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Business Case Summary

Pickering A Fuel Handling SPV Reliability Improvement 13 - 46634 (Capital) 13 - 46635 (OM&A)
Full Release Business Case Summary NA44 - BCS - 35300 - 00004 - R000

Name / Title / Phone	Location	Action	Signature	Date
Nahil Rahman Director - Pickering Projects 701-4053	P72-1	Review BCS		13 Feb 2012
Sean Granville Director Operations & Maintenance - Pickering 701-2099	PO5-A2	Review BCS		2012/2/24
Dwight Zerkee Manager, Investment Management 702-5058	P82-3	Review BCS		2 Mar 12
Randy Leavitt Vice President – Nuclear Finance 702-5177	P82-3	Review BCS		March 6, 2012
Stephen Rogers Director - Asset Planning & Integration 400-3993	H07-E5	Review BCS	M. Stephen Rogers	March 19/2012
Don Power Vice President - Corporate Investment 400-7172	H07-G05	Review BCS		March 26/12
Glenn Jager Senior Vice President – Pickering 701-3260	P42-E3	Submit BCS		30 MAR 2012
Wayne Robbins Chief Nuclear Officer 702-5294	P82-6	Review BCS		2012-04-02
Donn Hanbidge SVP & Chief Financial Officer 400-2395	H19-F27	Approve BCS		2012-04-27
Tom Mitchell President & CEO 400-2121	H19-A24	Approve BCS		2012-04-16
Carolyn Sicard Nuclear Investment Management 702-4082	P82-3B6.2	Return for Distribution		

OFFICE OF THE PRESIDENT & CEO

APR 30 2012

1/ RECOMMENDATION:

We recommend a **Full** Release of an **additional $23.088** Million ($16.136 Million **Capital** and $ 6.952 Million **OM&A**) to fund **completion of all modification, commissioning and closeout** for this project. Approval of this request will bring the total to date funding to **$34.262** Million including a contingency of [redacted] Million. The total project is estimated to cost **$ 34.262** Million with an estimated completion date of 12/30/2014.

The Business Objective of this **Sustaining** project is to improve the performance and reliability of the Pickering A Fuel Handling (FH) System to address the following issues:

- Pickering A FH System is a significant contributor to production loss from forced outages and Unit deratings
- Component obsolescence is becoming a major issue with the Fuel Handling System reaching its end of life
- Fuelling unavailability often disrupts outage critical path and station Integrated Operating Plan (IOP) schedules

In addition, during fuel handling equipment or systems failure, there is an employee and public safety risk when irradiated fuel cannot be transferred to the appropriate location where adequate cooling is maintained.

This project will replace, refurbish or overhaul the key system components that have aged past their design end of life. Specifically, the focus will be on components classified as Single Points of Vulnerability (SPV) equipment that have a zero tolerance of unplanned failures. Replacing these components will improve the FH system performance and reliability until the Station end of life.

Installation activities in Unit 4 during the 2011 planned outage were completed, for the most part, under the current funding release. Some work (Electrical Catenaries, Rolling Shield Gear Box and Y-Drive Mitre Box) could not be completed due to unavailability of materials at that time. Funds requested in this Full Release BCS are to complete design and installation activities for Unit 1, the remaining work for Unit 4 and project close out. Execution is planned during P1211 outage in Sep 2012 and during P1341 outage in Sep 2013 (for the remaining Unit 4 work).

$000's (incl contingency)	Funding	Type	LTD Dec 2011	2012	2013	2014	2015	2016	Later	Total
Currently Released	Partial	OM&A	200							200
		Capital	10,700	3,900						14,600
Adjustments to Current Release	Adjustments	OM&A	(146)							(146)
		Capital	(3,480)							(3,480)
Requested Now	Full	OM&A		6,952						6,952
		Capital		8,036	7,890	210				16,136
Future Funding Req'd	None	OM&A								-
		Capital								-
Total Project Costs		OM&A	54	6,952	-	-	-	-	-	7,006
Total Project Costs		Capital	7,220	11,936	7,890	210	-	-	-	27,256
Total Project Costs		Total	7,274	18,888	7,890	210	-	-	-	34,262
Other Costs										-

Investment Type	Class	NPV	IRR	Discounted Payback
Sustaining	Multi Class	24,652	20.3	5.2

Submitted By: (Date) 30 MAR 2012
Glenn Jager
Senior Vice President – Pickering Nuclear

Financial Approval By: (Date) April 27/12
Donn Hanbidge
SVP & Chief Financial Officer

(OAR Element 1.1 Project in Budget)
Line Approval By: (Date) 2012-05-06
Tom Mitchell
President & CEO

2/ BACKGROUND & ISSUES:

During the Pickering A Return to Service project, new safety requirements required conversion of adjuster rods to shutoff rods to increase total shut off rod reactivity worth. Following the changeover, adjuster rods cannot be retracted to compensate when fuel handling is unavailable. As a result, the system is required to be available to fuel at least every 33 hours or the reactor Units will de-rate. The original design requirement for the FH system availability was 70%, whereas the availability target is now 92%. Since the Pickering A FH systems are 35 to 40 years into their 40 year design life, component obsolescence and end of life issues present significant challenges in meeting the availability targets.

This project is an immediate priority due to continued FH system deterioration, known end of life components, and limited outage window availability to accommodate work without extending outage durations in the future. Since the Return to Service Project, Pickering A FH has seen its highest contributions to Forced Loss Rate (FLR):

- 36.2 days in 2008
- 0.5 days in 2009
- 17 days in 2010
- 6.7 days in 2011

With aging components and major obsolescence issues, this trend is estimated to increase and thereby pose a significant threat to the current Business Plan FLR targets of 42.4 days for 2012, 43.5 days for 2013 and 43.7 days for 2014.

