ONTARIO POWER GENERATION

Recommendation for Submission to the Board of Directors

March 5, 2010

NUCLEAR REFURBISHMENT PROJECTS

The purpose of this report is to provide an update on the Pickering B Refurbishment and Darlington Refurbishment Planning Activities Projects and to request Board approval on a partial release of funds pertaining to the Darlington Training and Mock-up complex.

Management submitted the Pickering B Integrated Safety Review ("ISR") Final Report to the CNSC on September 25, 2009. The CNSC is expected to render a decision on the ISR by the end of Q2, 2010. Management will continue to work with the CNSC to resolve and disposition any remaining issues in support of the Continued Operation Plan. The Pickering B Refurbishment Planning Activities project will be closed out in 2010.

Management continues to perform front-end planning in support of the Darlington Refurbishment project. Technical assessments and component condition assessments are nearing completion; regulatory work programs including the Integrated Safety Review are underway. A cross functional sourcing team has been established to finalize a contract strategy. Overall project planning, including scoping, estimating, scheduling, and the development of required project governance continues.

Planning to meet the infrastructure needs of the project is well underway. A Darlington Infrastructure report was issued in January identifying the infrastructure needs of the Darlington Refurbishment project. A Darlington Campus Master Plan working team has been established to coordinate infrastructure development at the Darlington site.

Based on lessons learned from refurbishments at Bruce Power and Pt. Lepreau, a minimum of two years of re-tube and feeder replacement tooling development, testing, and training is required on a full-size mock-up to avoid critical path delays during the refurbishment outage. As a result, Management is recommending the development of a Training and Mock-up Complex ("TMB") on OPG owned lands in the Clarington Energy Centre to the west of the Darlington NGS site.

This multi-purpose TMB will meet the needs and timeline of the Darlington Refurbishment project, including an information centre, training and security in-processing centre, a full-size mock-up, tooling, and testing facility for fuel channel and feeder replacement work in preparation for refurbishment execution, a warehouse to store refurbishment materials, and an office area to accommodate the off-site project management team.

Upon completion of the refurbishment project, the TMB will be turned over to the Inspection, Maintenance, and Commercial Services organization to consolidate their operations within the Darlington area.

RECOMMENDATION

That the Board of Directors approves the Training and Mock-up Complex Business Case including a partial release of funds in the amount of $18.4 in order to complete site servicing and contract tendering and prepare a full release Business Case by the end of 2010.

Submitted By:

ORIGINAL SIGNED BY:	**ORIGINAL SIGNED BY:**
W.R. Robinson Executive Vice President Nuclear Refurbishment, Projects and Support	Tom Mitchell President and Chief Executive Officer

This Board memorandum was reviewed and approved for submission to the Board of Directors by the Nuclear Generation Projects Committee on March 3, 2010.

UPDATE ON THE PICKERING B REFURBISHMENT PROJECT

1. Background

The Pickering B units were initially placed in service in 1983-1986. The nominal expected life was 30 calendar years, based on a pressure tube life of 210,000 EFPH at 80% capacity factor, with the possibility of extending life through replacement of major components. The current predicted nominal ends of service life are 2014 for Units 5, 6, and 7, and 2016 for Unit 8.

In June 2006, the Ontario Government directed OPG to assess the feasibility of refurbishing the existing nuclear plants and to begin an Environmental Assessment of the impacts of refurbishing Pickering B.

Based on the feasibility work completed to date, management has developed a good understanding of the regulatory requirements, environmental impacts, the scope of the project, the costs of refurbishment, and associated project risks. Due to the need to replace Steam Generators at Pickering B, and the required 5 to 6 year procurement lead time, the timing of a refurbishment of Pickering B would significantly overlap the Darlington Refurbishment project and other refurbishment projects in the province. This would present significant risks to the success of these projects, including project management and overall resource availability.

Management has also explored the continued operation of the Pickering B units for an additional four years beyond their current nominal operating lives (i.e. from 210,000 effective full power hours (EFPH) for an additional 30,000 EFPH to 240,000 EFPH, or until 2018 for Units 5 and 6 and 2020 for Unit 7 and 8), and is of the view that continued operation is possible with additional investments. Realization of this option would be of significant benefit to Ontario's electricity system during the 2014 to 2020 period.

