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Attachment 1 Tab 8

PNGS-A D2O Storage and Drum Cleaning Facility 13 - 49251

Developmental Release Business Case Summary NA44-BCS-38000-00001-R000

1/ RECOMMENDATION:

We recommend approval of a Developmental Release of $2,506k (including $593k contingency) to complete preliminary design, initiate detailed design, initiate Requests for Quotations for long-lead materials and develop a Partial Release for the PNGS D_2O Storage and Drum Handling Project by November, 2007. A Partial Release will be requested upon completion of preliminary engineering to facilitate a seamless transition to detailed design, long-lead material procurement, initiate Requests for Proposal for the construction contract and develop the Full Release. This funding strategy will minimize cost and schedule delays.

There are three business objectives of this project as per Project Charter N-PCH-03800-10000:

1. Improve detritiation capability within OPG-N
2. Provide operational flexibility for the storage and segregation of different grades of D_2O
3. Provide a drum cleaning facility to manage the backlog of D2O drums in the station

Note: Plant Life Extension and Decommissioning of P2 and P3 are not part of the mandate of this project.

Kinectrics was commissioned to study the Heavy Water Storage and Drum Handling issues from the overall OPG-N perspective. The recommended modification for Pickering is listed below:

- Install 1x 16 Mg downgraded, low curie, oily D_2O tank
- Install 1x 16 Mg downgraded, high curie, oily D_2O tank
- Install 1 x 46 Mg downgraded, low curie, non-oily D_2O tank
- Install 1 x 19 Mg downgraded, high curie, non-oily D_2O tank
- Install a Drum Cleaning Facility

Detritiation difficulties at PNGS cannot be solely tied to a lack of storage capacity at the Storage and Inventory (S&I) system and, therefore, it is not recommended any S&I tanks to be installed in PNGS. However, Pickering will be able to utilize Darlington's S&I tanks, that are to be installed under Darlington Project 16-31555, as temporary storage as required or TRF product reservoirs to ensure low curie D_2O is always available to Pickering for detritiation. Similarly, there is insufficient justification to install a drum cleaning facility at DNGS and that the Pickering's Drum Cleaning Facility will be used to clean dirty drums from Darlington.

Choose One	Funding	LTD 2005	2006	2007	2008	2009	2010	Later	Total
Currently Released	None								-
Requested Now	Developmental			1,330	1,176				**2,506**
Future Funding Req'd					2,837	7,720	4,319		**14,876**
Total Project Costs		-	-	**1,330**	**4,013**	**7,720**	**4,319**	-	**17,382**
Other Costs									-
Ongoing Costs									-
Grand Total		-	-	**1,330**	**4,013**	**7,720**	**4,319**	-	**17,382**
Investment Type		**Class**		**(IEV) Impact on Ec Value**		**IRR**		**Discounted Payback**	
Sustaining		**Capital**		**6,473**		**14.7%**		**7.8**	

Submitted By:

27 Nov '06

Rumina Velshi
Director, Commercial Activities
Project Sponsor
Date:

Finance Approval:

Nov. 27, 2006

Randy Leavitt
Director, Investment Management, NOSS
Date:

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

Nov 29/06.

Martin Tulett
Director, Operations & Maintenance, Pickering
Date:

2/ BACKGROUND & ISSUES

Both Pickering Nuclear Generating Station A and B need to improve their overall ability to manage D_2O inventories to support continuous station operations in a safe and cost efficient manner. In December 2004, Kinectrics Inc. was requested to perform a strategic study on OPGN's Heavy Water Storage and Drum Handling Strategy. (Ref; K-011043-001-RA-0001-R00A). In April 2006, Kinectrics Inc. was engaged by the Project to fine-tune the initial study with clear assumptions and verified information for the stakeholders.

The three main objectives of this project are as follows:

1. Allow large volume bulk swap of heavy water for detritiation to keep units running below the OP&P limit for tritium concentration.
2. Improve operational flexibility to segregate different streams of D2O to support normal operation and outages.
3. Improve the management of drums in the station and to reduce associated drum handling-related radiological and conventional safety hazards.

Decommissioning of P2 and P3 and Plant Life Extension are not part of the mandate of this project.

2.1 Large Volume Bulk Swap of Heavy Water for Detritiation

Pickering B units have exceeded their Administrative limits for tritium concentrations in both the Moderator and the Primary Heat Transport (PHT) system and are fast approaching the OP&P limits.