As well as being a major contributor to units FLR, poor fuel handling system reliability also impacts station performance objectives. Unplanned fuelling unavailability disrupts scheduled maintenance. When fuel handling capability is restored, priority is given to fuel the unit for full power operation. As a result, scheduled maintenance is deferred, particularly channelized maintenance and testing.

Outage critical path schedule adherence is also affected by poor fuel handling reliability. Fuel handling supports outage execution by providing a platform for reactor inspection and maintenance activities as well as delivery of inspection tools. Fuel handling system unavailability has a direct and negative impact on critical path during these outages.

Furthermore, when irradiated fuel is stranded in the fuel handling systems as a result of breakdowns, the required repairs pose a significant radiological safety risk to our employees and an increase in public safety risk.

A review of the fuel handling systems based on INPO AP-913 (Equipment Reliability Process) was conducted to determine the scope of work required to achieve acceptable levels of reliability for the Pickering A Fuel Handling systems. The review identified equipment that are Single Points of Vulnerability (SPV) or equipment with a zero tolerance of unplanned failures. Any FH SPV equipment failures (within the scope of this project) would result in Unit shutdown(s) and/or de-rating(s).

The project scope focuses on the replacement, refurbishment and overhaul of SPV equipment of the Pickering A Fuel Handling System. Improvements to maintenance capabilities and routine maintenance (i.e. component replacements) will also be performed to ensure maximum gains in system availability and reliability until the end of station life.

The following activities have been completed using the Partial Release funding:

- Purchase order issued for major equipment/component procurement for Units 1 and 4 (except U1 Ball Nuts as no OEM vendor was available to supply these nuts at that time)
- Unit 4 and Unit 1 work plan preparation and assessment completed

- Unit 4 Installation activities completed, except for the following:
  - Electrical Catenaries – due to material unavailability
  - Rolling Shield Gear Box – Obsolete part (spare gear box has now been obtained from Unit 3)
  - Y-drive Mitre box - due to material unavailability
- Return For Service (RFS) after Unit 4 SPVs replacement

The Partial Release was not fully spent due to the following:

- Some material was not available and could not be installed in P1141
- Labour cost less than estimated (reduced scope in P1141)
- Contingency not used

The P1141 OPEX has been incorporated into the remaining work scope. Some major OPEX includes:

- Thrust bearing – Use of manlifts to reduce time and dose.
- Configuration Issues on Y Drive alignment and elevator chain
- New Gear box rotation checks during installation
- FM Catenary Hoses – Alignment/Twists

3/ ALTERNATIVES & ECONOMIC ANALYSIS:

$ 000's	Base Case	Alt 1 (Recommended) Full Cost	Alt 1 (Recommended) Incremental Cost	Alt 2	Alt 3	Alt 4	Alt 5
Revenue	(93,744)	(8,573)	(8,179)	(18,335)			
Base OM&A	0	0	0	0			
Outage OM&A				0			
Project OM&A	0	(7,006)	(6,952)	(7,006)			
Total OM&A	0	(7,006)	(6,952)	(7,006)	0	0	0
Provision							
Capital		(25,689)	(18,533)	(27,328)			
Present Value (PV)	(50,559)	(32,425)	(25,907)	(37,471)			
Net Present Value (NPV)	**N/A**	**18,134**	**24,652**	**13,088**			
Internal Rate of Return (IRR) %	N/A	11.0	20.3	10.3			
Discounted Payback (Yrs)	N/A	6.2	5.2	7.0			

Base Case: × *Not Recommended* - **Stop the Project**

Maintaining the status quo is not an acceptable option for the following reasons:

- FH Systems will continue to be a main contributor to Unit de-ratings and forced outages and result in large financial losses. The consequences include:
  - De-rating 10% of both Units 1 and 4 for two weeks per year due to unavailability of SPV parts in the FH systems.
  - 10% probability of one unit shut down for one month per year because of FH SPV equipment failures and spare parts unavailable.
  - 50% probability of one unit shut down for three weeks per year because of FH SPV equipment failures.
- Considering component obsolescence and unavailability of spare parts, the probability of equipment failure will continue to increase within the intended station life
- Failures will continue to disrupt Outage critical path and IOP scheduled activities
- With fuel handling equipment or system failures, there is an employee and public safety risk if irradiated fuel cannot be transferred to the appropriate location where adequate cooling is maintained

Alternative 1: ✓ *Recommended* - **Replace/Refurbish/Overhaul SPV equipment**

The recommended alternative focuses on replacing the Single Point of Vulnerability (SPV) items identified by the Equipment Reliability Analysis Program as per AP-913 guidelines. This includes the development of Engineering Changes, procurement of long lead material and replacement and overhauling of life-expired FH equipment.

This option is recommended because:

- All business objectives are achieved
- It is in alignment with the Equipment Reliability Restoration Program (ERRP)
- It will help ensure current station FLR objectives and priorities are met
- It will contribute towards achieving FH equipment availability rate of 92%
- The P1211 and P1341 planned outages have sufficient windows for carrying out all installation work for Unit 1 and outstanding installation work for Unit 4

The following assumptions were made with regard to Unit deratings/outages until the modifications are completed:

- De-rating 10% of Unit 1for two weeks and Unit 4 for 1 week due to unavailability of SPV parts in the FH systems.
- 10% probability of Unit 1 shut down for one month and Unit 4 for 15 days per year because of FH SPV equipment failures and spare parts unavailable.
- 50% probability of one Unit 1 shut down for three weeks and Unit 4 for 10 days per year because of FH SPV equipment failures

The breakeven point for this alternative is 5.5 days FLR days per unit per year.

