Filed: 2013-09-27
EB-2013-0321
Ex. D2-1-3
Attachment 1 Tab 12

PNGS A - Mod/Replacement of FRP Components During 2010 VBO 13 - 49285

Superseding Business Case NA44 - BCS - 34320 - 00004 – R000

Routing	Location	Action	Signature	Date
John Melmer Section Manager Design Projects - Pickering A	P72-2	Review BCS		06APR2010
John Taras Section Manager Process Scheduling	P72-2	Review BCS		06Apr2010
Nahil Rahman 4053 Manager Design Projects - Pickering A	P72-1	Review BCS		06 Apr 2010
Mark Arnone Director Projects and Modifications	P72-1	Review BCS		06APRIL2010
Dwight Zerkee Manager Nuclear Investment	P82-3	Review BCS		7 Apr 10
Jeff Lehman Manager Performance Engineering, Pickering A	P42-3	Review BCS		APR 06/10.
Rob Powell Director Vacuum Building Outage	P42-1	Review BCS		APR 06/10
Rob Black Director Station Engineering, Pickering A	P42-3	Review BCS		6 APR '10
Louie Shoukas Director Business Support	P42-3	Review BCS		06 April 2010
Jamie Lawrie Director Nuclear Investment	P82-3	Review BCS		8 APRIL 2010
Glenn Jager Senior VP Pickering A	P42-3	Submit BCS		9APR2010
Randy Leavitt VP - Nuclear Finance	P82-3	Review BCS		April 15, 2010
Wayne Robbins CNO	P82-6A1	Review BCS		2010-04-16
Don Power VP Corporate Investment Planning	TCH07G05	Review BCS		April 23/10
Donn Hanbidge CFO	TCH19F27	Approve BCS		Apr 26/10
Tom Mitchell President & CEO	TCH19A24	Approve BCS		Apr 28/10
Sue MacKinnon Nuclear Investment Management 702-4082	P82-3B6.2	Return For Distribution		

PNGS A - Mod/Replacement of FRP Components During 2010 VBO 13 - 49285

Superseding Business Case NA44 - BCS - 34320 - 00004 – R000

1/ RECOMMENDATION:

We recommend a Superseding Release of $11.7M (including $1.8M contingency), for the PNGS A Modification/Replacement of Fiberglass Reinforced Plastic (FRP) Components During the 2010 Vacuum Building Outage (VBO) Project. The total released will be $24.5M (including $1.8M contingency).

The release history for this work had it moving from OM&A to Capital with change in strategy from inspect and selective replacement to full replacement. As such, the cost of the incremental costs that are now being included in this BCS were previously captured among the various contracts within the Outage. The main business objective of this project remains unchanged from the Full Release Business Case; however the BCS has been updated to include the following incremental costs required for the execution of the project that were not identified in the full release. The final project estimate includes the following costs:

1. Incremental scaffolding required to install the FRP piping. This was segregated from the remainder of the scaffolding requirements for the outage work program and is specific to the installation of the FRP,
2. Incremental Power Supplies associated with the installation of the piping.
3. Incremental Craning and Rigging requirements to transport/install the FRP material in the Vacuum Building.
4. Incremental Safety equipment required for installation of the piping due to hazardous fumes. This item was determined to be an incremental requirement late in the project due to one time use of the equipment associated with the resin environment.
5. Incremental resources to perform confined space monitoring duties due to the hazards created in the vacuum building due to hazardous fumes.

Items 1 -3 were discovered during a detailed review of outage scope, reviewed by Finance, and deemed to be an incremental cost of the project that satisfies the Capital eligibility requirements. The balance of the Superseding Release remains unchanged except for the updated financial figures throughout the balance of the document. The proposed scope remains unchanged as detailed in Section 4 – The Proposal. The superseding release has been developed in consultation with the Outage, Finance, Maintenance and Project organizations.