The current mode of detritiation is performed with the reactors online whereby high Curie Moderator D_2O is bled out from the unit and low Curie D_2O is fed from the Storage and Inventory System (S&I) into the unit simultaneously.

The preferred mode of detritiation of the station is to perform bulk detritiation on a unit during outages when the Moderator inventory is drained out and replaced by the same volume of low Curie D_2O which is often of a higher isotopic. As a result, the isotopic of the Moderator system is upgraded simultaneously. This mode of detritiation is opportunistic and requires more tanks for D_2O maneuvering; however, it is more effective since there will be no wastage of the low Curie D_2O being fed to the unit.

The following tables summarize the problems that are caused by the inability to perform large volume bulk swaps of D_2O for detritiation:

Table A. Problems caused by inability to perform large volume bulk swaps of D_2O for Detritiation

Problem	Issues	Impacts
There is inadequate Storage and Inventory (S&I) storage capacity to allow large volume bulk swap to be performed readily	• Reliance on online detritiation, as there is very limited capability to perform the more effective offline detritiation. • Require extensive planning and coordination with TRF and rearranging D_2O in S&I Tanks, even for on-line detritiation • Inability to efficiently perform moderator upgrading	• Less efficient reduction of tritium emissions to the environment • Less efficient reduction of dose absorbed by workers • Possibility of regulatory sanctions due to OP&P violations as a result of a lower efficiency of detritiation • Lower fuel-burnup efficiencies

2.2 Operational Flexibility to Segregate Different Streams of D_2O

The lack of storage capabilities for proper segregation of different streams of D_2O inventory is impairing operations. If off-site storage is required, or if operator work-arounds are warranted, then this increases costs and induces additional workload for operations.

2.2.1 Reactor Grade D_2O Storage & Segregation

During normal or outage situations, the following inventories of D2O should be segregated:

- High Curie D_2O (including Sulzer-B Upgrader Product)
- Low Curie D_2O (including UPP-B Upgrader Product)
- Moderator D_2O (containing Gadolinium)
- Primary Heat Transport D_2O (contains Lithium)
- TRF Grade D_2O (Very Low Curie)

The following table summarizes the problems that are caused by not having enough Reactor Grade D_2O (S&I) Tanks for storage and segregation:

Table B. Problems caused by insufficient S&I tanks for Reactor Grade D2O Storage and Segregation

Problem	Issues	Impacts
Limited flexibility in reactor grade D_2O segregation during outages	• During outages, when S&I tanks are taken up by moderator drains or PHT drains, then the existing inventory does not have space for storage	• Pickering Incoming/Outgoing D_2O Transfer System (PIOTS) is often used to store Reactor Grade D2O during outages, impeding TRF receiving and shipping activities • When S&I tanks are taken up by drains from the outage unit, there is limited capacity to hold upgrader products from Sulzer-B or UPP-B, causing these upgraders to go into reflux • High probability of human performance errors when tanks that were specified to hold a certain grade of D_2O must be filled with another grade of D_2O due to lack of storage space
Limited flexibility to store assigned TRF product's quota to meet PNGS's Detritiation Plan	• Shipment and receiving of TRF Product rely heavily on the availability of TRF and S&I • Requires planning and resources to rearrange contents in S&I before shipping and receiving	• Reduce capability to meet PNGS's detritiation plan

2.2.2 Downgraded D_2O Storage & Segregation

The existing storage capacity at the Ion Exchange Clean-Up System (IXCU) is not adequate for segregating downgraded D_2O. The following grades of downgraded D_2O should be segregated for maximum IXCU operating efficiency:

- High Curie, Non-Oily D_2O
- Low Curie, Non-Oily D_2O
- High Curie, Oily D_2O
- Low Curie, Oily D_2O

Table C. Problems caused by insufficient IXCU tanks for Downgraded D_2O Storage and Segregation

