111,973	\$ 117,863	\$ 1,983	\$ -	\$ 609,596	2	Level 3
73116	U4	RFR - Major Retubing	\$ -	\$ 401,191	\$ -	\$ 5,542	\$ 105,220	\$ 145,828	\$ 1,983	\$ 7,051	\$ 666,815	2	Level 3
Total Cost \$ k			\$ -	\$ 1,940,808	\$ -	\$ 183,924	\$ 533,108	\$ 754,757	\$ 11,813	\$ 7,051	\$ 3,431,460	-	-
			0%	57%	0%	5%	16%	22%	0%	0%	100%		

* excludes OPG Oversight - See Executive Dashboard

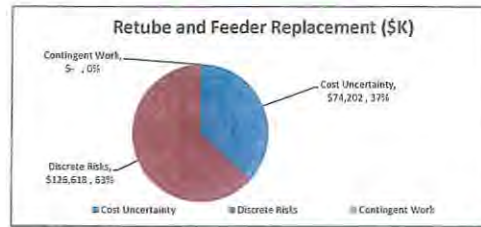
Excludes procurement for Other B



Contingency Summary and Breakdowns by Project or Function

RFR

Cost Uncertainty	Discrete Risks	Contingent Work
Retube and Feeder Replacement (\$K)	\$74,202	\$200,820



Top 10 Cost Uncertainty (P90)

Project / Work Package Description	P90 (\$K)
73100 / JV Fix Fee	\$ 12,647
73100 / RFR Balance	\$ 11,216
73113 / U2 JV - Project Management	\$ 5,673
73116 / U4 JV - Project Management	\$ 5,138
73113 / RWPB	\$ 5,000
73115 / U3 JV - Project Management	\$ 4,809
73114 / U1 JV - Project Management	\$ 4,412
73114 / U1 JV - Procurement	\$ 3,398
73116 / U4 JV - Procurement	\$ 3,093
73113 / U2 JV - Construction	\$ 3,002

RFR	P90 (\$K)
Contingency	\$ 200,820

Narrative:

July 2015 - NR Risk and Infrastructure set up a series of review workshop in preparation of each project and function groups for RQE Contingency Information. All Risk Register items for the projects and functional groups were uploaded into an expanded RQE template spreadsheet and populated with the latest discrete risk and cost uncertainty information.

August 2015 - Preliminary change meetings with projects team to review risk based contingency items and cost uncertainty elements for an integrated assessment of overall contingency values for Executive Review where snapshot #1 was presented.

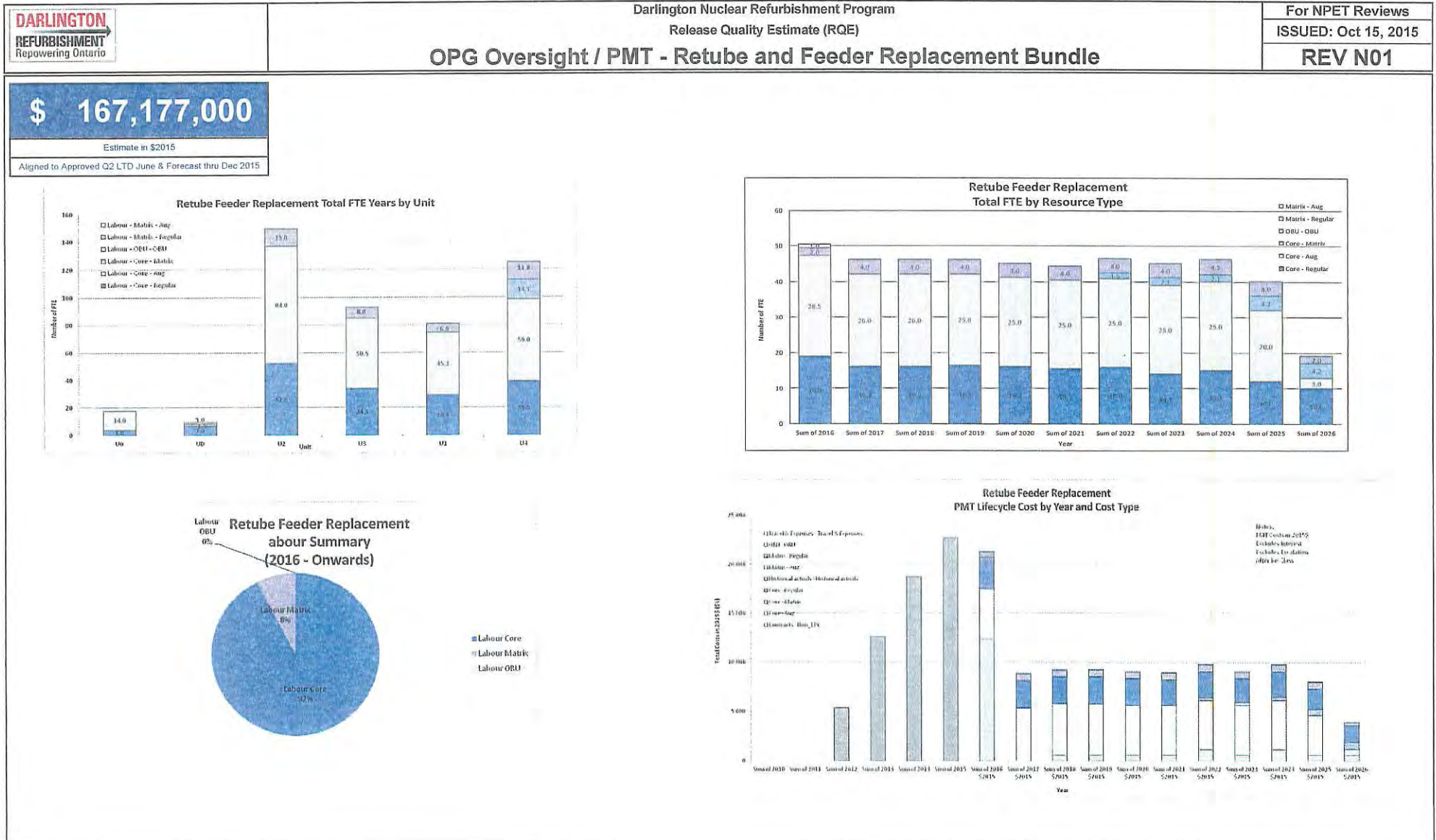
Sept 30, 2015 - RFR project contingency are composed of three major components:

1. RFR JV: P50 Contingency (calculated based on most likely duration and \$)
2. OPG RFR: \$161M, which is mainly for the risk cost impact ($\pm 15\%$ variation depending on the simulation samples)
3. OPG Schedule Contingency (ear marked to RFR):
 - * 80% of program schedule uncertainty contingency is contributing from RFR activities
 - * 20% of program schedule uncertainty contingency is contributing from OPG RFR and OPG JV risks

Uncertainty covers: Incomplete understanding of the scope of work, Imperfect understanding of known work, Variance and/or inaccuracy of factors applied in the develop of the estimate (i.e. labour productivity)

Discrete Risks (P90 Contingency Register)

Risk ID / Bundle / Risk Title / Risk Description	P50 (\$K)	P90 (\$K)
13925 / Retube and Feeder Replacement / Concealed Conditions The examples include, but not limited to: - CTSB Inspection Results; - Feeder nozzle found unsatisfactory; - Calandria tube contacting horizontal flux detector when they are moved; - As-built configurations vary from design and drawings, while laser scan and walk down etc. did not identify the variations and the JV had done everything possible; - Permanent builthead unexpected repairs identified during HDE; - Unexpected deficiencies of existing EPs in shutdown cooling rooms, after due diligence of JV exercised; - As-found "original construction" feeder flaws uncovered, after JV verification completes but could not identify those feeder flaws earlier; - Unexpected changes to containment boundary from OPG/other vendors may cause interruption to containment isolation pressure test; - Calandria Vessel discovery work requiring new tool and new method to remove the discovery materials; - PT fractures longitudinally, resulting in jagged end on the PT		
13911 / Retube and Feeder Replacement / Risk of need to procure additional pressure tubes / The first unit RFR scope include procurement of two full reactor quantities of pressure tubes from two separate vendors as a commercial risk mitigation strategy. The current project estimate includes 2 additional reactor quantities of pressure tubes (for a total of four reactor quantities). There is a risk that OPG may decide that all pressure tubes installed in Darlington Refurbishment must come from one vendor. If this is the case, the consequence would be that the pressure tubes from the vendor not installed in Unit 2 will not be useable by Refurbishment, and an additional reactor quantity of pressure tubes will need to be procured.		
13932 / Retube and Feeder Replacement / Ineffective Practices in Maintaining the Tools As results of ineffective practices to maintain, test, spare tool quantity, stock spare parts for tools, store the tools physically, move the Special Tools supplied by the JV Fixed Price Contract, and to maintain configuration data to supply reliable tools, the risk of not meeting the demand of turnover of the Tools may occur in the Execution Phase with negative impacts on cost and schedule.		
13929 / Retube and Feeder Replacement / Claims from Retube and Feeder Replacement (RFR) Vendor Not already Covered in the Contract As a result of OPG not meeting its obligations, there are risks of the RFR vendor making claims for additional costs, cost claim from schedule delay not covered in the Contract, in the Execution Phase.		
13917 / Retube and Feeder Replacement / Additional Tool Quantities for Execution The Risk is that the existing Tooling quantities for particular tools such as Column Handlers and AGVs may not be sufficient in the vent of breakdown during unit overlap. An additional contingency reserve is required to procure additional quantities.		
13960 / Retube and Feeder Replacement / OSM pricing from Unit-to-Unit Procurement / Due to Unit-to-Unit Procurement, there is a risk of cost escalation of the OSM pricing.		
13564 / Retube and Feeder Replacement / More Expensive Pressure Tubes for four Units Due to the potential direction of using the same vendor's Pressure Tubes in all four Units, the risk to use four Units of more expensive PTs may occur with negative impacts on Cost.		
13566 / Retube and Feeder Replacement / Tool Failure before end of their Life Cycles / Execution Phase: Due to resistance of JV to build new tools, the risk of wear out and depletion of tools may occur with Frequent Tool Failures before end of their life cycles with negative impacts on Schedule.		
11150 / Retube and Feeder Replacement / Risk of Vendor Default/Business Continuity / The risk is that the vendor is unable to meet the contractual obligation due to vendor default.		
12428 / Retube and Feeder Replacement / OPG Foreign Material Exclusion (FME) Events Concealed As a result of historical FME events, the risk of FME items sitting inside Concealed Areas that cannot be discovered/identified in Walkdowns may occur during RFR work in Execution Phase, which would lead to additional inspection / repair activities with negative impacts to * RFR cost * RFR schedule		
13555 * / Retube and Feeder Replacement/ Extra Bellows Need Replacement If bellows replacement is required for damages made in execution phase work (in addition to the previously SFC'd Channels (14 Bellows for 7 channels in U2 and U3), the risk of not enough spare bellows and extra durations for the replacement may occur with negative impacts on Execution cost and schedule.		
11005 / Retube and Feeder Replacement/ All physical Interferences in Unit not Identified There is a risk that not all potential interfaces were identified by the detailed design for modifications. This risk has the potential to adversely affect the cost and schedule of modification installations. Potential unforeseen discoveries include: unit to unit as-built differences/tolerances, structures, cable trays, etc.		
13926 / Retube and Feeder Replacement / Excusable Delays / Due to conditions beyond the control of JV and OPG RFR, 5.2 (a) Excusable Delays Section of EPC Agreement explains the condition and the contract terms of excusable delays, which have impacts on Execution phase Schedule. This risk concentrates on delays of more than 3 days.		
13327 / Retube and Feeder Replacement / Above and Beyond Assumed Escalation Cost / Execution Phase: Due to some costs that are uncontrollable by OPG and JV, the risk of higher costs flown through JV to OPG may occur with negative impacts to the Execution Phase cost. The examples of cost above and beyond assumed escalation cost include the following, but not limited to:		
13380 / Retube and Feeder Replacement / RTP first-of-a-kind in Darlington Vault / Execution Phase: As results of Retube Tool Platform (RTP) being the first-of-a-kind platform installed in the Darlington vault with various constraints, the risk of more downtime of the installation than planned may occur in Unit 2 with negative impacts on Execution Phase schedule.		
13936 / Retube and Feeder Replacement/ Calandria Tube Sheet Bore (CTSB) Needs to be Milled / If CTSB is gouged or scratched during the CT Removal, Calandria Tube Sheet Bore needs to be milled, which will have negative impacts on Execution schedule.		
13935 / Retube and Feeder Replacement/ Not Enough Commission Time for Volume Reduction System in Radioactive Waste Processing Building Due to RWPB construction being late, the risk of not enough commission time for Volume Reduction System may occur with negative impacts on Execution Phase cost and schedule.		
13561.U1 / Retube and Feeder Replacement/ Third and Fourth Unit (U1 and U4) / Due to many first-of-a-kind activities inside RWPB and lack of mock-up facility, the risk of Contamination Events may occur inside RWPB with negative impacts on Cost and Schedule.		
12922.U2 / Retube and Feeder Replacement / End Fitting Waste Processing - First of a kind risks / As a result of the first of a kind nature of the End Fitting waste processing with no existing operating experience, the risk is that there is more downtime of the tooling system than planned. Most importantly that the End Fitting Removal from the Vault may be faster than the End Fitting Waste Processing in Retube Waste Processing Building can handle, and the Waste Processing becomes the critical path, with negative impacts on the schedule.		
13428 / Retube and Feeder Replacement/ JV Performance Exceeds P50 Target Schedule Due to unexpected performance, the risk of JV performing worse than P50 Target Schedule may occur with negative impacts on Schedule. The risk reflects the portion between P50 and P90, of the Monte Carlo results of the Quantitative Risk Analysis of the JV Risk Model. The Contingency up to P50 has been covered in the JV Target Cost.		
13568 / Retube and Feeder Replacement / Non EF Waste Processing not Meeting Demand / Due to Performance of Waste Processing (excluding EFs, as there is another risk #12922 to deal with EF waste processing) lower than expectation, the risk of these Waste Processing tasks becoming the Critical Path and interrupting the reactor face work may occur with negative impacts on Schedule.		