$000's (incl contingency)	Type	LTD 2008	2009	2010	2011	2012	2013	Later	Total
Currently Released	Full		1,181	11,582	46				**12,809**
Requested Now	Superseding			11,701	-				**11,701**
Future Funding Req'd	N/A								**-**
Total Project Costs		**-**	**1,181**	**23,283**	**46**	**-**	**-**	**-**	**24,510**
Non Project Costs									**-**
Grand Total		**-**	**1,181**	**23,283**	**46**	**-**	**-**	**-**	**24,510**
Investment Type		**Class**		**NPV**		**IRR**		**Discounted Payback**	
Sustaining		Capital		19,724		N/A		N/A	

Submitted By:

Glenn Jager
SVP, Pickering A

9 APR 2010
Date:

Finance Approval:

Donn Hanbidge
CFO

Apr. 26/10
Date:

Line Approval (Per OAR Element 1.1 Project in Budget):

Tom Mitchell
President and CEO

28 April 2010
Date:

2/ BACKGROUND & ISSUES

This project is being implemented to complete modifications/repairs/replacement of FRP components located within the Vacuum Building.

The Water Spray System located in the Vacuum Building (VB) at the Pickering Nuclear Generating Station performs the pressure suppression function of the Negative Pressure Containment System (NPC) following a Loss of Coolant Accident (LOCA) or a Main Steam Line Break (MSLB) inside containment. The Vacuum Building supports both Pickering A and B stations.

The Water Spray System and the Vacuum System utilize FRP piping extensively. Degradation or aging of FRP components is being assessed and repairs have been required during past VBOs. Prior testing and analysis has concluded that the FRP components are fit for service until 2012.

There is currently an aging management program (project 49273) being executed by third party subject matter experts aimed at assessing the degradation of the material over time and gives recommendations for replacements or repairs to FRP components. Project 49273 includes testing of FRP samples removed during the 2000 VBO to determine the material properties and quantify the degradation. A series of recommendations have been developed which identify high risk FRP components as well as recommended samples to be removed to support the aging management program (reference NA44-CORR-34320-024520). The recommendations for the FRP components of the Vacuum System (SCI 34220) are being addressed by a separate project, the VB Basement Improvements Project 49278.

The higher risk components identified include the spray headers, spray plates and risers (below the EWST water line). Components considered to be low risk include the spray header T-sections, U-tubes, the Upper and Lower Down-Comers (UDCs & LDCs) and their flanges in the Upper Vacuum Chambers. Originally (at the time of Partial Release) one Riser and 1 Upper Down-comer sample were required. However, further assessment by the Aging Management program has been unable to conclusively support fitness for service of the existing Risers, therefore they are planned to be replaced. Also, in order to provide sufficient confidence in Upper Down-comer fitness for service, an additional sample must be taken (2 total). One Spray Header sample is to be extracted along with two Spray Header Saddle Supports. In addition, FRP parts are required to be on hand in case more components are found to be damaged/degraded beyond repair.

There is a known issue of possible gaps forming between the Spray Plates and Spray Headers during a douse due to the differential expansion under pressure and a deteriorated glue bond. The water spray function is not compromised by this condition (reference NA44-CORR-25000-0274905), however, load testing for spray plates will be completed (by IM&CS) to verify integrity of the glue bonds, and any failed plates will require repair or replacement during the outage.

The Down-Comers have Stiffening Rings installed for reinforcement to meet the required safety factor. Two types exist, "old" Stiffening Rings (installed in 1980) and "new" Stiffening Rings (installed in 2000). The new rings were redesigned to properly bond to the pipe but the old rings will need reinforcement FRP strips or "Reinforcement Bands" installed to ensure that they do not shift out of position. Some of the old rings were reinforced during the 2000 VBO.

The Spray Header Fill Lines are used to circulate the water that forms the loop seal in the U-tubes to separate the Main and Upper Vacuum Chambers. The connections to the Spray Headers are considered to be a sub standard design and at least one connection was found to leak in the last VBO.

The vertical leg of each Spray Header Saddle Support is constructed of an FRP pipe and press-molded flange. The flange is bolted to a steel plate which is connected to a concrete beam. One of the press-molded flanges removed during the 2000 VBO was badly damaged and some of the flanges are not properly glued to the support pipe. Although the Water Spray System is not required to be seismically qualified, seismic loading is considered in the stress analysis to avoid a VB outage for inspection following small earthquakes. It therefore must be demonstrated that the support pipe will not dislodge from the flange under seismic loading.