Problem	Issues	Impacts
The original design of the IXCU system is not adequate for the current recovery rates.	System Degradation, causing high leakage rates and a high load on recovery and clean-up systems	• When the load cannot be efficiently processed by the IXCU system, a large amount of backlog is accumulated, requiring all recoveries to be drummed, increasing drum handling, dose hazards and housekeeping issues
The IXCU system was not designed for high volumes of oily D_2O recoveries.	The Pickering fuelling machines leaks a hydraulic fluid which is collected in the Building Liquid Recovery system.	• Any backlogged oily D_2O is drummed, causing drums to become oily. • Oily recoveries may overflow into non-oily tanks, causing these tanks to become oily as well, contaminating clean recoveries. This further increases the oily load. • Additional expenses need to be incurred to clean the oil film off of the non-oily tanks every few years. • Oily recoveries process at a slower rate than non-oily recoveries, lowering the efficiency of the IXCU system. • Inadvertent leakage of oily recovery into the upgraders is a contributing factor to the degradation of upgrader's packing and to the reduction of heat transfer capability of the reboilers. • External upgrading services will be expensive and repacking of upgraders will cost millions.
IXCU was not designed to treat or segregate High TOC D_2O.	• Use of organic solvents and chemicals in the Reactor Building for cleaning and reactor components inspections causes high Total Organic Carbon (TOC) levels in recoveries • TOC is very difficult to remove and it requires sufficient time and segregation to be reduced to less than 1 ppm before they can be sent to the upgraders to prevent upgrader packing degradation and plugging of distributors.	• The degradation of upgraders due to TOC may be exacerbated to a point where external upgrading services are required. • Inadequate feed to the upgraders due to the inability to achieve specifications causes backlog at IXCU, while the upgraders to go into reflux, wasting operational resources • If a significant inventory cannot be upgraded, then the D2O must be made up from D2O rentals from external companies *Note: It is assumed that a UV-Oxidation Unit will be installed in Pickering, which is capable of reducing TOC from downgraded D_2O to the specified 1 ppm. The UV-Oxidation unit is designed to act as a polishing system to remove TOC after the majority of the contaminants are clean-up from the downgraded D_2O.*

2.3 Drum Cleaning Facility

Table D. Problems caused by a lack of a Drum Cleaning Facility

Problems	Issues	Impacts
Inability to process or reduce drum inventory	• Pickering has an inventory of 3000 drums around the station. • Oily drums being used to collect non-oily recoveries	• Drums that contain sludge cannot be disposed of • Housekeeping concern that has already instigated CNSC scrutiny • Drum Handling Hazards • Dose hazards • Takes up valuable real estate in the station • IXCU efficiency is reduced, causing a further backlog upstream, requiring the purchase of more drums to store the backlog @ \$700 to \$800/drum • If the inventory of unprocessable D_2O becomes too large to handle, then external cleaning services needs to be purchased

3/ ALTERNATIVES AND ECONOMIC ANALYSIS

\$000's	Do Nothing	Alt 1 (Recommended)		Alt 2	Alt 3
		Full Cost	Incremental Cost		
Revenue	0	0	0	0	3,573
OM&A	(68,296)	(19,132)	(19,132)	(27,203)	(19,107)
Capital	0	(17,384)	(17,384)	(18,442)	(36,000)
NPV (after tax)	(26,817)	(20,344)	(20,344)	(22,985)	(32,390)
Impact on Economic Value (IEV)	N/A	6,473	6,473	3,832	(5,573)
IRR%	N/A	14.7%	14.7%	14.1%	N/A
Discounted Payback (Yrs)	N/A	7.75	7.75	7.96	N/A

Status Quo - Not Recommended

Status Quo is **not** a recommended option.

Pickering units need to achieve better detritiation efficiency in order to prevent reaching the OP&P limits for tritium content.

During normal operation, online detritiation performed in a large volume requires careful planning, coordination with TRF and movement of Reactor Grade D_2O in S&I tanks. This is due to the limitation of S&I tank storage space, which sometimes prevents online detritiation to be executed.

During outages, the receiving and shipping of TRF product is often impeded by the available S&I tank space, causing the station to miss valuable opportunities to detritiate.

The downgraded D_2O storage capability is not sufficient to meet current recovery rates, causing excessive drum usage that induces radiological and conventional hazards for workers. The lack of sufficient segregation of downgraded D_2O has caused the IXCU system to run below optimal efficiency, limiting the input to the upgraders. Engineering – Common Services has indicated that if IXCU tanks were not provided to them by 2014, then upgrader packing replacement would be inevitable. Packing replacement is an extensive overhaul to the upgrader and can cost over \$10M. During the years where the flowrates of the upgraders can no longer meet its demand, external upgrading services will need to be purchased, costing over \$1.3M for every 10kg/h variance, per year.

The drum problem is further exacerbated by the fact that Pickering has no capability to clean dirty drums, causing a housekeeping and dose issues that has drawn scrutiny from the CNSC.