**This entirety of this document titled “Darlington Refurbishment
Program Final: Cost and Schedule Estimate” was filed at L-4.5-5
CCC-022, Attachment 1**

This document titled “Darlington Refurbishment: Execution Phase Business Case Summary” was filed at EX. D2-2-8, Attachment 1.



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Title: RQE PROJECT MANAGEMENT PLAN
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RQE Project Management Plan

NK38-NR-PLAN-09701-10004
2016-01-15

Order Number: N/A
Other Reference Number: N/A

Internal Use Only

Prepared by: Judy Willette
Judy Willette
RQE Project Support
Project Planning and Controls
Nuclear Refurbishment

Date: 15 Jan 2016

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RQE Project Manager
Project Planning and Controls
Nuclear Refurbishment

Date: 15 Jan -16

Approved by: Gary Rose
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Vice President
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Date: 18 Jan -2016

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Revision Summary

Revision Number	Date	Comments
R001	2015-01-15	Re-Write
R000	2014-11-20	Initial Release

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RQE Project Management Plan

1.0 PURPOSE

The purpose of the Release Quality Estimate (RQE) Project is to produce a comprehensive description of Darlington Nuclear Refurbishment Program (DNRP) life cycle scope, cost, and schedule that enables senior OPG management to secure OPG Board of Director's approval to proceed to execution.

The RQE Project deliverables are listed in DNRP milestone NK38-REF-09701-RL030, *Board of Directors Approval of Release Quality Estimate*. These deliverables will be captured in a single RQE Submission Package to be presented to the Ontario Power Generation (OPG) Board of Directors (BoD) requesting approval of the following in regard to the DNRP:

- Approval of the 4-unit high confidence life cycle cost estimate and schedule; and
- Approval to transition from the Definition Phase to the Execution Phase including a release of funds for mobilization activities for the first unit, to October 2016.

In addition to the RQE Submission Package, supporting materials will also be available as backup.

RQE represents a planned progression of scope definition as well as cost and schedule certainty commensurate with the transition from Definition to Execution phases.

1.1 Objectives

The objectives of the RQE Project – Management Plan are to:

- Describe the RQE Management Plan deliverables that constitute successful completion of the RL030 milestone and the RQE Submission Package (Section 2).
- Outline the background, context, and rationale for RQE within DNRP (Section 3).
- Provide a description of the RQE Submission Package (Section 4).
- Define the strategic processes and methodologies to be used by the RQE Project. These processes incorporate industry best practice approaches and activities (Section 5).
- Describe and detail expectations regarding RQE Project Management and Independent Reviews (Section 6).
- Define the roles and accountabilities associated with the RQE project and this document (Section 7).

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2.0 RQE MANAGEMENT PLAN DELIVERABLES

The RQE Project Management Plan requires that certain deliverables be created and managed by the RQE Project Manager to facilitate the Management Plan Objectives. These are:

2.1 Estimate Plan

The specific requirements, processes, and methodologies required to produce life cycle cost estimates for all program elements are contained in NK38-PLAN-09701-10235, *Nuclear Refurbishment Project RQE Cost Estimate Plan*.

2.2 Communication Plan

The RQE Communication Plan is outlined in NK38-PLAN-09701-0502946, *RQE Communications Plan*. This document contains a summary of planned communication events to ensure stakeholders receive information in regard to RQE as appropriate. The Darlington "Road to RQE" website includes links to the RQE Roadmap, weekly messages and other communication documents.

The *Road to RQE* Roadmap (Example exhibited in Appendix A) reflects key RQE activities and milestones leading up to successful completion of RQE Management Plan objectives. It shall be used as the primary visual communication tool regarding RQE progression. The roadmap will be revised and updated (typically weekly) to reflect the requirements, activities, priorities, reviews and approvals of RQE. Revisions/updates to the Roadmap will be published on the *Road to RQE* website.

The RQE Leadership Team (composed of NPET members) and the Executive Leadership Team will receive regular RQE status updates to ensure they are aware of RQE activities, achievements and challenges.

2.3 Timeline and Schedule

Scheduled work activities associated with the RQE Project will reside in Project Integrated Master Schedule (PIMS) and the RQE Schedule will be managed within Primavera P6.

The RQE Project schedule will not duplicate information or scheduled activities held in Bundle or Functional schedules.

2.4 RQE Project Management Plan Monitoring

The RQE Project Manager will monitor progress and status to RL030 completion and overall DNRP Readiness. Such monitoring may include but is not limited to:

- **RQE Roadmap and Schedule Review** and monitoring of progress against key activities leading up to RQE submission

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- **Release Quality Estimate Dashboards** to track progress of key inputs such as EC's complete, Estimate submissions, Schedule submissions, project and bundle gate progression and other information as may be required.
- **RQE Master Quality Checksheet** to monitor project and bundle estimate alignment to the final Master Consolidated File (MCF)
- **RQE Board Submission Package Spreadsheet** to monitor completion and collection of Approval and Supporting items for the RQE Submission Package.

Selected monitoring processes and tools will be created for RQE Project Team to report on the Program and Project/Functional level progress and cost elements. These will be based on existing DNRP data sources such as: Master Project List (MPL), Risk Management and Oversight Tool (RMO), Gate Packages, Proliance, P6, and Integrated Database (IDB). Additional reporting will be performed on an as needed basis. Such reporting will be dynamic in order to highlight the status of the priority requirements at the time.

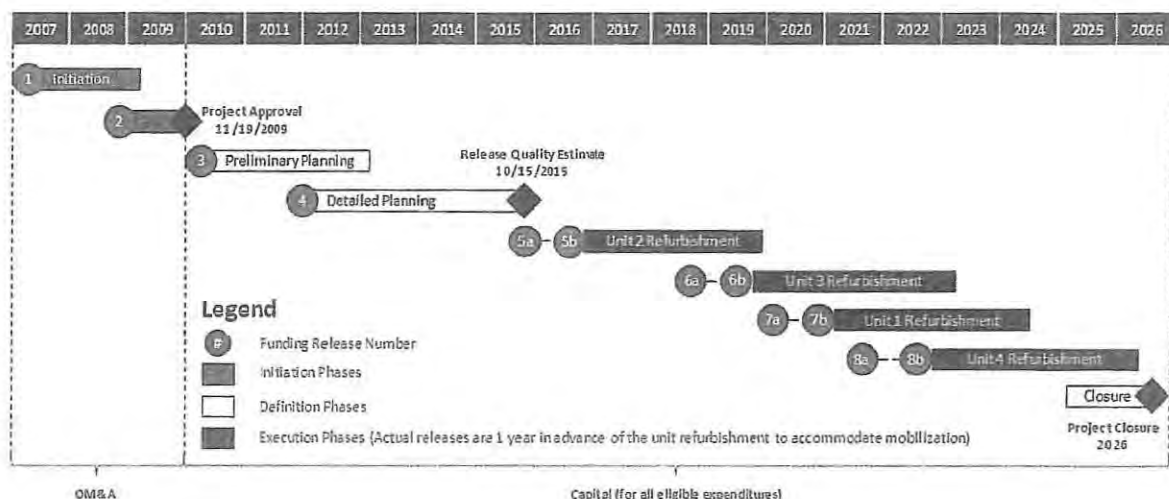
The **RQE Steering Committee** will enable, support and endorse the RQE Project in its activities in order to fulfil its mandate.