The Lower Down-Comer Split Flanges, located on the EWST Floor, are potential leakage sites. Pickering B requires the water in the tank for make-up to the moderator system following a DBE coincident with failure of the Emergency Water /Power Systems. The Water Spray System is not seismically qualified and therefore these flanges cannot be relied upon to maintain the seal following a DBE. It has been proposed that seismically qualified weirs be installed around the flanges to maintain adequate water inventory in the tank, refer to NK30-CORR-71330-0279688, "Requirement for Seismic Qualifications of the

Emergency Storage Water Tank".

In addition to the modifications to be completed and samples to be extracted, repairs to FRP components may be required based on inspections completed during the outage or, as a result of "grinding" required to support various inspections.

3/ ALTERNATIVES AND ECONOMIC ANALYSIS

$000's	Base Case	Alt 1 (Recommended)		Alt 2	Alt 3	Alt 4	Alt 5
		Full Cost	Incremental Cost				
PNGSA	(24,197)	(4,570)	(4,570)	(4,570)	0	0	0
PNGSB	(48,677)	(9,192)	(9,192)	(9,192)	0	0	0
Total Revenue	(72,874)	(13,762)	(13,762)	(13,762)	0	0	0
Total OM&A	0	0	0	0	0	0	0
Capital Expenditures	0	(24,382)	(23,140)	(25,269)	0	0	0
Present Value (PV)	(48,032)	(29,369)	(28,308)	(30,072)	0	0	0
Net Present Value (NPV)	N/A	18,664	19,724	17,960	0	0	0
IRR%	N/A	291.4%	N/A	449.7%	N/A	N/A	N/A
Discounted Payback (Yrs)	N/A	0.35	N/A	0.25	N/A	N/A	N/A

Base Case: Not Recommended - Status Quo

If replacement materials are not procured and design packages not completed, significant extensions to the 2010 VB Outage are likely. Current fitness for service is to 2012 only, therefore a subsequent outage may also be required if the necessary repairs and modifications cannot be completed during the 2010 VBO.

Alt. 1: Recommended - Modifications & Repairs - Riser Replacement with Contingency for Major Discovery Repairs

This alternative is recommended in support of the fitness for service evaluation of the FRP components to 2024. The following is a brief summary of the scope. A detailed description can be found in Section 4, The Proposal.

1. Extraction and replacement of FRP samples to support the aging management program
2. 100% replacement of the Riser sections below a cut made just above the EWST waterline
3. Procurement of limited number of spare components for Spray Headers, Spray Header Saddle Supports, Upper Down-Comers, Spray Plates and 4" Vacuum System piping as well as replacement as necessary during the VBO
4. Replace Spray Header Fill Line Connections (modification)
5. Add reinforcing bands to the Upper Down-Comer Stiffening rings installed in 1980
6. Install Weirs around the Upper Down-Comers to ensure EWST inventory is maintained following a DBE (modification)
7. Complete minor repairs to FRP components as identified by in-situ inspections.

This option provides the most economical solution by completing necessary replacements/modifications and preparing for the replacement/repair of additional high risk components. The highest risk components, the risers, will be replaced as part of scope. Other components will be procured but replacement cost is to be covered by specific contingency. The positive NPV calculated assumes that a 4 day outage extension is required for riser replacement but the risk of further extension (material lead time) and the risk of a subsequent outage for further repairs is mitigated.

The Partial Release included an option with a reduced amount of contingency preparation. This option has been eliminated based on the relatively low cost compared to significant consequences of an outage extension which could be as long as the material lead time of approximately 5 months.

Alt. 2: Not Recommended - Modification and Repairs with Stainless Steel

This alternative is not recommended. Replacement of the high risk Water Spray System components with new stainless steel to reduce requirements for aging of samples, associated with determination of long term integrity of FRP components. The main reasons for rejection of this alternative are discussed below:

Some components are not possible or practical to replace with stainless steel such as the fill line connection points, the spray plates and the lower components of the saddle supports. Also, transitions between materials (FRP flanges required) would be necessary for the riser replacement in order to maintain the current VBO schedule similar to Alternative 1. Therefore FRP expertise and design would still be required, and engineering effort would be substantially increased since these

replacements would no longer be equivalent. There is also a technical/operability risk introduced at the required mechanical joints due to the possibility of main to upper chamber leakage. To eliminate this risk, complete riser replacement would be required (up to flange in the upper chamber). The schedule would be substantially increased due to multiple field welds required for installation.