Alternative 1 - Install Additional Downgraded Storage Tanks and a Drum Cleaning Facility - Recommended

The recommended modification for Pickering is listed below:

Type of Tank	Size/Specifications	Location
Downgraded, low curie, oily D_2O tank	1 x 16 Mg	IXCU area, 274' el., RAB
Downgraded, high curie, oily D_2O tank	1 x 16 Mg	IXCU area, 274' el., RAB
Downgraded, low curie, non-oily D_2O tank	1 x 46 Mg	IXCU area, 274' el., RAB
Downgraded, high curie, non-oily D_2O tank	1 x 19 Mg	IXCU area, 274' el., RAB
Drum Cleaning Facility	Capable of cleaning a minimum of 10 drums/day	Between Solid Waste Handling Facility and PIOTS, 254' el., Service Wing

As a result of more rigorous review of the project needs vs. wants, the scope of the recommended option is leaner than that requested at the original project charter.

Installing additional downgraded storage tanks at IXCU and a drum cleaning facility will allow for the following (which are aligned with the project objectives):

1. Provide additional storage and segregation capability for downgraded D_2O to meet current recovery rates
   - Slow down degradation rates of upgraders to mitigate/delay costs to purchase external upgrading services
   - Mitigate costs to clean up oil-film build-up in non-oily tanks due to lack of proper segregation capability
   - Reduce the number of man-hours spent on tank maneuvering and backlog processing
2. Prevent the excessive use of drums
   - Reduce drum handling-related radiological and conventional hazards
   - Reduce the number of man-hours spent on drum handling
3. Allow Pickering and Darlington to clean oily drums
   - Prevents the use of oily drums to collect non-oily water
   - Reduce the number of drums in the station that are taking up valuable real estate
   - Mitigate costs to purchase external downgraded D_2O cleaning services.

The final recommendation does not include S&I tanks for the following reasons:

Since 1997, it was evident that "feed and bleed" detritiation has not been consistently performed. This increase in PNGS-B tritium concentration can be partially attributed to the lack of sufficient storage capacity for reactor grade D_2O at the S&I system. In addition, there are other factors that had contributed to this issue:

- Extended Tritium Removal Facility (TRF) outages which limited the amount of TRF product available for detritiation
- One 150 Mg S&I tank occupied with Gadolinium-D_2O for two years as a result of a previous attempt to perform bulk detritiation
- D_2O from Unit 4 Return-To-Service occupying S&I tanks
- Procedural issues associated with the safe execution of swaps that required 6-9 months to resolve
- Planning and resource coordination problems in shipments of D_2O to and from the TRF
- Detritiation can only be performed on weekends when the unit is in quiet mode

The additional S&I tanks installed at Darlington, as part of their D_2O Storage Project 16-31555 can alleviate Pickering's reliance on the availability of the TRF and can improve Pickering's opportunity to perform large volume bulk swaps. These tanks will act as temporary storage and TRF product storage tanks for Pickering when Darlington does not needs these tanks during outages. The utilization of Darlington's tanks in Pickering represents an additional investment mitigation of $18.6M.

Alternative 2 - Delay Project - Not Recommended

Delaying the project is **not** a recommended option. There is insufficient storage and segregation capability for downgraded D_2O since the recovery rates of downgraded D_2O have been increasing and the number of acute leakage events has been escalating. This causes backlog of recoveries that requires excessive drumming operations that may require more drum purchases. The number of drums in the station has already been causing housekeeping and dose issues that has drawn scrutiny from the CNSC. The backlog of drums maybe further aggravated when oily recoveries overflow to non-oily tanks causing clean recoveries to be contaminated with oil. Since oily D2O processes at a slower rate at the IXCU trains, this creates a vicious cycle of additional drum usage.

Furthermore, Engineering – Common Services has indicated that if IXCU tanks were not provided to them by 2014, then upgrader packing replacement would be inevitable. Packing replacement is an extensive overhaul to the upgrader and can cost over $10M. During the years where the flowrates of the upgraders can no longer meet its demand, external upgrading services will need to be purchased, costing over $1.3M for every 10kg/h variance, per year.

Alternative 3 – Install Pickering's own Storage and Inventory Tanks, Install Additional Downgraded Storage Tanks and a Drum Cleaning Facility - Not Recommended

Although installing additional S&I tanks will benefit Pickering station by increasing its flexibility in storing and segregating reactor grade D2O, this is **not** a recommended option. Kinectrics has suggested that the inability to detritiate or improve moderator isotopics effectively over the last 10 years at Pickering cannot be solely tied to a lack of storage capacity at S&I. Although installing Pickering's own S&I tanks improves Pickering ability to detritiate and increase moderator's isotopic, the savings from dose reduction and better fuel burn-up cannot recover the investment required to complete this modification before end-of-life of the Pickering A and B units.