3.0 BACKGROUND

3.1 Program Release Strategy

Funding for the DNRP is released in phases, in accordance with the Program Release Strategy shown in Figure 1. Release 4D is the last annual release for the Detailed Planning phase of the DNRP, and thus is considered to be a full release for the Definition Phase.

Figure 1: Darlington Refurbishment Release Strategy



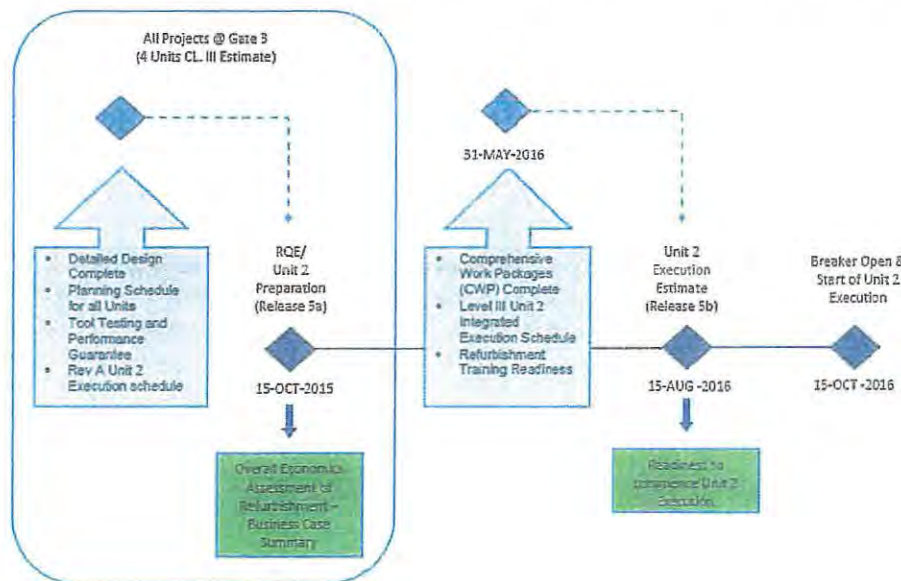
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As the Darlington Refurbishment Project transitions from Release 4D (Dec2014), through RQE to Unit 2 and subsequent units, a staged approach will be utilized for funding release.

At the time of RQE, the Senior Vice President (S.V.P.) Nuclear Projects will provide to the OPG BoD a definitive life cycle cost estimate for the DNRP, an assessment of the overall impact of the revised estimate on the overall economics of the project, and a request for approval to continue with the project, including the release of funds (Release 5a) for the finalization of the Definition phase planning, Unit 2 mobilization and preparation (up to October 2016).

From early 2016 through August 2016, a more detailed work package based “Unit 2 Execution Estimate” will be developed for the execution phase of Unit 2. This estimate will then form the basis for the funding request (Release 5b) to proceed with the execution of Unit 2, as illustrated in Figure 2.

Figure 2: Execution Phase Unit Release Strategy



Note: Activities and deliverables for this “Unit 2 Execution Estimate” will confirm and validate the RQE estimate basis and cost control baseline defined by “Release 5a”. At this time, the “Unit 2 Execution Estimate” and associated activities are outside the scope of the RQE Management Plan. “Gate 3a” milestone requirements shall be defined at a later date.

3.2 RQE Context

OPG is developing the DNRP Project estimate in accordance with OPG corporate, divisional and organizational practices in alignment with the Association for the

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Advancement of Cost Engineering (ACE) estimate classification model as shown in Figure 3 below. Figure 3 provides an overview of the classification model and provides a reference to the general type of estimate and the associated uncertainty band.

The RQE signifies the completion of the Definition Phase of the Darlington Refurbishment Program Release Strategy. RQE will demonstrate that the maturity of scope, schedule, cost and risk of the DNRP are consistent with a Class 3 estimate, based on ACE, and as such, RQE will provide a Budget/Control estimate for the program.

The DNRP Project Estimate, also referred to as the RQE Estimate or Program Basis of Estimate (BOE) estimate, is the point estimate produced in alignment with ACE recommended practices, and with classification requirements as defined in the RL030 definition statement. It will be produced to the requirements defined in NK38-PLAN-09701-10235 *Nuclear Refurbishment Project RQE Cost Estimate Plan*. OPG BOE must be viewed as a consolidation of multiple documents produced under those protocols and governed by their respective governance and processes. See examples below:

Program Aspect	Main Source Documents
Functions	FMPs & Templates
EPC	Vendor Submissions
Bundles	Gate 3 Package documents
Legacy Projects Completed	Proliance Actual Cost

The expectation is that the RQE Project will provide an integrated view and consolidated description of this BOE document set for the purposes of the Submission Package.

Figure 3: ACE Estimate Progression and Classifications



The RQE Submission Package becomes the basis of Program validation that all key deliverables associated with the current funding release strategy, as based on the October 2016 First Unit Outage schedule proposed in the November 2013 Darlington Refurbishment Business Case Summary (BCS, Doc # N-REP-00120.3-10000, Rev 1 OPG Confidential), have been completed within the detail planning phase.

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4.0 RQE SUBMISSION PACKAGE - DESCRIPTION

The RQE Project's main output is the production and management of the RQE Submission Package. Components of the RQE Submission package are outlined in Appendix B and found in Share point site:

Team Sites > Nuclear > Nuclear Support > Nuclear Refurb > Planning & Controls > RQE > 04 - BoD Submission Components

5.0 STRATEGIC APPROACH / METHODOLOGY

Production of the RQE Submission Package will take place in stages, as outlined in Figure 4 and further detailed in Appendix D *Cost & Schedule Integration Process post June 30*. The *Road to RQE Roadmap* will be used to communicate and provide focus on current and upcoming priorities to ensure ongoing progress in a project involving many processes and people.

Figure 4: RQE Submission Package Approach



5.1 RQE Work Stream Inputs/Source Documents

Inputs to RQE are produced by various work streams, corporate support and management organizations. Work streams, as outlined on the RQE Roadmap (Appendix A) and the Cost & Schedule Integration Process (Appendix D), include Estimating & RQE, Functions, U2 Outage and Projects.

Work stream component inputs are produced, and associated processes defined by, various Bundle and Functional level work streams. A work stream lead, as defined by the roles and accountabilities in section 7 of this document will provide interface for the RQE Project Team on behalf of the respective work stream.

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Work stream leads will be responsible for providing inputs including scope, schedule and cost elements to be consolidated and integrated into the RQE package. Work streams and supporting organizations are governed and managed by their respective owners and documentation. Key work stream inputs and associated processes are listed in Appendix C.

5.2 Consolidation and Integration

Consolidation of documents and integration of component inputs into the RQE Cost Estimate and Submission Package will be managed by the RQE Project Manager, with support from various work streams.

With respect to consolidation and integration activities, the RQE Project Manager and associated project team are responsible for:

- Identification, collaboration, collection, review, analysis and integration of Work stream inputs for the purposes of producing the consolidated RQE Cost Estimate and Submission Package
- Communicating expectations and requirements to the organization
- Assisting the organization with products of interface aspects of their work for RQE purposes only

5.2.1 Cost/Schedule Integration

Cost/schedule integration dashboards and Executive dashboards (examples included in Appendix E for reference) will be prepared to summarize the RQE costs, including consolidated resource histograms and key ratios for comparison purposes. Internal project teams will review and perform quality checks and comparisons against prior Gate approvals for variance, and resolution of issues prior to management review/challenge. Bundle cost flows will be forwarded to Finance for inclusion into the MCF.

5.2.2 RQE Cost Estimate Plan and BOE Report

The process and mechanics of producing the release quality estimate are described in the NK38-PLAN-09701-10235 *RQE Cost Estimate Plan*. The estimate inputs, source documents, and supporting information are described in NK38-REP-09701-0548257 *RQE Basis of Estimate Report*.

The RQE Cost Estimate, as part of the RQE Submission Package, will incorporate all the elements of cost management best practices and activities which include; plan over plan comparison to a 4D based baseline package; Program Risk and Contingency Analysis, and process and data quality management review, in line with Industry standards and OPEX application.

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5.2.3 Master Consolidated File (MCF)

As illustrated in Figure 5, cost and schedule data from various sources are integrated to develop an overall Program cost / cashflow in an RQE Master Consolidated file (MCF). The MCF consolidates data from all sources – US Cost (Vendor/EPC's), P&C Lead input, RQE Estimate Templates (Functions, OPG PMT, Legacy/Historical) and Proliance (Campus Plan F&IP/SIO projects) so that costs can be converted to 2015 dollars, then "Dollars of the Year", fully escalated and interest added throughout the Program lifecycle (to 2026). In the MCF, costs are captured monthly to the end of 2017 and yearly thereafter.

A Change Management Process will be utilized to track and incorporate all changes to the MCF through the consolidation and management review phases.

Figure 5 – Release Quality Estimate – Master Consolidated File

		RQE Inputs				2015 \$				Escalated DOY \$			
Program Category		RQE Source		Project #, and data cost attributes	2008 to 06-2015	07-2015 to 12-2015	2016 - 2026 FTE's and \$\$	2008 to 06-2015	07-2015 to 12-2015	2016 - 2026 FTE's and \$\$	2008 to 06-2015	07-2015 to 12-2015	2016 - 2026 FTE's and \$\$
Historical & Legacy		Proliance											
OPG Functions		RQE Excel Templates											
OPG PMT		RQE Excel Templates											
Campus Plan F&IP/SIO		Forecast in Proliance											
EPC / Vendor	RFR	Proxy Excel					RFR - Proxy						
	T/G	JV Excel					JV Estimate in Excel						
	SIG	Gate Est & Flow					Project Gate Info						
	SDLU	US Cost					Cost flowed by integrating US Cost and P&C resource profiles by PEPCCC						
	BoP												
	DF												
	UI, Etc.												
Below the line items		Calculated at Bundle Level		Contingency & Mgmt Reserve			Cost Flowed			Cost Flowed			Cost Flowed
		Calculated at Level in Est Provided		Escalation			Excluded			Excluded			Included in Above
		Calculated at Level in Est Provided		Interest			Excluded			Excluded			Included in Above
				Total Program.....			TOTAL \$			TOTAL \$			TOTAL \$

5.3 RQE Submission Package – Program Level Analysis

Program level analyses are primarily produced, managed, and processes defined, by the RQE Project Manager. These components may be completed with support from various Work streams or other Centre Led resources and vendors as required.

These are the programmatic level reviews and analysis using standard cost management processes and techniques to produce conclusions and recommendations which satisfy investment planning requirements. The recommendations and conclusions resulting from these component activities will provide the basis and justification for the BCS update.