4/ THE PROPOSAL

There is significant risk of outage extensions due to as-found condition of FRP components. This project will ensure readiness to repair or replace high risk FRP components as well as support the aging management program to ensure fitness for service to at least 2024.

The following is the proposed scope for the recommended alternative (Alt. 1):

Risers
(a) Procure, Remove and Replace all 14 (section below a cut made above the EWST water line)
(b) Procure 1 additional section (similar to the replacement components) for aging management
(c) Procure 1 extra 10' length of riser pipe for additional parallel plate tests as requested by the aging management program

Upper Down-Comers
(a) Procure, Remove and Replace 2 sections (section below a cut made above the EWST water line) for aging management
(b) Procure and Replace 1 additional section (dependent on inspection results, installation costs included in contingency)
(c) Procure 1 extra Upper Down-Comer to be used for aging management (no installation involved)

Spray Headers
(a) Procure, Remove and Replace 1 section for aging management
(b) Procure and Replace 1 additional section (dependent on inspection results, installation costs included in contingency)
(c) Procure 1 extra header section to be used for aging management (no installation involved)

Spray Plates
(a) Procure and replace 100 new Spray Plates (dependent on inspection results, installation costs included in contingency)

Spray Header Saddle Supports
(a) Procure, Remove and Replace 2 supports (from under the Spray Header section removed) for aging management
(b) Procure and Replace 2 additional supports (dependent on inspection results, installation included in contingency)
(c) Procure 2 extra Saddle Supports for aging management (no installation involved)
(d) Procure 51 additional replacement parts for the lower flange. Installation costs are covered under contingency.

4" Vacuum System Piping in the Main Volume
(a) Procure and Replace up to 20 feet of pipe and 8 elbows (dependent on inspection results)

Spray Header Fill Line Connections
(a) Modify/Replace all 28 fill line connections via the modification process

Stiffening Rings
(a) Install Reinforcing bands on old Stiffening Rings not previously reinforced.

Lower Down-Comer Split Flanges
(a) Install Weirs around 14 Lower Down-Comer Split Flanges (around Upper Down-Comers), via the modification process

This release also includes the execution support work directly required to complete the above scope of work.

This Full Release will include:
Project Management Services
Completion of Detailed Design
Installation Contracts Awarded
QA/QC Support Contracts Awarded
Installation, Commissioning, AFS and Closeout

5/ QUALITATIVE FACTORS

The following project benefits have not been quantified in the Economic Analysis but are significant and therefore worth noting.

This project will procure samples of new material and extract/replace samples from the VB. These are required to support future aging management.

Pickering B requires a supply of water from the EWST for moderator makeup following a seismic event. Installation of seismically qualified weirs around the Lower Down-Comer Split flanges will ensure this supply is available. Currently Pickering B risk assessment does not include external events (seismic) but must do so by 2010 as per the new operating license.

The risk of disengagement or excessive leakage from the Spray Header Fill Line connections will be eliminated through a modification.

Spare Spray Header sections, Spray Header Saddle Supports, Spray Plates, and 4" FRP pipe, will be available and replaced if necessary, contributing to fitness for service.

All of the repairs/replacements/modifications identified in this BCS, support fitness for service evaluation for the Vacuum Building Water Spray System until 2024.

6/ RISKS (see Attachment D for details)

Low = 1 to 3	Medium = 4 to 9	High = 10 to 25

Probability \ Impact	1	2	3	4	5
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Risk Description	Mitigating Activities	Before Mitigation: Probability x Impact									After Mitigation: Probability x Impact								
		Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)	Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)
Preferred FRP **Contractor Resource availability** (includes design, manufacturing and installation).	1. Issue contracts as early as possible to secure resources. 2. Communicate with contractor on a regular basis to avoid unexpected situations.	6	6	9						**9**	4	4	6						**6**
QA/QC Resources availability from both Contractor and OPG groups.	1. Coordinate with support groups as early as possible. 2. Ensure resources are input in appropriate databases, workgroups informed of required resources and commitment obtained from work groups (i.e. FE). 3. Issue contracts with 3rd party contractors for FRP QA inspections as early as possible.	6	6	9						**9**	4	4	6						**6**
Increased installation costs	1. Obtain quotes from multiple contractors 2. Obtain input from CMO and FE regarding estimated hours for execution. 3. Obtain fixed price contracts where possible.	12								**12**	8								**8**
Increased costs for FRP material/manufacturing	1. Obtain material contracts as early as possible. 2. Maintain close communication with material vendor/fabricator. 3. Track FRP thru supply chain process.	9								**9**	6								**6**
Conventional Safety and	1. Maintain close communication with	12	12				8	8		**12**	8	8				6	6		**8**