Alternative 2: × *Not Recommended* - **Delay for 2 Years**

Although this alternative satisfies all objectives of the project, it is not recommended because:

- Delaying the project will impact key business production objectives due to the high probability of existing Fuel Handling system equipment failure
- Any cost savings would be offset by the increased risk and consequence of forced outages due to equipment failure
- The delay period has a negative impact on the probability of aging equipment failure
- P1441 and P1511 outage windows may not be adequate for completing all installation activities which may result in an outage extension

4/ THE PROPOSAL

The following are the objectives and expected results (deliverables) for this Full Release BCS:

- Project Management Support
- Engineering Support
- Modification - SPV equipment replacement for Unit 1 and remaining work for Unit 4
- Stress Assessments
- Project Close Out

The following activities will be completed using the Full Release Funding:

- Capital Activities
  - Purchase order issued for U1 Ball Nuts (deferred from partial release)
  - Design and procurement activities for TM Rotor Bearing Tooling and Replacement of U1 & U4
  - Unit 1 Installation activities during P1211
  - Unit 4 remaining work (Electrical Catenaries, Rolling Shield Gear Box, and Y-drive Mitre Box) during P1341 (deferred from 2011 outage)
  - Operations acceptance/RFS for Unit 1 and remaining work for Unit 4
  - Unit 1& 4 Design Close Out
  - Project Close Out

- OM&A Activities:
  - Ball Screw Stress Assessment
  - FM Pressure Boundary Stress Assessment
  - FM Carriage/Trolley Structure Stress Assessment

Please refer to Attachment "E" for detailed scope of the project.

Note:
The scope of the project is limited to SPVs (as listed in Attachment 'E') that have been determined to pose the greatest risk or have uncertainty that requires further assessment. Any additional equipment/component will be addressed under the FH/Station maintenance program. Ball screw and pressure boundary component analyses are included in the project scope; however if replacements are required a separate project will be initiated to complete the required work.

TM Overhaul (SPV 895) – The TM Rotor bearing replacement in U1 and U4 will be executed if it is determined that the condition of the bearings in U2 or U3 indicates the need for replacement.
In situ inspection of the bearing in running units will result in high doses and high hazard work. Tooling will be developed to carry out in situ inspection in U2/U3. Based on the observed condition of the TM rotor bearing with similar service life in U2/U3, the decision will be made for the path forward for U1/U4. Specific contingency money is allocated if the TM Rotor bearings cannot be replaced in situ resulting the need to remove the TM from the unit. The plan is to develop tooling to replace bearings "in situ", practice on U2/U3 and execute in U1 and U4.

5/ QUALITATIVE FACTORS

1. Improve FH System health and reliability by replacing SPV components.
2. Reduce risk of radiological dose to public and employees until end of station life.
3. Avoid disruption to Outage critical path and IOP schedule activities.

6/ RISKS ANALYSIS (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	Mitigation	Specific Cont'ncy $000's	Probability X Impact: Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environmental	Nuclear Safety	Risk Rating (1 to 25)
Cost a) The Project Charter identifies Fuel Transfer Mechanism Overhaul (SPV 875) as part of the scope. It is not conclusive if a complete overhaul is necessary to replace the TM Rotor Bearings. Additional funds will be required, if work to remove and/or overhaul the TM is to be completed.	1. Allocate specific contingency for Fuel Transfer Mechanism Overhaul (SPV 875) should it be required to remove it from the unit. 2. Develop tooling early so assessments can be performed ASAP to determine extent of work required for FTM.	Before	5,000	9	9							9
		After		4	4							4
b) Estimate is based on similar projects, first unit installation and consultations with other work groups involved. There is no OPEX available for some major works such as trolley bearings, electrical catenaries. Assessment cost estimates are of conceptual quality and may be conservative.	1. Use OPEX from first unit construction. 2. Allocate contingency to address over expenditures. 3. Monitor project costs on a weekly basis to avoid cost over runs.	Before		9	6							9
		After		4	4							4
Scope: Scope of work is fairly well defined but there may be discovery issues during installation, such as unforeseen radiological hazards e.g. Hot particles and high dose situations. Discovery work may also require additional Design and Installation contract efforts.	1. Ensure Fuel Handling personnel reviews scope and assesses work to be completed. 2. Allocate contingency to address issues that may arise. 3. Obtain Radiation Protection input when preparing and assessing work plans to minimize/reduce radiation hazards. 4. Have all stakeholders perform walkdowns and conduct comprehensive Pre-job briefings. 5. OPEX	Before		3	9				6			9
		After		2	4				2			4

Schedule Ability to complete the required prerequisite work at risk within the outage window. Above risks may result in outage extension or deferring of some work. Conflicting projects (i.e. ECI vs. FH SPV) will impact outage schedule and may result in outage extension or deferring of some work. Ability to complete the work is at risk due to critical material availability like Ball Nuts. OPEX from U4 modification, - changes in outage schedule, insufficient time allowed for FH to conduct testing, configuration issues, discovery work, legacy issues. All these can impact schedule (and cost).	1. Work closely with the Outage group and Fuel Handling to coordinate activities. 2. Engage Supply Chain to ensure all materials (including ball nuts) required for installation are available and ready for use. 3. Close coordination and field walkdowns. 4. General contingency added to address these risks. 5. OPEX from U4	**Before**		6	9						9
		After		4	4							4
Resources Possibility of a change in personnel working on this project such that knowledge and experience from previous installation will not be fully applied. Station resources may be pulled to complete higher priority work during outages. OPEX from U4 modification – Maintenance Techs required to support troubleshooting, are not always available readily, causing delay.	1. Obtain early commitment from OPG resources i.e. Design, Field Eng and Station. 2. Fuel Handling Technical and Assessing units will assist and be consulted by projects group to help build expertise. 3. Use augmented staff or have additional budget to complete work. 4. Contractor Engaged	**Before**		3	9	9						9
		After		2	4	2						4