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Selected Reporting processes and tools will be created for Program level and variance reporting in the RQE Project. The RQE package and total cost summary will include a set of comprehensive views and analyses on the Lifecycle cost estimate including resource requirements, summaries of unitization, contingency, oversight, estimate classification, vendor estimate-to-complete, various cost flows and staffing summaries and various project sorts.

5.4 Risk & Contingency Analysis

Risk and Contingency Analysis is a management review function which is required for a true understanding of the uncertainties surrounding the BOE Point values. The RQE Submission Package will acknowledge and address uncertainties in the handling of associated contingency application at a programmatic level and will also incorporate the cost risk assessment.

Note: Contingency application affects the margins of confidence on calculated estimate range values and available management reserve, once sensitivity analysis has been completed. Narrower margins result in greater levels of confidence in the final range estimate.

Standard cost analysis methods will be used to analyze identified sources of uncertainty at the Program level; characterizing and reducing uncertainty in the results of the analysis. This includes an RQE Risk & Issues assessment which will review and identify DNRP Risks and Issues which may impact or affect:

- The production of RQE Submission Package in alignment with AACE requirements.
- The probabilistic margin limits on the range estimates as a result of contingency application
- The confidence in the estimate.
- The quality of the supporting documentation.

The RQE Contingency Development Plan is detailed in NK38-PLAN-09701-10270 and will result in output including the RQE Contingency Development Report, Program Risk Register and Project Risk Register.

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6.0 RQE SUBMISSION PACKAGE – MANAGEMENT & INDEPENDENT REVIEWS

6.1 Bundle / Function Reviews

A series of review meetings will be held to review each bundle / functional estimate to ensure understanding of inputs to the RQE Program Cost estimate and Submission package for the Bundle or Function. Follow-up actions from these meetings will be documented as Tier 1 (to be completed prior to RQE) or Tier 2 (to be completed prior to Unit 2 Execution Estimate). These Bundle/Function reviews will ensure interfaces are optimized, all costs are captured yet there is no duplication of costs.

6.2 Management Review

Management Reviews will be held to validate the overall adequacy of the RQE estimate in order that management can be assured that the level of detail available for the estimate, the assumptions, estimating methods employed, and the skills of the estimating and project teams support their decision making process on whether to proceed.

NPET level reviews (including stakeholders such as corporate senior management and internal and external oversight) will ensure consistency of understanding across major project bundles and functions. Acceptance by NPET members that the scope, cost estimates and schedules are complete, reasonable and appropriate for the purposes of RQE provides confidence in RQE submission to the Board.

Management review will also include explanatory discussion of how the Program contingency amount was developed, with discussion regarding associated levels of risk is necessary in order for management to accept the level of risk indicated, or change the amount of contingency and accept more or less risk for the project. The risk analysis review will discuss the areas of high risk, and what is being done to mitigate those risks

6.3 Independent Assessment, Review and Response

The Independent Third Party Assessment will result in a report on RQE readiness and RQE process. This report will be reviewed and findings will be dispositioned and a management response created.

6.4 Quality Assurance and Verification

NK38-REP-09701-0564969 *RQE Quality Assessment Report* will perform a quality assessment review of the Release Quality Estimate (RQE), in relation to:

- **Planning:** RQE processes were established consistent with industry standards and in alignment with the unique needs of the Refurbishment program and its objectives.

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- **Execution:** The RQE was developed in accordance with the plan established. Deviations from plan were managed to ensure that outputs met the established objectives.
- **Review:** Project, functional, management and stakeholder reviews were sufficiently thorough and rigorous to achieve established objectives.

Additionally the report will provide support to the RQE BoD submission with regard to:

- **Compliance:** Describe the content of the RQE cost estimates, their completeness with respect to quality estimates in terms of estimate cost classifications, basis of estimate (BOE), structure, and risk analysis of cost, schedule and contingency.
- **Effectiveness** ("meets the need"): Using a rigorous framework, assess the quality of the cost estimates and assess the underpinning supporting data that has been presented. This will be supplemented with information (and analysis) concerning risk and uncertainty.

Lastly, the report will establish key lessons learned and recommendations in order to optimize the effectiveness of the next iteration of the DNRP life cycle estimate to be completed prior to Unit 2 execution.

6.5 Validation

The RQE Submission Package will include variance analysis and reconciliation against 4D baseline and approved Gating documentation.

The BCS update as a result of the RQE will include reporting that uses key industry benchmark ratios to compare RQE to previous releases, historical values and any other available, similar projects.

7.0 ROLES AND ACCOUNTABILITIES

The RQE Project Team is responsible for the management of and delivery on RL030 milestone. This includes integration and interfaces with the individual Refurbishment Program Organizations, and review and assessment of inputs from their respective Work Streams.

Specific roles and accountabilities associated with the RQE Submission Package and this management plan are defined as follows.

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7.1 RQE Leadership Team

The RQE Leadership Team is responsible for adhering to the requirements and deliverables as defined in the TOR and is comprised of the NPET (sponsored by the Director, P&C), the Senior Manager, Enterprise Risk Management (ERM); the Director, Controllershship, Nuclear Projects, Finance; and Director, Unit Outage, Refurbishment Execution.

7.2 Director of Planning and Controls (P&C)

The Director of P&C is accountable for the RQE planning process and the preparation of the RQE Submission Package, DRC and Board of Directors memos.

7.3 The RQE Project Team

The RQE Project Team is comprised of:

- The RQE Project Manager & Project Support
- The RQE Work stream Leads:
 - Director, Unit Outage, Refurbishment Execution
 - Unit 2 Director, Refurbishment Execution
 - Project Director, Refurbishment Engineering
- P&C Managers – Estimating, Scheduling, Risk & Project Infrastructure, Reporting, Integration and Cost.

7.3.1 RQE Project Manager

The RQE Project Manager shall report to the Director of Planning & Controls and is responsible as the RQE Project Single Point of Contact (SPOC) for coordination, administration, management, and reporting and development of RQE processes and deliverables as may be required to successfully complete RQE milestone RL030.

7.3.2 Work Stream Leads

RQE Work Stream Leads will be the RQE SPOC interfaces with all Refurbishment Program Organizations.

Inputs to work stream or program products and deliverables may be prepared by OPG and/or an existing approved Vendor(s); however accountability of the process and outputs of those work streams lies solely with OPG Work stream leads.

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7.3.3 P&C Manager, Estimating

The P&C Manager, Estimating is accountable for managing the Nuclear Refurbishment Project RQE Cost Estimate Plan.

The Estimating Manager is accountable to verify the classification level achieved for each Program component (Bundle/Functional work packages).

7.3.4 P&C Manager, Scheduling

The P&C Manager, Scheduling is accountable for managing the Nuclear Refurbishment Project Integrated Schedule and Milestones and inclusion of resource workhours data.

7.3.5 P&C Manager, Risk & Project Infrastructure

The P&C Manager, Project Infrastructure is accountable for managing and maintained the the Nuclear Refurbishment Project Risk, Issues, Actions and Assumptions logs and databases, as well as defining and managing the Program Risk and Contingency Plan.

The RQE Project Team may be supported by EPC and Specialized Support Contractors as well as OPG Centre Led and Support Organizations as required.

7.4 The DNRP Organization

The DNRP has two distinct organizational groups, Bundle and Functional, as outlined in N-MAN-00120-10001 SCH-05 Nuclear Program/Project WBS, Control Accounts and Work Packages with accountabilities and support organizations as defined in defined in the *Darlington Refurbishment Program Assurance Program Management Plan* (NK38-NR-PLAN-09701-10001 Sheet: 0011).

It is the accountability of the Project Managers and Functional Managers to ensure the estimate submitted for RQE meets the minimum requirements of the RQE milestone, including the expectation that all estimates will be, as a minimum, aligned to AACE classification requirements defined as per RL030.

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8.0 ACRONYMS

AACE	Association for the Advancement of Cost Engineering
BCS	Business Case Summary
BoD/BOD	Board of Directors
BOE	Basis of Estimate
DNRP	Darlington Nuclear Refurbishment Program
EPC	Engineering, Procurement and Construction
ERM	Enterprise Risk Management
FMP	Functional Management Plan
IDB	Integrated Database
MCF	Master Consolidated File
MPL	Master Project List
NPET	Nuclear Program Executive Team
NR	Nuclear Refurbishment
OPEX	Operating Experience
OPG	Ontario Power Generation
P&C	Planning & Controls
PGMP	Program Management Plan
PIMS	Project Integrated Master Schedule
PMP	Project Management Plan
RL030	NK38-REF-09701-RL030 - Board of Directors Approval of Release Quality Estimate (RQE)
RMO	Risk Management and Oversight Tool
RQE	Release Quality Estimate
SPOC	Single Point of Contact
S.V.P	Senior Vice President
TOR	Terms of Reference
V.P.	Vice President
WBS	Work Breakdown Structure