Low = 1 to 3	Medium = 4 to 9	High = 10 to 25

Probability \ Impact	1	2	3	4	5
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Risk Description	Mitigating Activities	Probability x Impact — Before Mitigation									Probability x Impact — After Mitigation								
		Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)	Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)
Environmental Protection (impact on material, labor, etc). Examples include styrene and dust hazards, and confined space requirements.	Conventional Safety and Environmental Department to identify requirements as early as possible. 2. Pre-determination of hazards, compensatory actions and equipment to be used.																		
Training cost and schedule (Additional due to unforeseen training requirements, extended training schedule due to classes being full, etc).	1. Clearly document training requirements in contracts. 2. Reserve training spots for contractors as early as possible	6	6							**6**	4	4							**4**
Regulatory involvement Could cause delays and / or additional costs. Planned Modifications are to be addressed with CNSC.	1. Maintain communication with CNSC regarding planned modifications. 2. Submit design documentation to CNSC for approval/ disposition where required as early as possible.	9	9			9				**9**	6	6			6				**6**
VBO Schedule/Priority Changes	1. Maintain continued communication with VBO group to ensure adequate coordination. 2. Ensure VBO representation in Project Status Meetings.	9	9							**9**	6	6							**6**
Construction quality issues may cause delays and rework	1. Ensure stakeholder participation in COMS meetings and technical review meetings. 2. Ensure direct feedback from Design Agency to contractor where appropriate to avoid miscommunications. 3. Ensure ITPs and related documentation are reviewed by FRP expert. 4. Construction and support staff O/T if necessary.	8	8	8						**8**	4	4	4						**4**
Contingency\Discovery Work	1. Identify major spares to be procured (Additional material costs for major spares	9	9							**9**	6	6							**6**

Low = 1 to 3	Medium = 4 to 9	High = 10 to 25

Probability \ Impact	1	2	3	4	5
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Risk Description	Mitigating Activities	Probability x Impact – Before Mitigation									Probability x Impact – After Mitigation								
		Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)	Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)
	included in project estimate). 2. Review design and construction issues at regular meetings to uncover possible issues. 3. Complete thorough drawing reviews. 4. Utilize experience gained during previous VBOs and OPEX .																		
Legacy issues may result in necessary field changes.	1. Engage field engineering in design review. 2. Follow COMS procedure. 3. Engage station support to complete Field Initiated Changes as quickly as possible	6	6							**6**	4	4							**4**
Minor scope changes / additions might be required by VBO group	1. Maintain close communication with stakeholders. 2. Challenge all potential scope additions and ensure appropriate processes are followed. 3. VBO Scope Change approval process to be followed.	9	9							**9**	9	9							**9**
Minor changes in **post-accident design temperatures**	1. Reactor Safety/Analyst expected to provide post-accident temperature and make final decision on impact to design temperatures. Project Team to follow up. 2. Correspondence from Reactor Safety (P-CORR-34200-0291154) and Memo of Understanding (P-CORR-34200-0280240) indicate that temperature changes should not greatly affect the design of FRP components.	8	8							**8**	8	8							**8**

7/ POST IMPLEMENTATION REVIEW PLAN

Type of PIR:	Targeted Final AFS Date:	Targeted PIR Approval Date:	PIR Responsibility (Sponsor Title)
Simplified	May 2010	Dec 2010	Vacuum Building Outage Manager

	Measurable Parameter	Current Baseline	Targeted Result	How will it be measured?	Who will measure it? (person / group)
1.	Return to service of the VB following the 2010 VBO	Repairs and replacements required as identified by Aging Management Program	Necessary repairs / replacements completed.	Sign off of ITP's / workplans, WO tasks set to finished	Design Projects Pickering A **and/or** Vacuum Building Outage Organization
2.	Fitness for Service of Water Spray System FRP	Fitness for service declared to 2012	Fitness for service declared to 2024	Fitness for service report	C&E Engineering through the Aging Management Program
3.	Seismically qualified water supply to Pick B Moderator System.	Not available	Available	AFS of Lower Down-comer Split Flange Weir modification	Design Projects Pickering A **and/or** Performance Engineering Pickering B
4.	Risk of Spray Header Fill line leakage/ disengagement	High	Low	AFS of Spray Header Fill line connection modification	Design Projects Pickering A **and/or** Performance Engineering Pickering B