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Quality Quality of design and manufacturing of ball nuts being installed may lead to "new" failure modes which may not show up during testing or commissioning. There is a possibility that new components may not be compatible with existing system. There will be a major schedule impact if issues with the components arise. OPEX from U4 modification – some quality issues with the new material	1. Use qualified and experienced vendors (on ASL) with access to quality manufacturing facilities. Engage OEM supplier for critical components. Request Supply Chain inspections at various stages in the production process. 2. Use OPEX from previous U4 FH maintenance/work. 3. Use lessons learned from previous Unit installation. Work plans updated with OPEX from U4 4. Employ strict quality control and testing of new components. 5. Save the old components, in case it is to be reused.	**Before**		3	9	9						9
		After		2	6	4						6
Technical a) Hot spot in Unit 1 tensioning tower may affect conveyor cart overhaul work. Work will require additional Radiation Protection consideration and extra rigor.	1. Engage Radiation Protection and ALARA in advance to come up with strategy to complete work. 2. Consult Radiation Protection for preparation of work plans.	**Before**		6	9				6			9
		After		3	6				3			6
b) Configuration Issues	1. OPEX from U4 2. FH Technical Support to address 'as found' 3. General Contingency	**Before**		6	6							6
		After		3	3							3
c) Ball screw and pressure boundary component analysis and assessments will be done in this project There is a very low probability that replacements will be necessary.	Ball screw & Pressure boundary component replacement will be carried out as separate project, if required.	**Before**		8	**10**							**10**
		After		2	4							4

7/ POST IMPLEMENTATION REVIEW

Type of PIR:	Targeted Final AFS Date:	Targeted PIR Approval Date	PIR Responsibility (Sponsor Title)
Comprehensive	31-Dec-13	30-Jun-14	Fuel Handling Manager

	Measurable Parameter	Current Baseline	Targeted Result	How will it be measured?	Who will measure Person / Group?
1.	Forced Loss Rate due to Fuel Handling	FLR 3% (2010) and trending upward	FLR <2%	FLR attributed to SPV failure	Fuel Handling Manager
2.	Replace/Refurbish/Overhaul SPV equipment identified in Project Charter	Equipment is at the end of design life	No SPV component failures leading to unit outage/ de-rating	Outages/De-rating contributed by SPV failures.	Fuel Handling Manager
3.	Availability of Fuel Transfer mechanism	Equipment is at the end of design life. Condition of bearings unknown.	Assessment completed and suitable actions taken to mitigate the risk.	FLR attributed to SPV failure	Fuel Handling Manager
4.	Life expectancy of Ball screws	Near end of design life. Remaining life expectancy unknown.	Assessment completed and remaining life expectancy known.	Assessment completion	Fuel Handling Manager
5.	Health of PB components and load bearing structures.	Near end of design life. Remaining life expectancy unknown.	Assessment completed and remaining life expectancy known.	Assessment completion	Fuel Handling Manager

APPENDIX "A' GLOSSARY (acronyms, codes, technical terms)

AFS	Available for Service
ALARA	As Low As Reasonably Achievable
BCS	Business Case Summary
CMO	Contract Management Office
CNSC	Canadian Nuclear Safety Commission
COMS	Constructability, Operability, Maintenance, Safety
ECC	Engineering Change Control
EOL	End of Life
ERRP	Equipment Reliability Restoration Program
FH	Fuel Handling
FLR	Forced Loss Rate
FM	Fuelling Machine
FTM	Fuel Transfer Mechanism
INPO	Institute of Nuclear Power Operations
IOP	Integrated Operating Plan
IRR	Internal rate of return
NICR	Non-Identical Component Replacement
NPV	Net Present Value
OAR	Organizational Authority Register
OEM`	Original equipment manufacturer
OM&A	Operation, Maintenance and Administration
OPEX	Operational Experience
OPG	Ontario Power Generation
PB	Pressure Boundary
PEP	Project Execution Plan
PIR	Project Implementation Review
REIS	Report of Equipment In Service
RFS	Return For Service
SCR	Station Condition Record
SPV	Single Point of Vulnerability

APPENDIX "B"

Comparison of Total Project Estimates

$ 000's		This Appendix compares the Total Project Estimate for each BCS										
			Total Project Estimate (by Year incl Contingency)									Total Project
BCS Type	Class	Mth	Yr	2011	2012	2013	2014	2015	2016	2017	Later	Est
Developmental	Capital	Jan	2011	8,000	14,500	500						23,000
Partial	Capital	Feb	2011	10,700	15,500	750						26,950
Partial	OM&A	Feb	2011	200	7,990							8,190
Full	Capital	Jan	2012	7,220	11,936	7,890	210					27,256
Full	OM&A	Jan	2012	54	6,952							7,006
												0

LTD Spent	Capital	Dec	2011	7,220								7,220
LTD Spent	OM&A	Dec	2011	54								54
LTD Spent												0

Comments:

APPENDIX "C" FINANCIAL MODEL – ASSUMPTIONS

Financial Assumptions:

Discount Rate:	7%	Cost Escalation (Yr)	3%	SR&D Opportunity	No
Progress Payments	No	Foreign Currency	No	Retainer Fee	No
Depreciation Rate (Capital)	Generating Equip 8%	PST	No	Interest Rate (Capital)	6%
Revenue Rate	Corp SEV	Leasing	No	Indexed Priced Contract	No

Comments:

Major assumptions about contribution of the FH system to unit de-rates/shutdowns used in the financial evaluation for the base case and Alternative 1 are listed in Section 3 "Alternative and Economic Analysis". These assumptions are based on available FLR data and OPEX from FH department.