The total cost to implement this option is $36.0M, including contingency, with a +60%/-40% accuracy.

Alternative 4 – - Not Recommended

Alternative 5 – - Not Recommended

4/ THE PROPOSAL

This Developmental Release of $2,505K (including contingency) will be used to complete the following deliverables:

- Provide project management support
- Provide OPG Design Support
- Prepare and award a Design Contract for Preliminary and Detailed Design
- Complete Preliminary Design (up to 40% Detailed Engineering)
- Issue Technical Specifications for Long-lead materials
- Review/Approve Preliminary Design
- Initiate Detailed Design
- Prepare Preliminary PEP
- Issue a Partial BCS

Refer to Appendix C for a list of the project milestones.

5/ QUALITATIVE FACTORS

Benefits to the Community/Regulator Relations

- Lower Tritium Emissions by using Darlington S&I tanks (Project 16-31555) to alleviate Pickering's reliance on the availability of the TRF, thereby ensuring a readily available supply of low curie product to detritiate Pickering's units.
- Eliminate scrutiny from CNSC of Pickering's tritium emissions

Health and Safety

- Effective utilization of the IXCU system will reduce the backlog of downgraded D2O in drums, reducing the occurrences of drum handling-related safety issues
- Clean drums can be re-used or disposed of to improve housekeeping in the stations

Operational Considerations

- Reduce operator workarounds, lowering the probability of human-performance errors

6/ RISKS

Description of Risk	Description of Consequence	Risk Before Mitigation	Mitigating Activity	Risk After Mitigation
Cost				
Overall project cost exceeds current estimate.	Unable to accomplish all project objectives without futher release of funds	**High**	Detailed conceptual study completed by Kinectrics. Helyar review of project cost. Adopt optimal contracting strategy to mitigate cost escalation. Further fine tuning of overall project schedule and costs in a Partial BCS.	**Medium**
Fine tuning of contracting strategy & changes to funding release strategy may impact overall cost and schedule	Delay project schedule and increase costs.	**High**	Obtained agreement with line management on present funding strategy. Contracting strategy and design/installation requirements will be reviewed with Supply Chain, Procurement, Design and Legal.	**Medium**
Scope				
Unknown cost justification information not submitted to Projects causing cost and schedule impacts.	Rework will be required to evaluate impact of additional cost justification on preferred option. Additional costs and delays will be incurred.	**Medium**	Rigrous communication with stakeholders prior to submission of BCS to ensure that all cost justification information have been submitted.	**Low**
Preliminary Design/Detailed Design may result in an increase in scope.	Changes in scope results in delays in schedule and additional cost to the project.	**Medium**	Scope has been clearly defined, communicated, and agree to by stakeholders. Design will be reviewed and challenged by OPG.	**Low**
Schedule				
Schedule for completing contractor selection may be delayed due to rigorous management, supply chain and legal reviews of the RFP.	Schedule delay.	**High**	Reviewed OPEX & had adjusted schedule to allow more time. Early Supply Chain involvement to ensure that the tendering process for the contract is completed as soon as possible.	**Medium**
Fine tuning of contracting strategy & changes to funding release strategy may impact	Delay project schedule and increase costs.	**High**	Obtained agreement with line management on present funding strategy. Contracting strategy and design/installation requirements	**Medium**