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8.1 REFERENCES

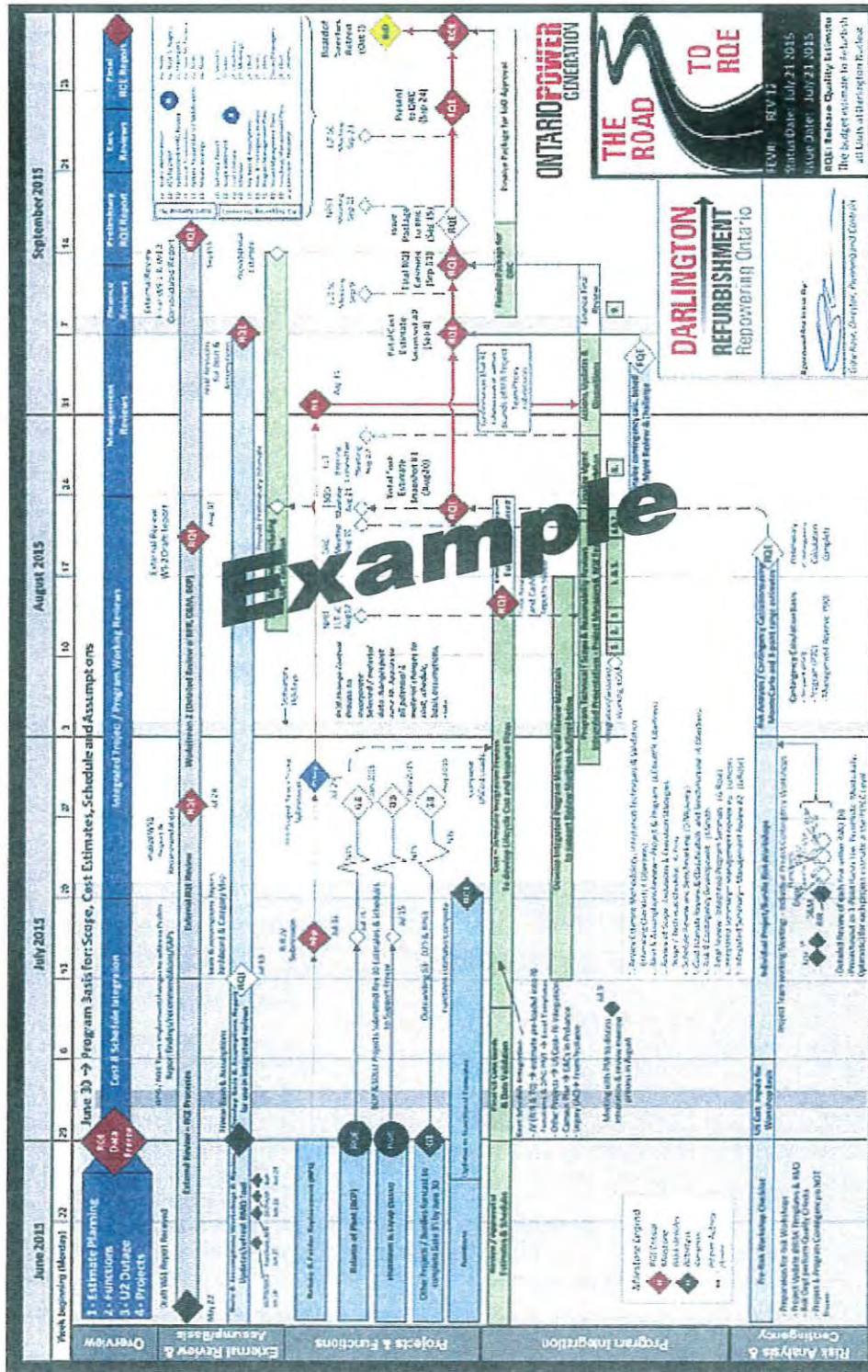
Document Number	Document Name
N-REP-00120.3-10000 (OPG Confidential)	Darlington Refurbishment Business Case Summary
NK38-NR-PLAN-09701-10001 (All Sheets)	Darlington Refurbishment Program Structure
NK38-PLAN-09701-10235	Nuclear Refurbishment Project RQE Cost Estimate Plan
NK38-REF-09701-10005	RQE Steering Committee – Terms of Reference
NK38-REF-09701-RL030	Board of Directors Approval of Release Quality Estimate (RQE)
N-MAN-00120-10001 (All Sheets)	Nuclear Refurbishment
OPG-PROG-0006	Investment Management
NK38-GUID-09701-10023	Functional Management Plan Guideline
NK38-PLAN-00300-10000	Darlington Refurbishment Program Integrated Master Schedule
NK38-PLAN-09701-10097	Interface Agreement Between Nuclear Refurbishment And Darlington Nuclear
NK38-REF-09701-PG-00-1402	Darlington Refurbishment Program Milestone Definition Template - Issue Site Integrated Transition Plan
NK38-REF-09701-MSO0010	Darlington Refurbishment Program Milestone Definition Template Revise Cap\oversight Ownership Transfer Plan
NK38-REF-09701-OP2210	Darlington Refurbishment Program Milestone Definition Template - U2 Risk Mitigation Plans Prepared
NK38-REP-09701-0490147	Overall Planning Pre-execution Review For Maintenance Owner Support Services For Darlington Refurbishment Project
NK38-REF-09701-OP2220	Darlington Refurbishment Program Milestone Definition Template - U2 Refurb Outage Execution Organization Identified
NK38-REF-09701-OP2280	Darlington Refurbishment Program Milestone Definition Template - U2 Refurb Outage Pre-requisites Complete
NK38-REP-09701-0548257	RQE Basis of Estimate Report
NK38-MAN-09701-10005	Nuclear Refurbishment Planned Outage Management

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NK38-PLAN-09701-10270	RQE Project – Contingency Development Plan
NK38-PLAN-09701-0502946	RQE Communication Plan
NK38-REP-09701-10067	Darlington Refurbishment Transition Plan Strategy
NK38-REP-09701-0523355	OPEX Review for RQE
NK38-PLAN-09701-10227	Nuclear Refurbishment – Pre-Gate Readiness Review Alignment Meeting -Terms of Reference

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APPENDIX A: RQE Roadmap



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APPENDIX B: Table of Contents

Release Quality Estimate (RQE)

RQE Board Submission Package - Approval & Supporting Items

Team Sites > Nuclear > Nuclear Support > Nuclear Refurb > Planning & Controls > RQE > 04 - BoD Submission Components

#	Package Element	Document/Record Number
Approval Items		
A1	Board Memorandum	November 13, 2015 - Darlington
A2	Business Case for Darlington Refurbishment Program (OPG Confidential)	N-REP-00120.3-10001
A4	External Presentation	
Supporting Items		
1.0	RQE Summary	
1.1	RQE - Basis of Estimate Report	NK38-REP-09701-0548257
1.2.1	KPMG RQE Independent Review- Executive Summary	NK38-REP-09701-0568875
1.2.2	KPMG RQE Independent Review- Consolidated Main Report	NK38-REP-09701-0568865
1.3	Conference Board of Canada Report	
1.4	RQE Quality Assessment Report	NK38-REP-09701-0564969
2.0	Scope	
2.1	Scope Summary - CEO report	NK38-REP-09701-0568867
2.2	Scope Summary (Complete)	NK38-REP-09701-0568863
2.3	RQE Master Project List	NK38-REP-09701-0568869
2.4	Darlington Refurbishment Program Management Work stream, Application Coding Requirements	NK38-REP-09701-0568869
3.0	RQE Plan	
3.1	RQE Project - Management Plan	NK38-NR-PLAN-09701-10004
3.2	RLOSD Milestone Completion Board of Directors Approval of RQE	NK38-REF-09701-RL030
3.3	RQE Steering Committee - Technical Reference	NK38-REF-09701-10005
3.4	OPEX Review for RQE	NK38-REP-09701-0523555
3.5	RQE Communication Plan	NK38-PLAN-09701-0502946
3.6	Memo: RQE Strategies re Gate 3 Submission for Approval	
3.7	RQE Directives	NK38-REP-09701-0572741
3.8	RQE Schedule - Data Date Nov. 26 2015	N/A
3.9	Road to RQE (Selected) Roadmaps - REV 0, 4, 8, 12, 15, 24	N/A
3.10	RQE Approved Service Level Agreements - OBU Corp Services	NK38-REP-09701-0573636
3.11	RQE Approved Service Level Agreements - OBU Nuclear Services	NK38-REP-09701-0573637
4.0	Cost Estimate - Refurbishment	
4.1	Estimate Plan	
4.1.1	Nuclear Refurbishment Project RQE Cost Estimate Plan	NK38-PLAN-09701-10235
4.2	Additional Estimate Docs	
4.3	RQE Program Cost Estimate Reports	
4.4	Bundle Estimate Reports & BOE Support Documents	
4.5	Bundle Summaries-Executive Dashboards (Excel)	
4.6	Bundle Estimate Source Reconciliation Sheets	
5.0	Schedule	
5.1	Planning Assumptions Regarding 4-unit Refurbishment Schedule	NK38-REP-09701-0568619
6.0	Program Basis	
6.1	RQE Program Basis	NK38-REP-09701-0568874
7.0	Program Risks & Contingency Analysis	
7.1	RQE Contingency Development Plan	NK38-PLAN-09701-10270
7.1.1	RQE Contingency Development - June 24, 2015 Presentation	NK38-REP-09701-0575618
7.2	RQE Contingency Development Report	NK38-REP-09701-10304
7.3	Contingency Development Report Supporting documents	NK38-REF-09701-0566066
7.4	Palisade - OPG RQE Model - Summary and Final Report	NK38-REP-09701-0567077
7.5	Refurbishment Program Risk Register	NK38-REF-09701-0568710
7.6	Refurbishment Project Risk Register	NK38-REF-09701-0568711
7.7	Lessons Learned Report 2010-2015	NK38-REF-09701-0506878
7.8	OPEX Library 2014-2015	NK38-REF-09701-0568709
7.9	RQE Contingency Calculation - Snapshot 3 Report (Risk/Excel Spreadsheet)	NK38-REP-09701-0566838
8.0	Program Management Plans	
9.0	Project Management Plans	
10.0	Functional Management Plans & Transfer Plans	
11.0	Transfer Plans	

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APPENDIX C: Work Stream, Corporate and Program Support Components

Key Work stream inputs to the strategic approach and methodology for the RQE Submission Package include, but are not limited to:

1. Functional Management Plans (FMP)

Reference:

- NK38-GUID-09701-10023 - Functional Management Plan Guideline
 - NK38-NR-PLAN-09701-10001 Sht: 0001 - Darlington Refurbishment Program Structure

2. Scope / Gated Process / Project Management Plans

References:

- N-MAN-00120-10001 Sht: SCOPE - Nuclear Projects Scoping Process
 - N-MAN-00120-10001 Sht: SCOPE-02 - Darlington Refurbishment Prescreening Review Process For Late Scope To Be Executed By The Station
- N-MAN-00120-10001-GRB - Nuclear Projects Gated Process
 - NK38-PLAN-09701-10227 - Nuclear Refurbishment – Pre-Gate Readiness Review Alignment Meeting -Terms of Reference

3. Scheduling

References:

- NK38-PLAN-00300-10000 - Darlington Refurbishment Program Integrated Master Schedule
 - N-MAN-00120-10001 Sht: SCH - Nuclear Projects Schedule Management
 - N-MAN-00120-10001 Sht: SCH-10 - Darlington Nuclear Refurbishment Co-ordination And Control Schedule (C And CL2) - Terms Of Reference
 - N-MAN-00120-10001 Sht: SCH-05 - Nuclear Program Project Work Breakdown Structure (WBS) Control Accounts And Work Packages
 - N-MAN-00120-10001 Sht: SCH-01 - Task Instruction - Work Breakdown Structure Direction
 - N-MAN-00120-10001 Sht: SCH-03 - Task Instruction - DNG Refurb - Program And Project Missed Milestones Recovery Process
 - N-MAN-00120-10001 Sht: PC-01 - Nuclear Refurbishment-cost And Schedule Change Control

4. Transition Plan Strategy

Reference:

- NK38-REP-09701-10067 – Darlington Refurbishment Transition Plan Strategy

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- NK38-REF-09701-PG-00-1402 - Darlington Refurbishment Program Milestone Definition Template - Issue Site Integrated Transition Plan
- NK38-REF-09701-MSO0010 - Darlington Refurbishment Program Milestone Definition Template Revise Cap/Oversight Ownership Transfer Plan
- NK38-PLAN-09701-10097 - Interface Agreement Between Nuclear Refurbishment And Darlington Nuclear