Project Cost Estimate:

Design Complete:	100%	Fixed Price Contract	No	3rd Party Estimate	No
Quality of Estimate	Budget +30% to -15%	OPEX used	Yes	Lessons Learned	Yes
Similar Projects	Yes	Budgetary Quote	Yes	First Unit Actual Used	Yes
Firm Vendor Proposal	No	Cost Sharing	No	Competitive Bid	Yes
Reviewed by Sponsor	Yes	Fee for Service	No	Contracts in place	Yes

Comments:

Project cost estimate is based on man-hour commitment provided by various contributing groups such as Projects, Design, Field Engineering, Station resources, Contract Management Office and Project Management Office. The project estimate for remaining installation work is based on the first unit construction costs. There is no OPEX for some major work such as FT magazine bearing, electrical catenaries and assessments. No contracts are in place for stress assessment/analysis and quality of estimates is conceptual.

Rationale for Capital Cost Classification:

As per FIN-PROC-PA-003, this project qualifies for Capital funding since it involves the upgrade/replacement of a system that will contribute to extending the life of the asset.

Generation Plan Assumptions:

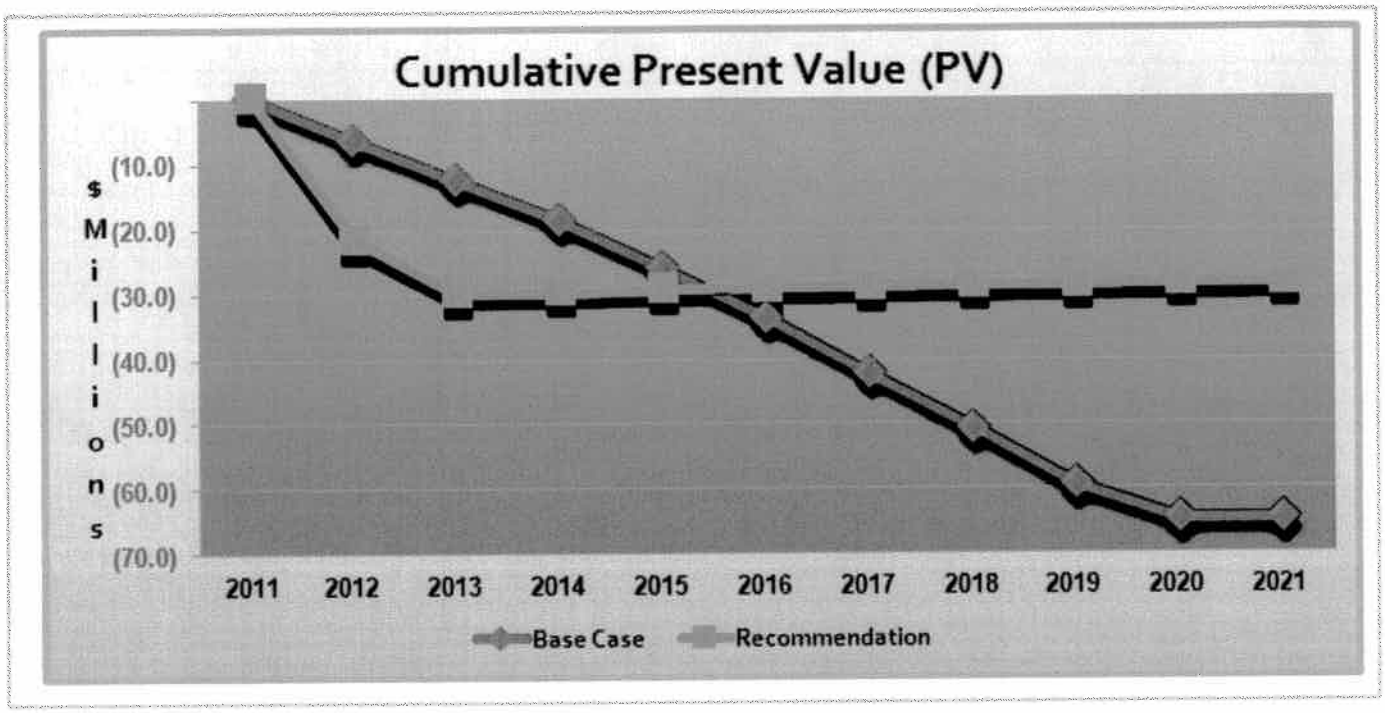
Station	Unit	EOL or Refurb	MW	Planned Outages for Project Work						
Pickering A	1	Jun-20	515	P1211						
	4	Jun-20	515	P1141	P1341					
Pickering B	5	Nov-18	516							
	6	Nov-18	516							
	7	Jun-20	516							
	8	Jun-20	516							
Darlington	1	Sep-16	878							
	2	Feb-18	878							
	3	Sep-19	878							
	4	Jan-21	878							