overall cost and schedule			will be reviewed with Supply Chain, Procurement, Design and Legal.	
Insufficient information to determine the timeline of design deliverables accurately, and design deliverables may not be on time	Delay to Schedule	**Medium**	Finetuning of final design deliverable timeline is available via partial BCS. Select approved vendor, provide clear scope and deliverables, review progress regularly. Establish and monitor effective design performance metrics.	**Low**
Resources				
Insufficient OPG design resources available.	Delay project schedule and milestones	**High**	Design will be contracted out to an external agency. OPG Projects Design have committed to provide DTL support for this project.	**Low**
Availability of qualified vendors to perform engineering	Delay in issuing contract due to the need to assess various interfacing risks and vendor qualification issues and contracting language	**Medium**	Obtain OPEX from other OPG projects of similar nature. Early involvement with Supply Chain and various other departments on potential vendors and the associated contracting strategies.	**Low**
Technical				
Commercial drum cleaning equipment being recommended may be more complicated than anticipated when installed in a nuclear system.	Costs and schedule delays if extensive testing and re-engineering is required.	**High**	Potential design vendor will be informed that the equipment must be evaluated for suitability in the plant before equipment purchase and implementation.	**Medium**
Meeting seismic requirements	Increase cost to the project due to unknown civil upgrades to meet the seismic requirements	**High**	Seismic qualification considered as part of the conceptual study. Seismic qualification requirements to be included in Preliminary Design.	**Low**
Legacy issues on Design	Re-engineering may be required if there are legacy issues with the systems that the Project is modifying.	**High**	Completed preliminary system walkdown to identify potential legacy issues. Further detail reviews of documents and site scanning will be conducted to determine impacts at the Preliminary Engineering stage.	**Medium**
Regulatory				
Regulatory approvals (CNSC/TSSA) may require moer time than anticipated	Delay in project and potential cost impacts to the contract.	**Medium**	Identify required time allowance in project schedule. Incorporate approved time in contracting strategy. Review OPEX with	**Low**

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			similar projects.	
Environmental				
Drum cleaning procedures may impact of MOE requirements.	The drum cleaning method is yet to be finalized at the Design Stage. The solvent used may impact of MOE requirements, requiring special treatment before disposal.	**High**	The most appropriate method of drum cleaning will be evaluated during the Preliminary Engineering phase. Perform testing at vendor site if necessary.	**Low**
Health & Safety				
N/A				
Investment				
Some of the cost assumptions in the base case are worst case scenarios based on engineering judgment.	NPV and IRR results may be less optimistic than calculated.	**Medium**	Stakeholder line management was involved in obtaining information from historical performances of the systems.	**Medium**
Inability to recover investment	Insufficient time to recover capital investment before stations' end of life.	**Medium**	The current NPV and IRR indicate a return of investment before stations' end of life.	**Low**
Early end of life of PNGS	Insufficient time to recover capital investment if end of life is earlier then currently forecast	**Low**	Using the current forecast of DNGS end of life date the current NPV and IRR indicate a positive return on investment before stations' end of life	**Low**

7/ POST IMPLEMENTATION REVIEW PLAN

Type of PIR:	Targeted Final AFS Date:	Targeted PIR Approval Date:	PIR Responsibility (Sponsor Title)
TBD in Next Release	TBD in Next Release TBD in Next Release	TBD in Next Release TBD in Next Release	

Comments:

	Measurable Parameter	Current Baseline	Targeted Result	How will it be measured?	Who will measure it? (person / group)
1.					
2.					
3.					
4.					
5.					

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

CNSC	Canadian Nuclear Safety Commission
D_2O	Heavy Water
Downgraded D2O	Heavy Water of an isotopic that is not suitable for use in the moderator or the primary heat transport system
ECs	Engineering Changes
EOL	End of Life
IXCU	Ion Exchange Clean Up
OP&P	Operating Policies and Principles
PHT	Primary Heat Transport
Reactor Grade D2O	Heavy Water of an isotopic that is suitable for use in the moderator or the primary heat transport system
S&I	Storage and Inventory
Sulzer-B Upgrader	High curie heavy water upgrader
TOC	Total Organic Carbon
TRF	Tritium Removal Facility
UPP-B Upgrader	Low curie heavy water upgrader

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Appendix "B" — Project Funding History

$ 000's Release Type	Month	Year	Previous Releases (incl contingency) Cumulative Values							Later	Total
None											0
											0
											0
											0
											0
											0
											0
											0
LTD Spent											0

Comments:

The current total project estimate of $17.4M (including $4.1M contingency) is a conceptual quality estimate of +60%/-25% and has an estimated Available for Service Date in Q2 of 2010. Altus Helyar has independently verified this estimate and includes a contingency of 31%, as recommended by OPG Finance. Given that this estimate is based on conceptual information, there is a risk that this estimate may escalate (refer to Section 6, Risk Table)

Project funding in the amount of $5.0M (excluding contingency) is listed in the current approved Business Plan 2006 to 2010. There is $0 capital spending released to date for this project. The funding variance in the Business Plan will be corrected via PCRAF in 2007.

Appendix "C" Financial Model – Assumptions

Project Cost Assumptions:

OPG staff will provide project management and support role during design and implementation.
Material cost assumptions are based on using Class 3 tanks, hangers, piping and associated components and equipment.
Design and installation work will be contracted out.