5. Management and Oversight Tools

References:

- NK38-REP-09701-0523355 OPEX Review for RQE

6. 4D Funding Release Estimate

Reference:

- Preparation for Nuclear Refurbishment Release 4D Funding” - Memo, May 09 2014 (Team Sites > Nuclear > Nuclear Support > Nuclear Refurb > Planning & Controls > Releases > Release 4D > Admin)
 - N-MAN-00120-10001-PC-13 - Nuclear Refurbishment - Cost Management and Reporting
 - N-MAN-00120-10001 Sht: SCH-07 - Nuclear Refurbishment Earned Value Management

7. Engineering

- NK38-NR-PLAN-09701-10001 Sht: 0008 - Darlington Refurbishment Engineering Program Management Plan

8. RQE Cost Estimate and Basis of Estimate (BOE)

References:

- NK38-PLAN-09701-10235 - Nuclear Refurbishment Project RQE Cost Estimate Plan
 - N-MAN-00120-10001 Sht: EST - Nuclear Projects Cost Estimating
 - N-MAN-00120-10001 Sht: EST-01 – Nuclear Refurbishment Cost Estimate
 - N-MAN-00120-10001 EST-02 – Estimate Classification Requirement and Assignment
 - N-MAN-00120-10001 EST-04 – Nuclear Refurbishment – Project Basis of Estimate and Documentation
 - N-MAN-00120-10001 EST-05 - Nuclear Refurbishment – Project Estimate Planning and Development
 - N-MAN-00120-10001 EST-06 - Nuclear Refurbishment Estimate Commodity Code Standards
 - N-MAN-00120-10001 PC-01 - Nuclear Refurbishment-Cost And Schedule Change Control

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9. Risk and Contingency Analysis

References:

- NK38-PLAN-09701-10270 RQE Contingency Development Plan
- NK38-REF-09701-OP2210 - Darlington Refurbishment Program Milestone Definition Template - U2 Risk Mitigation Plans Prepared
- N-MAN-00120-10001 Sht: RISK - Nuclear Projects Risk Management Process

10. Outage and Work Management

References:

- NK38-MAN-09701-10005 - Nuclear Refurbishment Planned Outage Management
- NK38-REF-09701-OP2220 - Darlington Refurbishment Program Milestone Definition Template - U2 Refurb Outage Execution Organization Identified
- NK38-REF-09701-OP2280 - Darlington Refurbishment Program Milestone Definition Template - U2 Refurb Outage Pre-requisites Complete
 - N-MAN-00120-10001 Sht: SCH-02 - Task Instruction - DNG Refurb - Standard Projects Milestone List
 - N-MAN-00120-10001 Sht: SCH-06 - Nuclear Refurbishment - Milestone Definition Framework
 - N-MAN-00120-10001 Sht: SCH-11 - Darlington Refurbishment: Schedule Management Plan For Integrated Level 3 Execution
 - N-MAN-00120-10001 Sht: PC-01 - Nuclear Refurbishment-cost And Schedule Change Control
 - N-MAN-00120-10001 Sht: SCH-03 - Task Instruction - DNG Refurb - Program And Project Missed Milestones Recovery Process
 - N-MAN-00120-10001 Sht: PC-14 - Darlington Refurbishment Program Management Work Stream Applications And Coding Requirements
 - NK38-REP-09701-0490147 - Overall Planning Pre-execution Review For Maintenance Owner Support Services For Darlington Refurbishment Project
 - NK38-NR-PLAN-09701-10001 Sht: 0009 - Darlington Refurbishment -maintenance Program Management Plan
 - NK38-NR-PLAN-09701-10001 Sht: 0012 - Darlington Refurbishment –Construction Program Management Plan

11. P&C Memos and Directives

As required by the organization P&C has issued additional documents to provide direction such as:

- May 9, 2014 4D Planning Memo
- April 27, 2015 Gate 3 Memo
- Directives for RQE Roadmap, Projectization, Unitization, Schedule Durations, Lvl3and Lvl25

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12. Program Management Plans

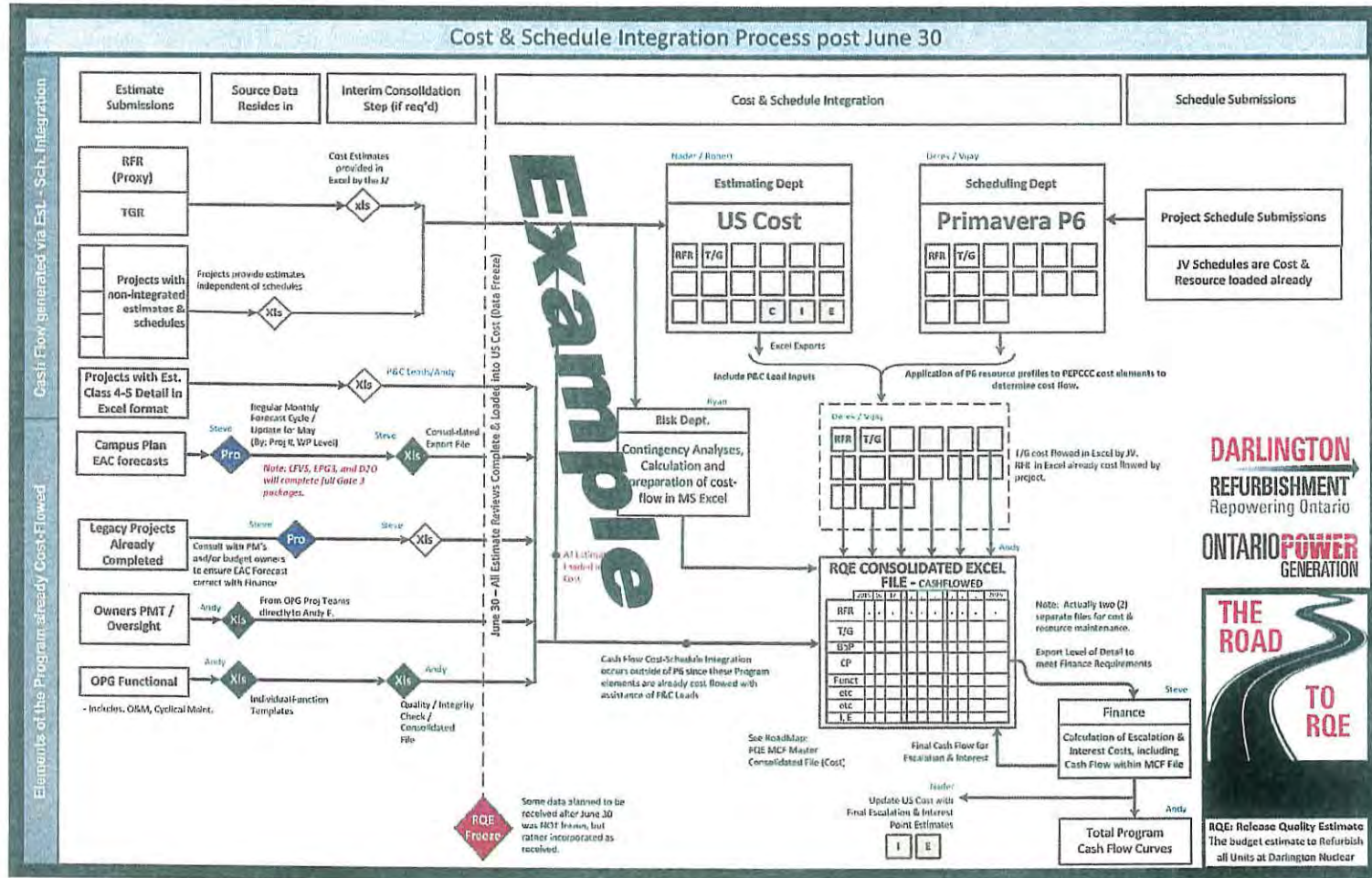
Reference:

- NK38-NR-PLAN-09701-10001 - Darlington Refurbishment PgMP (all applicable Sheets)

RQE Project Management Plan

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APPENDIX D: Cost & Schedule Integration Process

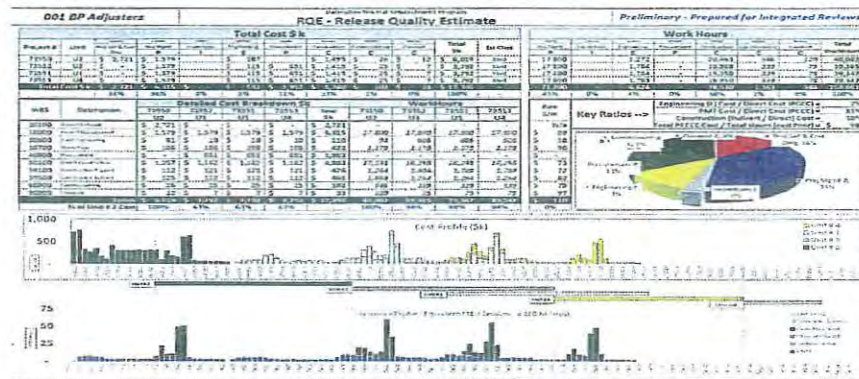


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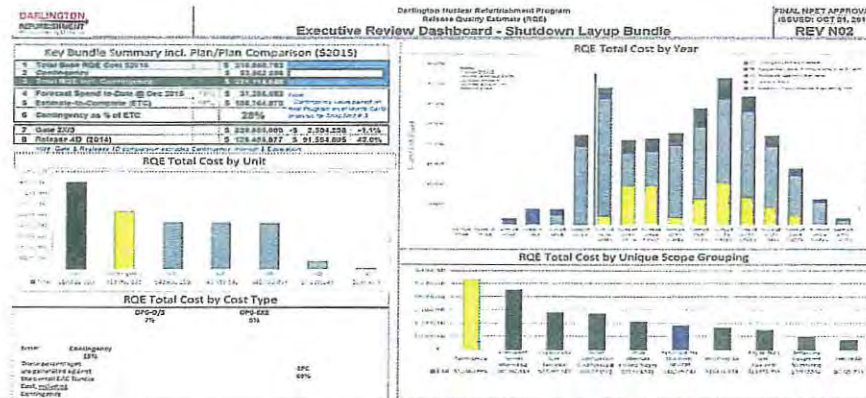
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RQE Project Management Plan

APPENDIX E: Dashboard Examples

COST/SCHEDULE INTEGRATION DASHBOARD



EXECUTIVE DASHBOARD



This document titled “Release Quality Estimate – Basis of Estimate Report” was filed at L-4.3-15 SEC-033, Attachment 4.