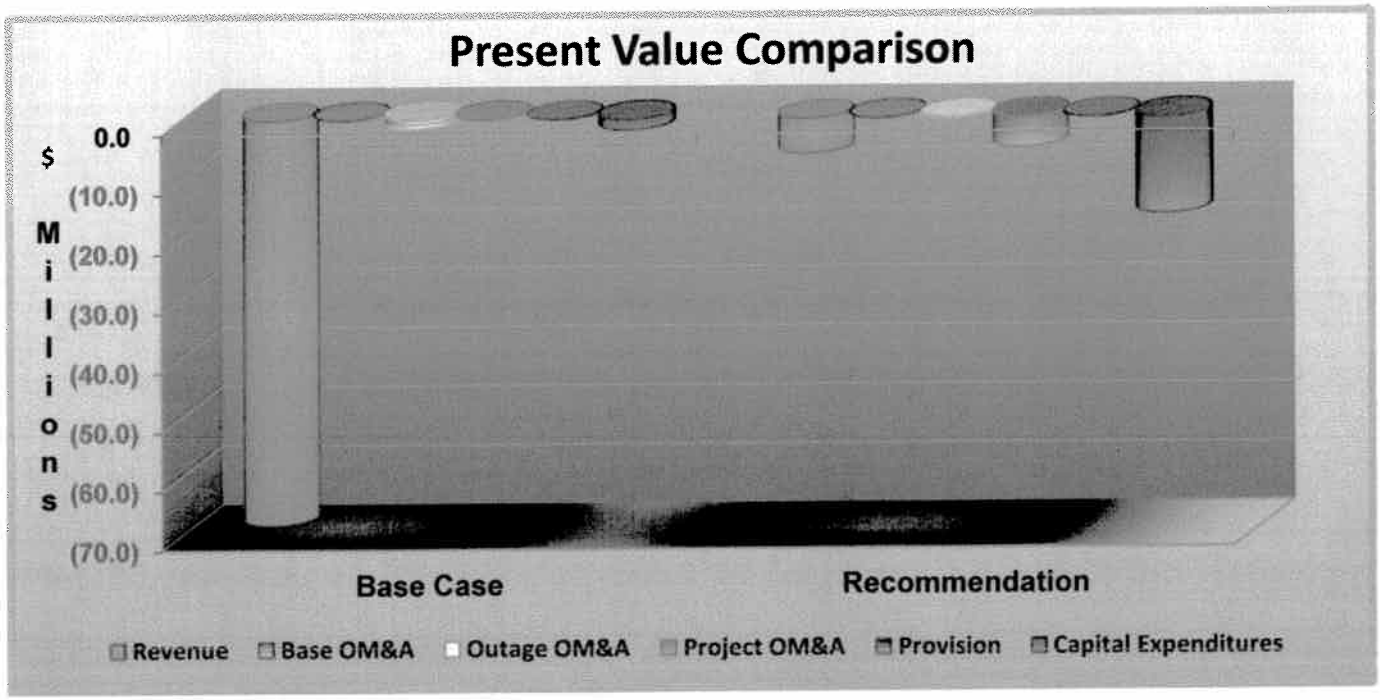
Comments:

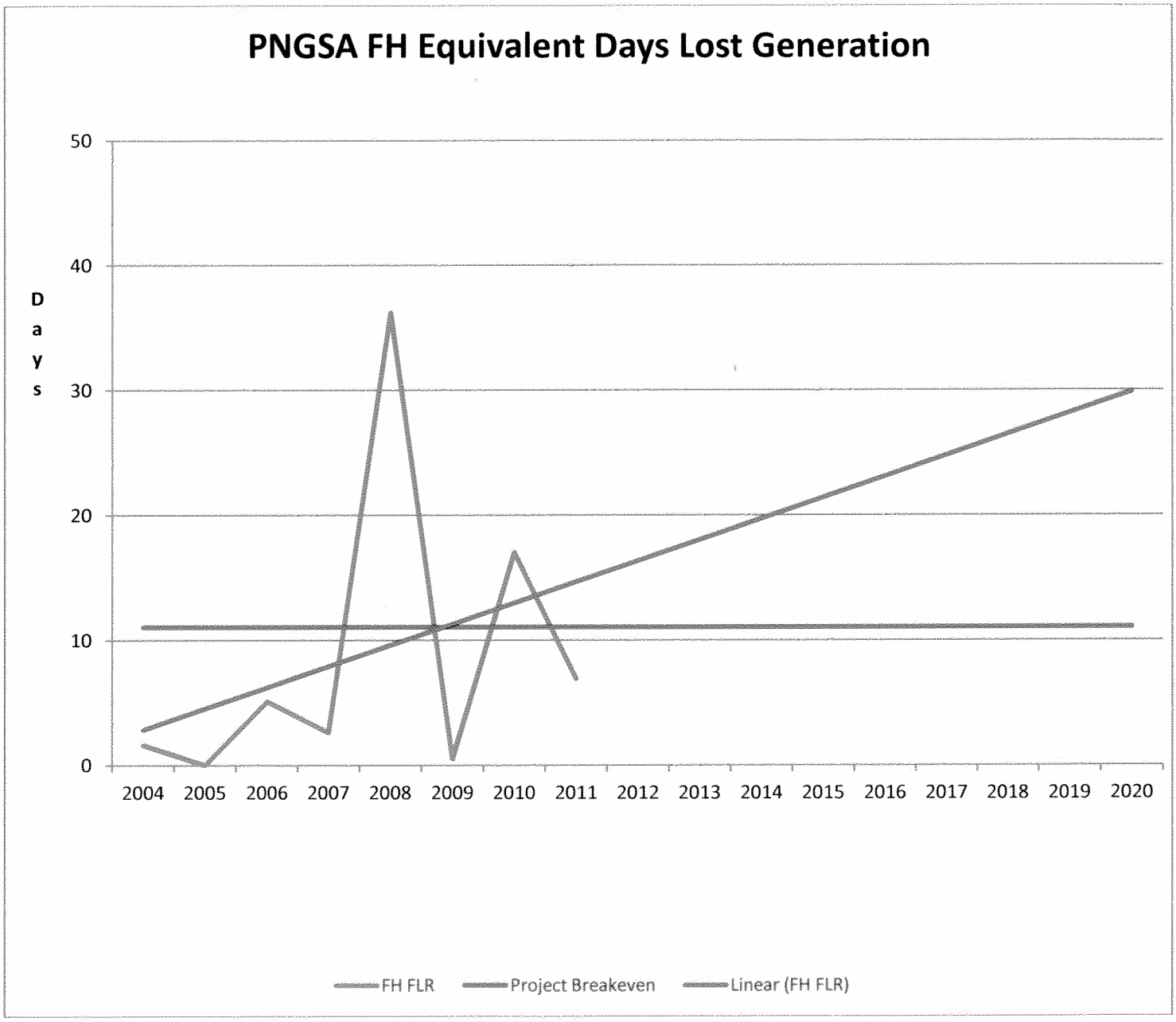
If TM Rotor Bearing cannot be replaced in situ, then FT Mechanism replacement will need to be scheduled in a future outage.