Financial Assumptions:

Escalation rate on employee wages: 3%
Escalation rate on other expenses: Canada IPPI

Project / Station End of Life Assumptions:

As per memo J. Froats to D. Power, May 10, 2006, File No. NK30-01060 P, Pickering B Units 5,6 and 7 will have a End of Life of 2014 and 2016 for Unit 8.

See Attachment D for details of Expenses & Savings assumptions.

Energy Price / Production Assumptions

N/A

Operating Cost Assumptions

New operating costs are negligible.
External costs to upgrade D_2O is $15/kg
Cost to lease D_2O from AECL is $0.055/kg/day

Other Assumptions:

All work is within the secured area with incumbent restrictions.
OPG will procure all Nuclear Class and Pressure Boundary materials.

PNGS-A D2O Storage and Drum Cleaning Facility Project 13 - 49251

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Attachment "A" **Project Cost Summary**

Choose One Choose One	LTD Prior Yr 2006	This Release 2007	This Release 2008	Future Release 2008	Future Release 2009	Future Release 2010		Later	Total
Project Management (OPG)		435		671	748	538			2,392
Engineering & Drafting (OPG)		304		558	425	447			1,734
Material				511	1,635				2,146
Installation – PWU, BTU				205	420	210			835
Contract - Design		250	898	10	47	45			1,250
Contract - Installation					2,236	1,828			4,064
Contract - Other				60					60
									-
									-
Interest (Capital Project Only)		26		151	382	229			788
Project Costs (excl contingency)	-	1,015	898	2,166	5,893	3,297	-	-	13,269
General Contingency		315	278	671	1,827	1,022			4,113
Specific Contingency									-
Project Costs (incl contingency)	-	1,330	1,176	2,837	7,720	4,319	-	-	17,382
2006-2010 Business Plan	200	1,000		3,000	800	-			5,000
Variance to Business Plan	(200)	15	898	(834)	5,093	3,297	-	-	8,269
Committed Cost									-
Inventory Write Off Required									-
Spare Parts / Inventory									-
Total Release (excl contingency)	-	1,015	898	2,166	5,893	3,297	-	-	13,269
Total Release (incl contingency)	-	1,330	1,176	2,837	7,720	4,319	-	-	17,382

Ongoing OM&A (non-project)									-
Removal Costs (incl in above)									-

Basis of Estimate					
Design Complete	Zero to Minimal		Quality of Estimate	Conceptual + 60% to - 25%	
3rd Party Estimate	Yes	OPEX used	Yes	Lessons Learned	Yes
Reviewed by Sponsor	Yes	Budgetary Quote(s)	No	Phase 1 Actual Used	N/A
Similar Projects	N/A	Contracts in place	N/A	Competitive Bid	N/A

Variance to Business Plan

The estimated variance(s) to the 2006-2010 Business Plan will be addressed through the portfolio management process. A PCRAF will be approved by Jan 2007.

Reviewed By: [signature] NOV 21/06

Stephanie Tham
Project Manager

Date:

Approved By: [signature] for Peter Floyd 22Nov06

Peter Floyd
Eng & Mods Manager (Strat IV)

Date:

ProjectPNGS-A D2O Storage and Drum Cleaning Facility Pr Name 13 - 49251

Developmental Release Business Case Summary NA44-BCS-38000-00001-R000

Attachment "B" **Project Variance Analysis**

Capital	LTD Nov 2006	Choose One: Last BCS N/A N/A	Choose One: This BCS Nov 2006	Variance	Comments
Project Management (OPG)				0	
Engineering & Drafting (OPG)				0	
Material				0	
Installation – PWU, BTU				0	
Contract - Design				0	
Contract - Installation				0	
Contract - Other				0	
				0	
				0	
Interest (Capital Project Only)				0	
Project Costs (excl contingency)	0	0	0	0	
General Contingency				0	
Specific Contingency				0	
Project Costs (incl contingency)	0	0	0	0	
Committed Cost				0	
Inventory Write Off Required				0	
Spare Parts / Inventory				0	
Total Release (incl contingency)	0	0	0	0	
Total Release (excl contingency)	0	0	0	0	