Appendix "A" **Glossary** (acronyms, codes, technical terms)

AFS	Available for Service
CGD	Commercial Grade Dedication
CNSC	Canadian Nuclear Safety Commission
DBE	Design Basis Earthquake
EC	Engineering Change
EQ	Environmental Qualifications
ECR	Engineering Change Request
EWST	Emergency Water Storage Tank
FIPR	Fabrication & Installation Package Release
FRP	Fiberglass Reinforced Plastic
IRR	Internal Rate of Return
ITP	Installation and Test Plan
LOCA	Loss of Coolant Accident
MSLB	Main Steam Line Break
NC	Nuclear Class
NPC	Negative Pressure Containment
NPV	Net Present Value
NSS	Nuclear Safety Solutions
OM&A	Operations, Maintenance, and Administration
PV	Present Value
RAB	Reactor Auxiliary Bay
SCR	Station Condition Record
SME	Subject Matter Expert
VB	Vacuum Building
VBO	Vacuum Building Outage

Appendix "B"

Project Funding History

$ 000's		All Existing and Planned Releases (incl contingency) Cumulative Values									
Release Type	Month	Year	2009	2010	2011	2012	2013	2014	2015	Later	Total
Partial	Jun	2009	839	1,085							1,924
Full	Oct	2009	1,181	11,582	46						12,809
Superseding	Mar	2010	1,242	23,222	46						24,510
											0
											0
											0
											0
											0
LTD Spent	Mar	2010	6,971								6,971

Comments:

Appendix "C"

Financial Model – Assumptions

Financial Assumptions:

Discount Rate	7%	Cost Escalation (yr)	None	SR & D Opportunity	No
Progress Payments	N/A	Foreign Currency	No	Retainer Fee	No
Income Tax Rate	Generation	PST		Interest Rate (Capital)	6%
Depreciation Rate (Capital)	N/A	Leasing	N/A	Indexed Priced Contract	N/A

Comments:

Project Cost Estimate:

Design Complete	100%	Quality of Estimate	Release + 15% to - 10%	3rd Party Estimate	No
Reviewed by Sponsor	Yes	OPEX used	Yes	Lessons Learned	Yes
Similar Projects	Yes	Budgetary Quote(s)	Yes	First Unit Actual Used	Not unitized
Cost Sharing	Yes	Contracts in place	Yes	Competitive Bid	Yes
Fixed Price Contract	Yes	Fee for Service		Firm Vendor Proposal	Yes

Comments:

Rationale for Cost Classification:

Switch from OM&A to Capital – Replacement of Water Spray system FRP components which have significant risk of not being fit for service until the next VBO.

Generation Plan Assumptions:

Station	Unit	EOL		MW	Capacity	Planned Outages for Project Work (eg P1071)						
Pickering A	1	N/A	N/A	513	85%							
	4	N/A	N/A									
Pickering B	5	N/A	N/A	516	85%							
	6	N/A	N/A									
	7	N/A	N/A									
	8	N/A	N/A									
Darlington	1	N/A	N/A	N/A	N/A							
	2	N/A	N/A									
	3	N/A	N/A									
	4	N/A	N/A									

Comments:

The NPV calculations are all based on the risk of lost generation due to an outage extension in 2010 VBO or a subsequent outage in 2012 (when FRP fitness for service expires). The end of life of all 6 remaining Pickering units therefore does not factor into the calculation.