APPENDIX "D"

FINANCIAL MODEL – ASSUMPTIONS
Impact on Operations







The number of days lost due to PNGSA fuel handling failures has been trending upwards since re-start in 2004. While some of the lost generation is due to failures other than SPV equipment, it is assumed that SPV equipment failures will be the predominant failure mode going forward. The breakeven point for this $35M project is 11 days equivalent of lost generation due to fuel handling failures (or 5.5 days per unit).

APPENDIX "E"

PROJECT DELIVERABLES
For this Release

Description	Item	Cost ($000's)
Provide Project Mangement Support	Design Projects and Project Controls	1,185
	Project Close Out	67
Provide Engineering Support	Design and Drafting Support	564
	Design Agency Support	200
	Field Eng. Support	877
	EC Close Outs (U1 and U4)	87
Procurement	Unit 4 Materials	500
Construction	Installation of SPVs for Unit 1	[redacted]
	TM Rotor Bearing Tooling Development	
	Installation of remaining SPVs for Unit 4	
	CMO, Rad Protection, ALARA	
Stress Assessments (OM&A)	Ball Screw	
	FM Pressure Boundary	
	FM Carriage Trolley Structure	
Interest	Capital Project	
Contingencies	General Contingency	
	Specific Contingency	
		23,088

PROJECT DELIVERABLES
From Partial Release (Jan 2012 – Mar 2012)

Description	Item	Cost ($000's)
Provide Project Mangement Support	Design Projects and Project Controls, CMO, Rad Protection, Field Engineering	441
Provide Engineering Support	Design and Drafting Support	114
Procurement	Unit 1 Materials	2,263
Interest	Capital Project	[redacted]
Contingencies	General Contingency	
		3,918

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ATTACHMENT "A" PROJECT COST SUMMARY - 13-46634 (Capital)

	$ 000's Capital	LTD Dec 2011	2012	2013	2014	2015	2016	2017	Later	Total
Accounting Basis	Project Mgmnt & Support	2,127	1,087	272	131					3,617
	Engineering	441	1,269	394	44					2,148
	Procurement	1,909	2,263	500						4,672
	Construction	[redacted]								
	Other									
										-
										-
										-
	Interest (Capital Project)									
	Project Costs									
	General Contingency									
	Specific Contingency									
	Project Costs	7,220	11,936	7,890	210	-	-	-	-	27,256

	$ 000's Capital		LTD Dec 2011	2012	2013	2014	2015	2016	2017	Later	Total
Funding Basis	Current Release	Project Costs	[redacted]								
		Contingency									
		Total									
	Adj to Current Release	Project Costs									
		Contingency									
		Total									
	This Release	Project Costs									
		Contingency									
		Total									
	TTD Released	Project Costs									
		Contingency									
		Total	7,220	11,936	7,890	210	-	-	-	-	27,256
	Future Releases	Project Costs								-	-
		Contingency								(0)	(0)
		Total	-	-	-	-	-	-	-	(0)	(0)
	Project Funding										
	Contingency Funding										
	Total Funding		7,220	11,936	7,890	210	-	-	-	(0)	27,256
Budget	2011 - 2015 Business Plan		7,220	8,100	600						15,920
	Variance to Budget		0	1,847	1,808	175	0	0	0	0	3,830
Other	Removal Costs (above)										-
	Inventory W / O										-
	Spare Parts in Invent										-

Reviewed by: (Date)
FEB 10/12
Craig Verwey
Project Manager

Approved by: (Date)
13 Feb 2012
Nahil Rahman
Director – Pickering Projects

Pickering A Fuel Handling SPV Reliability Improvement 13 - 46634 (Capital) 13 - 46635 (OM&A)
Full Release Business Case Summary NA44 - BCS - 35300 - 00004 - R000

ATTACHMENT "A" PROJECT COST SUMMARY - 13-46635 (OM&A)

	$ 000's Capital	LTD Dec 2011	2012	2013	2014	2015	2016	2017	Later	Total
Accounting Basis	Project Mgmnt & Support	34	184							218
	Engineering	20	136							156
	Procurement									-
	Construction									-
	Other									-
	Assessments									
	Interest (Capital Project)									
	Project Costs									
	General Contingency									
	Specific Contingency									-
	Project Costs	54	6,952	-	-	-	-	-	-	7,006

	$ 000's Capital		LTD Dec 2011	2012	2013	2014	2015	2016	2017	Later	Total
Funding Basis	Current Release	Project Costs									
		Contingency									
		Total									
	Adj to Current Release	Project Costs									
		Contingency									
		Total									
	This Release	Project Costs									
		Contingency									
		Total									
	TTD Released	Project Costs									
		Contingency									
		Total	54	6,952	-	-	-	-	-	-	7,006
	Future Releases	Project Costs								-	-
		Contingency								-	-
		Total	-	-	-	-	-	-	-	-	-
	Project Funding										
	Contingency Funding										
	Total Funding		54	6,952	-	-	-	-	-	-	7,006

Budget	2011 - 2015 Business Plan	54	6,150							6,204
	Variance to Budget	0	170	0	0	0	0	0	0	170

Other	Removal Costs (above)									-
	Inventory W / O									-
	Spare Parts in Invent									-