Ongoing OM&A (non-project)				0	
Removal Costs (incl in above)				0	

Comments:
N/A

Attachment "C" **Key Milestones**

Completion Date			Description
Day	Mth	Yr	
21	DEC	2006	Project Start Milestone (PSM)
23	DEC	2010	Project Complete Milestone (PCM)
02	JAN	2009	Budget Quality Estimate Approved (BEA)
04	JUN	2009	Full Release BCS Approved (FR1)
17	JUL	2009	Major Contract Awarded (MCA)
19	NOV	2007	Preliminary Design Complete (DES)
03	DEC	2007	Engineering Work Scope Identified (ESI)
05	NOV	2007	Regulatory Approval Obtained (RAO)
17	SEP	2008	DCP Approved - Drum Cleaning Facility (DCP)
16	OCT	2008	DCP Approved - IXCU (DCP)
17	SEP	2008	Final Design Complete Phase 1 (FD1)
11	AUG	2009	Start of Installation (SOI)
07	JAN	2010	AFS - Drum Cleaning Facility (AFS)

A Project Execution Plan (PEP) will be approved by Aug 2007

Comments:
Other Key milestones:

26	APR	2010	AFS- IXCU (AFS)
21	JUL	2010	In-Service Declaration (ISD)
26	NOV	2007	Long Lead Materials Identified (LLT)

Attachement D: Incremental Costs & Expenses Assumptions

Category	Comments	
	Before PND-B End of Life (2007 to 2016)	**After PND-B End of Life (2017 to 2026)**
	Expenses Without Drum Cleaning Facility (DCF)	
New Drum Purchases	$700/drum x 20 drums/year; 0 drums/yr after AFS	15 drums/year after PB end of life; 0 drums/yr after AFS
Additional Drum Handling Cost	2.7 drums/day @ 3 hours/drum x $80/hr x 365d; 0 drums/yr after AFS	2.0 drums/day after PB end of life; 0 drums/yr after AFS
Costs to clean drum contents	$525K per event once every 2 years; $0 after AFS	
Costs on Drum Disposals	10 drums x 0.25 m3 x $4000/m3 disposal; $0 after AFS	7.5 drums after PB end of life ; $0after AFS
Leasing costs-D2O Makeup for unprocessable water	$0.055/day/kg x (0.3 drums/day x 365d/yr x 230 L/drum x 30% isotopic x 1 kg/L) x 200 days of lease; $0 after AFS	0.2 drums/day after PB end of life; $0 after AFS
	Expenses Without Additional IXCU tanks	
Costs to cleaning IXCU Tanks	105K per event once every 2 years $0k after AFS	
Operator Work Around for Tank Handling	2 FTE; 0 FTE after AFS.	
Upgrader Degradation - External Mitigation Costs (with escalation)	External upgrading cost=$15/kg when demand feedrate is less than upgrader's capability; Without IXCU, entire yearly load will be upgraded externally during repacking in 2014. Upgrader degradation rate: -8Kg/hr/yr :UV in service only in 2007, or -2kg/hr/yr: UV & IXCU in service in 2010; Demand feedrate reduces from 150kg/h to 105kg/h in 2015/2016 when 3 PB's units are out of service.	Same except the Demand upgrader feedrate reduces to 90kg/h after PB end of life.
Packing Change Costs (with escalation)	$10M to repack in 2014 without IXCU tanks; or delayed to 2042 if IXCU is installed.	
	Expenses Without Additional S&I tanks	
Offsite water storage - TDO Shipments Costs	$200/TDO trip x 7.5 trips/year; 0 trip after AFS	5 trips/year after PB end of life; 0 trip/year after AFS
	Incremental Operating Expenses of DCF	
Operation Expense of DCF - Labour	1FTE	
Incremental Operational Expense - Utilities	$50/drum x 10 drums/day x 365days	
Waste Disposal Costs of DCF	100 drums with sludge of 3.5" in each (ONE TIME COST of 0.0889m x (0.61m/2)^2*Pi x $4000/m3.	

Attachement D: Incremental Costs & Expenses Assumptions (Cont..)

Category	Comments	
	Before PND-B End of Life (2007 to 2016)	**After PND-B End of Life (2017 to 2026)**
Savings After Additional S&I Tanks Installed		
Fuel Burn Up Savings	About 187Mg of the yrly TRF product shortfall can be received to detritiate & improve moderator isotope after AFS (reference: Kinectrics Report Appendix A for detailed calculation & yearly distribution).	
Dose (ALARA) Savings	About 187Mg of the yrly TRF product shortfall can be received to detritiate & improve ALARA after AFS (reference: Kinectrics Report Appendix A for detailed calculation & yearly distribution).	