Appendix "C"

Financial Model – Assumptions
Impact on Operations

Impact on Revenue

	Present	2,010	2,011	2,012	2,013	2,014	2,015	2,016	Later	Total
Rate MWH	52.98	54.58	54.58	56.23	56.23	57.93	57.93	59.68		
Probability	0	0.10	0	0.20	0	0	0	0	0	0
Consequence	0	(516,076)	0	(106,332)	0	0	0	0	136,581	(485,827)
Risk	**0**	**(51,608)**	**0**	**(21,266)**	**0**	**0**	**0**	**0**	**0**	**(72,874)**
Other	0	0	0	0	0	0	0	0	0	0
Base Case	**0**	**(51,608)**	**0**	**(21,266)**	**0**	**0**	**0**	**0**	**0**	**(72,874)**
Probability	0	1.00	0	0	0	0	0	0	0	1
Consequence	0	(13,762)	0	0	0	0	0	0	0	(13,762)
Risk	**0**	**(13,762)**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**(13,762)**
Other	0	0	0	0	0	0	0	0	0	0
Recommendation	**0**	**(13,762)**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**(13,762)**
Net Impact	**0**	**37,846**	**0**	**21,266**	**0**	**0**	**0**	**0**	**0**	**59,112**

Comments:

See NPV Calculations for Details and Summary

Impact on OM&A

	Present	2,010	2,011	2,012	2,013	2,014	2,015	2,016	Later	Total
Base OM&A	0	0	0	0	0	0	0	0	0	0
Outage OM&A	0	0	0	0	0	0	0	0	0	0
Project OM&A	0	0	0	0	0	0	0	0	0	0
Base Case	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Base OM&A	0	0	0	0	0	0	0	0	0	0
Outage OM&A	0	0	0	0	0	0	0	0	0	0
Project OM&A	0	0	0	0	0	0	0	0	0	0
Recommendation	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Net Impact	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Comments:

No impact on OM&A since the project is being transferred to the Capital Portfolio.

See NPV Calculations for Details and Summary

PNGS A - Mod/Replacement of FRP Components During 2010 VBO 13 - 49285
Superseding Business Case NA44 - BCS - 34320 - 00004 – R000

Attachment "A" **Project Cost Summary**

	$000's Capital	LTD 2009	2010	2011	2012	2013	2014	2015	Later	Total
Scores Basis	Project Mgmnt & Support	375	1,402	21						1,798
	Engineering	867	700	17						1,584
	Procurement		4,000		-					4,000
	Construction		15,200		-					15,200
	Other		-	-	-					-
										-
										-
										-
										-
	Interest (Capital Project Only)		120	8						128
	Project Costs	**1,242**	**21,422**	**46**	**-**	**-**	**-**	**-**	**-**	**22,710**
	General Contingency		1,800							1,800
	Specific Contingency									-
	Project Costs	**1,242**	**23,222**	**46**	**-**	**-**	**-**	**-**	**-**	**24,510**
Cash	**Adjust to Cash Basis + / -**	1,561	(1,561)						-	-
	Project Costs	**2,803**	**21,661**	**46**	**-**	**-**	**-**	**-**	**-**	**24,510**

Funding	**Currently Released**	1,181	11,582	46						12,809
	This Release		11,701	-	-					11,701
	Future Release		-	-					-	-
	Project Funding	**1,181**	**23,283**	**46**	**-**	**-**	**-**	**-**	**-**	**24,510**

Note: Scores Basis = Cash Basis = Funding Basis (Timing differences only)

Budget	2010-2014 Business Plan	1,242	8,695	46	-					9,983
	Variance to Business Plan	**-**	**12,727**	**-**	**-**	**-**	**-**	**-**	**-**	**12,727**

Other	Removal Costs included above									-
	Inventory to be written off									-
	Spare Parts in Inventory									-

The estimated variance(s) to the **2010-2014 Business Plan** will be addressed through the portfolio management process.
A PCRAF **is not required** .

Reviewed By: 06 APR 2010

John Melmer
Project Manager
Date:

Approved By: 06 Apr 2010

Nahil Rahman
Strat IV Manager
Date:

PNGS A - Mod/Replacement of FRP Components During 2010 VBO 13 - 49285

Superseding Business Case NA44 - BCS - 34320 - 00004 – R000

Attachment "B" **Project Variance Analysis**

	Capital	LTD Feb 2010	Total Project: Last BCS Oct 2009	Total Project: This BCS Mar 2010	Variance	Comments
Scores Basis	Project Mgmnt & Support		1798	1798	0	
	Engineering		1329	1584	255	Additional analysis support required to qualify new FRP components.
	Procurement		1571	4000	2429	Original values based on budgetary quote received from vendors to supply similar material to that supplied for the 2000 VBO. Current estimate based on actuals.
	Construction		5151	15200	10049	Includes actual awarded contract costs for FRP work as well as directly related additional execution support costs eg. Scaffolding, confined space monitoring, power, rigging, lighting, PPE, craning and VB access.
	Other				0	
					0	
					0	
					0	
					0	
	Interest (Capital Project Only)	0	73	128	55	Increase due to increased scope.
	Project Costs (Scores Basis)	**0**	**9922**	**22710**	**12788**	
	General Contingency		**1562**	**1800**	238	Increased due to increased scope.
	Specific Contingency		1325	0	-1325	Awarded labour contract includes contingency hours based on required manpower to complete known scope within the outage window.
	Project Costs (Scores Basis)	**0**	**12809**	**24510**	**11701**	

Other	Removal Costs included above				0	
	Inventory to be written off				0	
	Spare Parts in Inventory				0	

Comments:

Project variances are compared to the previous release which was approved under OM&A project 46604.

Attachment "C"

Milestones and In Service Declarations

Key Milestones

Completion Date			Description
Day	Mth	Yr	
19	Apr	2010	Start of Installation (SOI)
19	May	2010	In Service (AFS)
15	May	2011	Plan Complete Milestone (PCM)

A Project Execution Plan (PEP) **was approved in Oct 2009**

In Service Declarations: (Capital Only)

Month	Year	Description	$ 000's	%
May	2010	Water Spray System component replacements AFS.	22665	100%

Attachment "D"

Risk Probabilities Chart

Likelihood	Improbable	Unlikely	Possible	Likely	Probable
Probability	<= 1 in 1000	About 1 in 100	About 1 in 10	About 1 in 5	>= 3 in 4
Rank	1	2	3	4	5

Risk Impact Chart

Impact Rating	Financial	Project Schedule (12 months)	Quality	Corporate Reputation	Regulatory / Legal	Health & Safety	Environment	Nuclear Safety
5	>80% of Total Project $	> 90 day delay	Significant, unacceptable non-conformance requiring extensive rework	National and international adverse coverage or impacts	Non-compliance with potential for significant implications for personnel, potentially large damages or Criminal Charges **OR** Potential loss of operating licenses	Potential for fatality(s)	Spill or release causing immediate and extended impact with off-site impacts, e.g.: Clean-up costs > $15M Cat. A spill (>55 pts)	Loss or serious degradation of a safety system
4	30% - 80% of Total Project $	30 - 90 day delay	Unacceptable non-conformance requiring some rework, but not major	Long-term local or national impact	Legislative non-compliance with potential for fines, charges, and damages **OR** Major degradation of reputation with regulatory bodies	Potential for life-threatening critical injury or permanent total disability, including occupational disease	Exceedances resulting in charges or Director's Order Cat. A spill (45 - 55 pts) Public complaints with OPG implications Explosion and/or major fire	Reduced effectiveness of a safety system
3	15% - 30% of Total Project $	10 - 30 day delay	Non-conformance bordering design tolerances, potential to require rework	Major local impact or minor national impact. Minor local damage	Systematic non-compliance with potential for fines OR Potential to cause strained relationship with regulator, increased surveillance and/or regulations	Potential for less serious critical injuries (e.g. fractures), permanent partial disabilities and temporary total disabilities of a significant nature	Cat. B spills Emission in exceedance of regulatory or legal limits Field orders or AMP's Public complaints with OPG implications Danger to health, life, or property	Reduced effectiveness of redundant safety system components
2	5% - 15% of Total Project $	3 - 10 day delay	Acceptable non-conformance, within design tolerances, no rework required	Complaints from local officials / politicians	Systematic non-compliance with impacts to project schedule OR Possibility of regulatory / legal implications	Potential for less serious temporary disabilities and injuries requiring off-site medical attention other than first-aid. Complete recovery by worker.	Cat. C spills - reportable Administrative infractions Public Complaints with plant level implications	Impact on a safety support or safety related system
1	<5% of Total Project $	< 3 day delay	Minimal impact on quality Routine non-conformance, can be easily dispositioned	Complaints from local public	Isolated non-compliance OR Routine approval / notification	No medical attention beyond first aid, no impairment to worker or complete recovery of worker.	Administrative, non-reportable events Cat. C spills non-reportable and spills resulting from Acts of God	