Refurbishment Readiness for Execution

Roy Martin
April 26, 2016

BEHAVIOURS

- Say It, Do It
- Simplify It
- Think Top and Bottom Line
-
-



VALUES ▪ SAFETY ▪ INTEGRITY ▪ EXCELLENCE ▪ PEOPLE & CITIZENSHIP ▪

Refurbishment Ready for Execution



- Completion of the Definition Phase
 - RQE delivery
 - Execution Organization implementation

- Readiness to Execute Plan
 - Preparing of Processes for testing
 - Implementation of the RTE Test period work
 - Table-Top exercises for the balance of Processes
 - Lessons Learned implementation and Process Adjustment
 - Change Management throughout

Readiness to Execute Plan Periods



■ Plan Periods

- Lead-up Period (Complete)
 - Develop the test plans for the Test Period, and define 'table top' exercises to test those plans, processes and activities that can't be directly tested during the implementation of the Test modifications
- Pre-test Period (Complete)
 - Refine work programs and 'proxies' for the test period, conduct challenge meetings and indoctrinate the Execution team on the RTE purpose
 - Preparation for the for the RTE field work
- Test Period (February 2016 – mid-June 2016)
 - Execute the planned field work activities and 'table-top' exercises
 - Develop the basis of information for conducting extensive lessons learned reviews focused improvements and corrections to training, work processes, team dynamics and worker and team behaviours
- Implementation of Lessons Learned (June 2016 – October 2016)
 - Make the identified changes based on vetted results from the Test Period
 - Conduct change management to ensure that all part of the integrated execution are practicing the changes in their work

Readiness to Execute Plan Work Streams



■ Work streams

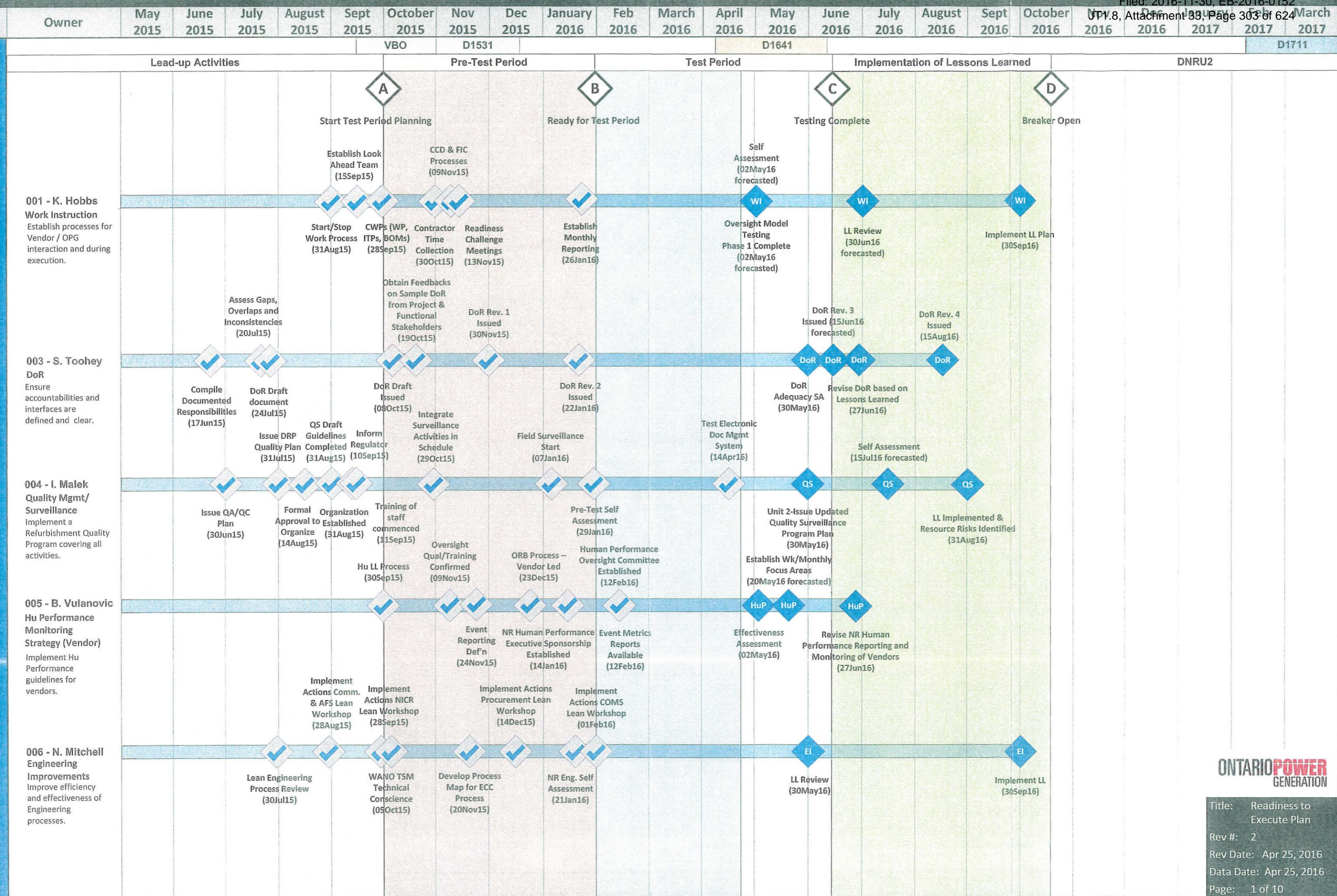
- Process stream – Activities that are principally focused on defining, clarifying and testing the processes and information infrastructure that will be used during the Execution of Unit 2 Refurbishment.
- Cross-Functional stream – Activities that are highly cross-functional and/or integrated across all of the Project Bundle. Many of the activities in this stream will involve OPG, both Refurbishment and Darlington, and all of the primary vendors and their sub-vendors
- Bundles stream – Work being undertaken by each of the Project Bundles during the Test Period, including those modifications that will form the basis of Test Period field implementation learning
- Execution stream – Activities that define, practice and refine the day-to-day work practices of the field execution work force completing the construction, QA, QS and QC activities, materials handling, as well as, testing and refining the assumptions around access to the work site, timekeeping and 'barrier busting'

RTE Example Review



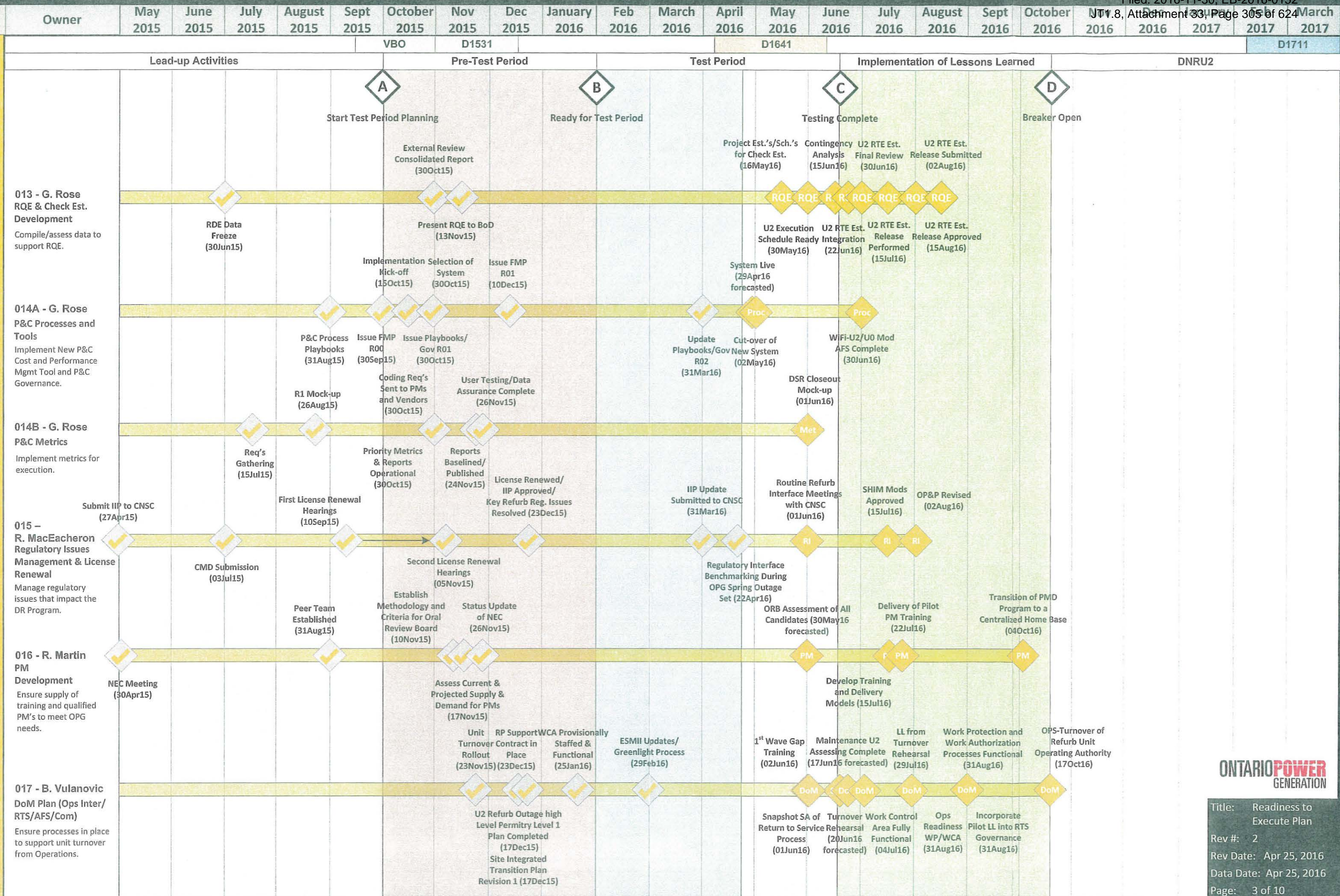
- Distribute RTE Package and Review examples