Reviewed by: (Date) FEB 10/12
Craig Verwey
Project Manager

Approved by: (Date) 13 Feb 2012
Nahil Rahman
Director – Pickering Projects

ATTACHMENT "B" PROJECT VARIANCE ANALYSIS

	$ 000's Capital	LTD Dec 2011	Total Project: Last BCS Jan 2011	Total Project: This BCS Jan 2012	Variance	Comments
Scores Basis	Project Mgmnt & Support	2,161	2,500	3,835	1,335	See comments below.
	Engineering	461	1,100	2,304	1,204	See comments below.
	Procurement	1,909	6,000	4,672	(1,328)	New estimate based on actual cost per OPEX from Unit 4.
	Construction	[redacted]				
	Other					
	Analysis/Assessments					
					-	
					-	
					-	
	Interest (Capital Project Only)					
	Project Costs (Scores Basis)					
	General Contingency	[redacted]				Less is required due to OPEX from unit 4.
	Specific Contingency					
	Project Costs (Scores Basis)	**7,274**	**35,140**	**34,262**	**(878)**	

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

Comments:

PM increase due to:

- Field Eng./Rad. Protection/PM costs under estimated in previous release
- Increase in original Project duration

Engineering increase due to:

- Field Eng./FH Technical Support costs now included here vs. PM support.
- Configuration/Engineering cost greater than original estimate
- Additional engineering work for revision to Non-Identical Component Replacement (NICR) to be completed for Electrical Catenaries due to configuration issues.

Construction increase due to:

- Increase in project duration and TM Rotor Bearing Tooling development
- CMO and Rad. Protection costs now included here vs. PM

ATTACHMENT "C" SCHEDULE

Key Milestones

Completion Date	Description
26-Sep-12	Start of Installation, Unit 1, P1211 - SOI
2-Jan-13	Operations Acceptance/Readiness for Service for Unit 1 - AFS
9-Oct-13	Start of Installation, Unit 4 (remaining SPVs) , P1341 - SOI
30-Dec-13	Operations Acceptance/Readiness for Service for Unit 4 - AFS
30-Dec-14	Project Complete Milestone - PSM

A Project Execution Plan (PEP) will be approved by 29-Feb-12

In Service Declarations: (Capital only)

Date	Description	$000's (Total = Project Cost excl contg)	% In Service (= 100%)
31-Dec-11	SPV's in service in Unit 4 (P1141)	7,298	37
2-Jan-13	SPV's in service in Unit 1 (P1211)	10,426	53
20-Dec-13	Remaining SPV's in service in Unit 4 (P1341)	2,026	10
		19,750	100

Comments:

Attachment "D"

Risk Probabilities Chart

Likelihood	Improbable	Unlikely	Possible	Likely	Probable
Probability	<= 1 in 100	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 month	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 > $15MCat. 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 ORMajor 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 OrderCat. 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 finesORPotential 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 spillsEmission in exceedance of regulatory or legal limitsField orders or AMP'sPublic complaints with OPG implicationsDanger 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 scheduleORPossibility 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 - reportableAdministrative infractionsPublic 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 qualityRoutine non-conformance, can be easily dispositioned	Complaints from local public	Isolated non-complianceORRoutine approval / notification	No medical attention beyond first aid, no impairment to worker or complete recovery of worker	Administrative, non-reportable eventsCat. C spills non-reportable and spills resulting from Acts of God	

Attachment "E" Project Scope

The project scope is divided between two funding classes, Capital and O&MA. Scope of work for each funding class is listed below:

Capital – SPV's Replacement:

I. U1/U4 Fuelling Machine SPV parts Replacement/Refurbish/Overhaul

- Y drive Pillow Block Bearings replacement (SPV#10)
- Y drive Mitre box replacement (SPV20)
- Guide Column Reducing gear box (SPV30)
- Guide Column Ball nuts overhauling and tooling development (SPV35)
- Modification and replacement of wiring harness (SPV 195-515)
- Replacement of Catenaries (SPV 565)

II. U1/U4 FM Vault SPV parts Replacement/Refurbish/Overhaul

- Rolling shield Reducing gear box (SPV40)
- Rolling shield Mitre box (SPV45)
- Rolling shield chains (SPV55)
- Rolling shield Pillow block bearings (SPV56)
- Rolling shield Couplings (SPV50)
- Rolling shield sprockets (SPV57)
- Thrust bearing (SPV610)

III. Fuel Transfer mechanism SPV parts Replacement/Refurbish/Overhaul

- Ferguson drive clutch & brake (SPV145)
- Cable harness (SPV 170-190, 471,472.1,473.1,474.1,476.1,477.1,478.1,479,481,482.1,483.1,484)
- Elevator carriage overhaul (SPV 585)
- Fuel transfer bearing cam follower (SPV590)
- Transfer mechanism Carriage bearing /bushing (SPV 595)
- TM Ferguson drive (SPV 600)
- Fuel Transfer mechanism Overhaul (SPV 875)

- Elevator gear box (SPV 995)
- Elevator carriage (SPV 1000)
- Elevator top housing snout assembly (SPV 1005)
- Elevator top housing intermediate assembly (SPV 1006)
- Elevator top housing Take up assembly (SPV 1007)
- Elevator top housing sprocket (SPV 1010)
- Elevator top housing spherical roller bearing (SPV 1015)
- Roller bearing (SPV 1020)
- Elevator top housing sprocket assembly (SPV 1025)
- Elevator chain (SPV 1030)
- Elevator bottom housing sprocket (SPV 1035) (inspection only)
- 1&4-35230-DM2 (SPV 150)

IV. Irradiated fuel bay SPV parts Replacement/Refurbish/Overhaul

- Conveyor Cart Overhaul and develop tooling (SPV 580)

V. Stress analysis of FM pressure boundary and load bearing components for life extension.

- Carriage/Trolley load bearing structure/welds SPV 130
- FM Pressure Vessel SPV 135

VI. Non SPV oil Catenaries

- Oil Catenaries SPV 956

VII. Non SPV D2O Catenaries

- D2O Catenaries SP V957

OM&A – Assessments:

I. Ball Screw Stress Assessment

II. FM Pressure Boundary Stress Assessment

III. FM Carriage Trolley Stress Assessment