Process

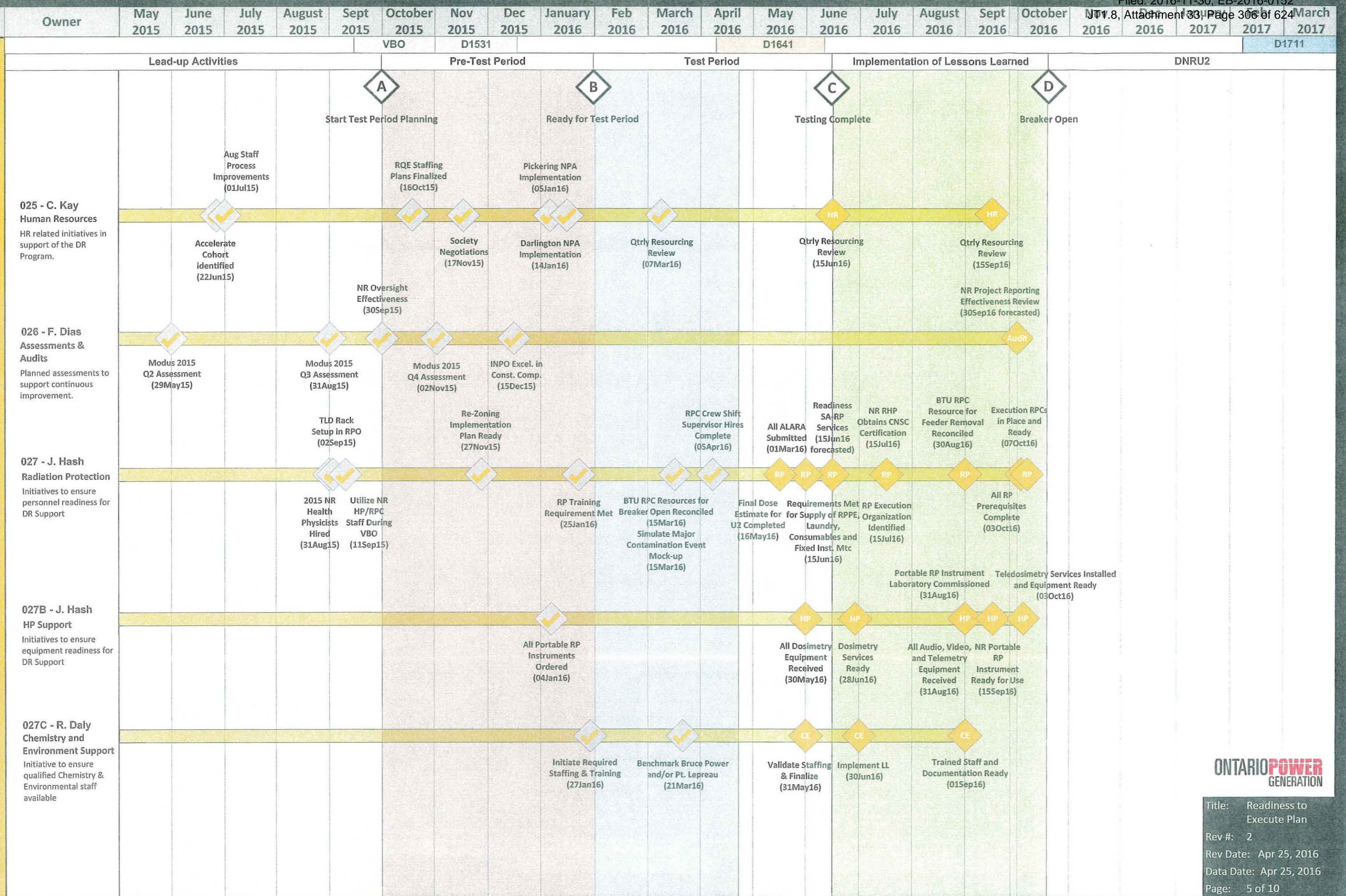




Cross-Functional

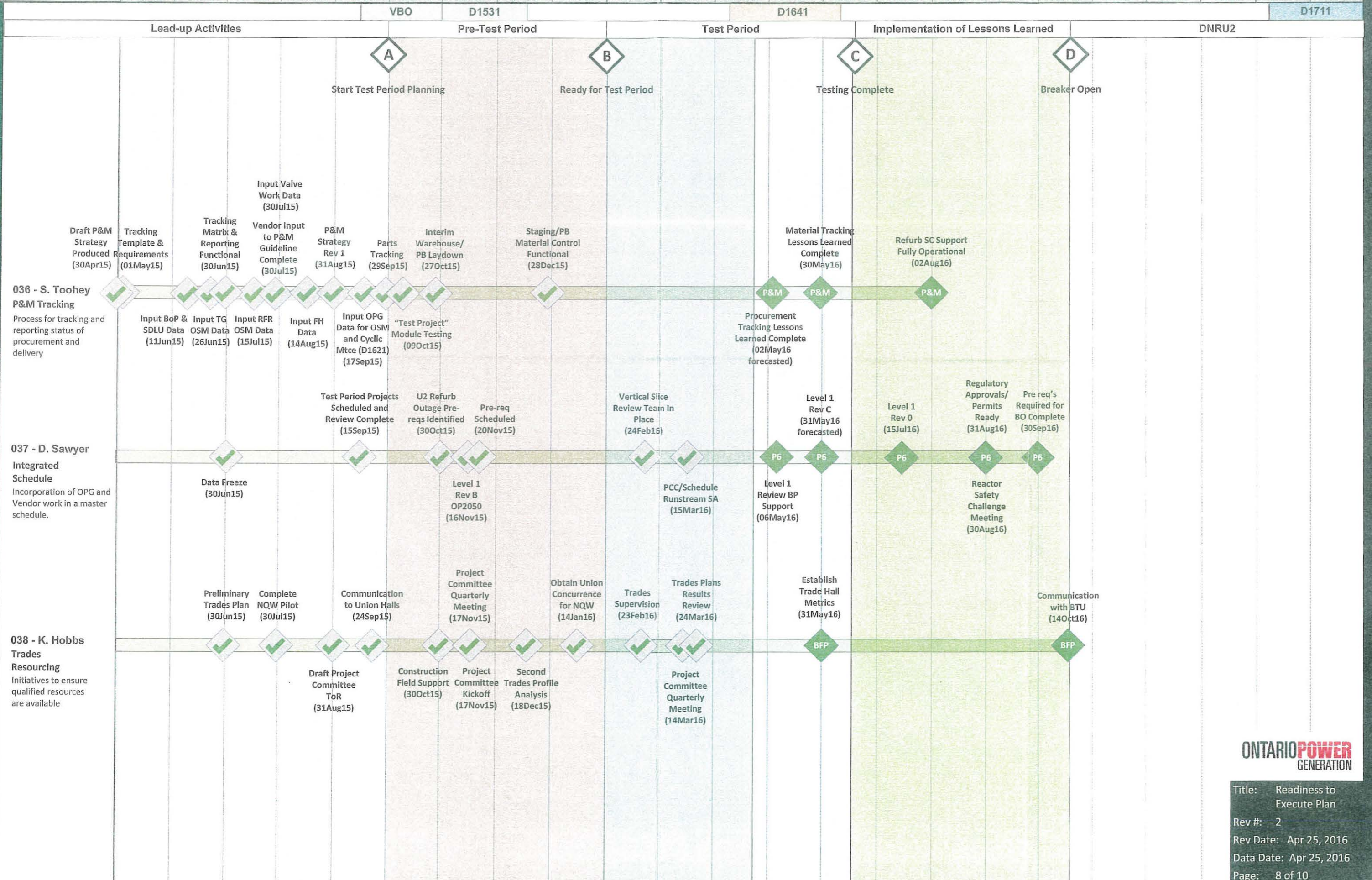


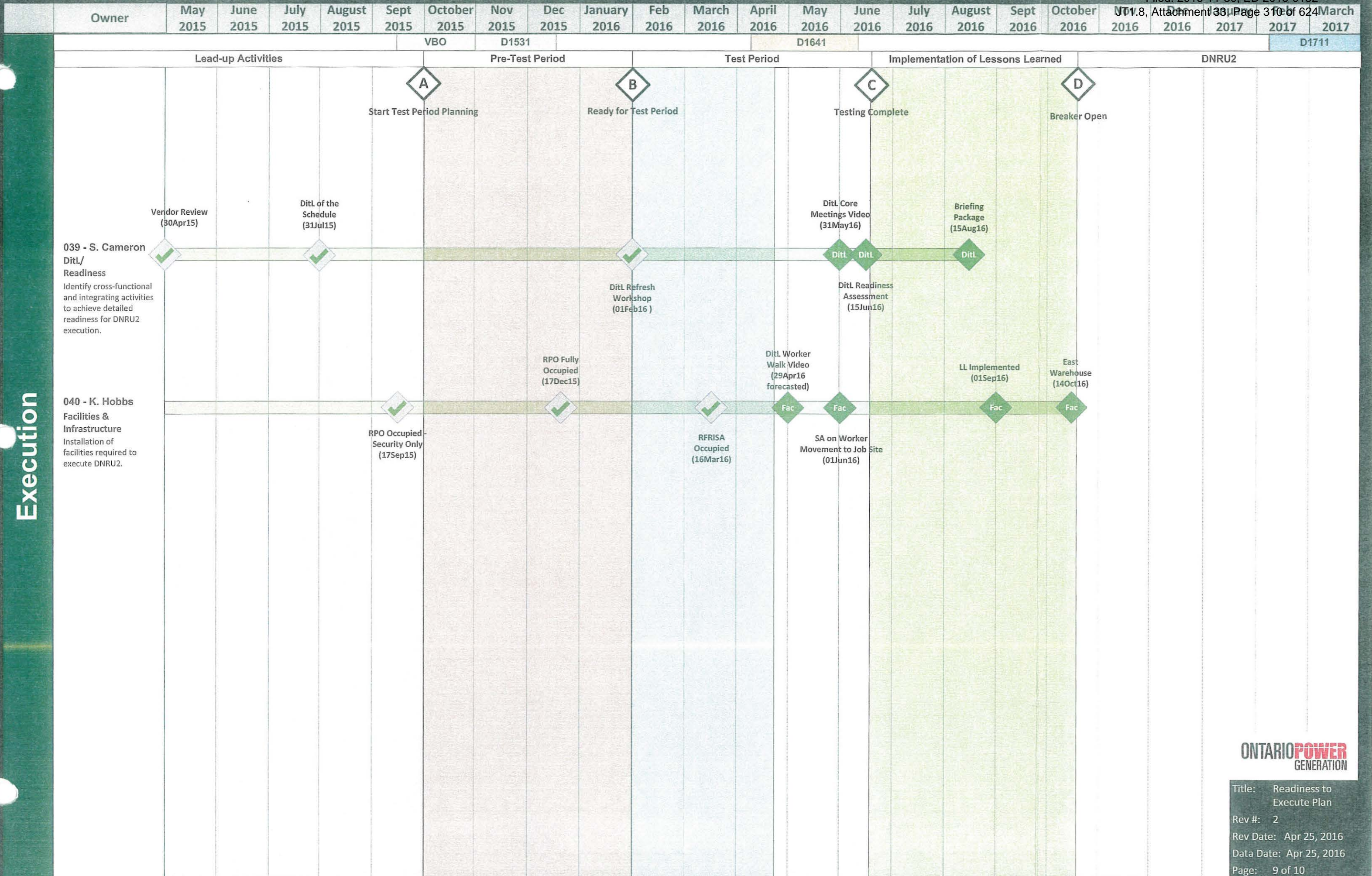
Cross-Functional





Execution





Execution