In November, 2009, due to the economic benefit of the Continued Operation option at Pickering B, the required lead time to procure Steam Generators and the resulting overlap with other refurbishments, the scarcity of resources to manage multiple refurbishments in the province, and the need to manage the overall availability of OPG's nuclear fleet, Management recommended that OPG continue with the Continued Operation work program on Pickering B and not refurbish Pickering B.

In November, 2009, OPG's Board of Directors has approved Management's recommendation not to refurbish Pickering B and to continue to work on the Continued Operation option.

On February 16, 2010, OPG announced its decision to invest $300 million to ensure the continued safe and reliable operation of OPG's Pickering B nuclear generating station for approximately 10 years. Following this, OPG will begin the longer term decommissioning process as refurbishment of the Pickering B station will not be pursued.

In 2010, Management will close the Pickering B Refurbishment Planning Activities project.

2. Update on the Planning Activities Phase

The following sections summarize the status of the key work programs within the project:

a. Plant Condition Assessment

A rigorous Plant Condition Assessment of all critical components has been completed and forms the basis of the core project scope.

b. Environmental Assessment

On January 26, 2009, the CNSC issued their acceptance of the EA Screening Report. The report concluded that, taking into account the identified mitigation measures, the refurbishment and continued operation of the Pickering B nuclear station is not likely to cause significant adverse environmental effects.

c. Integrated Safety Review (ISR) Update

The Pickering B Integrated Safety Review (ISR) was submitted to the CNSC on September 25, 2009. The ISR, comprising of more than 2,000 pages of documentation in a 20-volume report, and a Global Assessment, concluded that the existing Pickering B station demonstrates a high level of compliance with modern codes and standards, and can be operated safely today and in the future, should the decision be made to refurbish the plant.

At this time, it is expected that the CNSC will complete their review of the Final ISR Report and render a decision by the end of Q2, 2010. Management will continue to work with the CNSC to resolve and disposition any remaining issues in support of the Continued Operation Plan.

d. Budget Update

The 2009 expenditures on the project are $4.3M on a plan of $4.8M. The project is $0.5M under plan due to lower spending on internal labour and contract costs (-$0.8M), partially offset by higher CNSC fees (+$0.3M).

Life-to-date expenditures as of December 31, 2009 for the Pickering B Refurbishment Planning Activities Project are $49.1M, including $44.8M in prior years, assessing the feasibility of refurbishing Pickering B. An additional $1.2M is expected to be spent in 2010 in order to obtain approval of the Final ISR report from the CNSC resulting in a total project cost, for the Planning Activities phase, of $50.3M.

UPDATE ON THE DARLINGTON REFURBISHMENT PROJECT

1. Background

Darlington nuclear units are currently predicted to reach the nominal ends of their service lives in 2019 and 2020. Service life predictions are developed by assessing the impacts of a number of operating, technical and regulatory considerations on both unit and station economics. A decision to remove a unit from service will likely be primarily an economic decision as the number of components requiring replacement grows and the frequency and duration of inspections required ensuring a unit's fitness-for-service increases. End-of-service life predictions are continually reviewed as new inspection information and knowledge of possible degradation mechanisms becomes available and future production levels are revised.

The goal of the refurbishment project is to provide approximately 30 additional years of post-refurbishment generation. The refurbishment would involve an outage for replacement of life-limiting components, as well as maintenance or replacement of other components which are most effectively done during the refurbishment outage period.

The initiation phase of the Darlington refurbishment project began in late 2007 following the directive from the Province requiring OPG to undertake feasibility studies on refurbishing its existing nuclear units. A feasibility assessment of the economics of refurbishing the Darlington units has been completed. The assessment indicated that the economics of refurbishing the Darlington units compared very favourably with alternative generation options.

Work completed in 2008 and 2009, including technical assessments of major components and a plant level condition assessment, was used in the feasibility assessment.

In 2008 preparatory work commenced on the ISR including CNSC approval of the ISR code effective date. In 2009, OPG completed a review of modern codes and standards in accordance with the requirements of the regulatory process in support of the ISR. Technical assessments of the major refurbishment components as well as plant condition assessments commenced. Planning related to the preparation of the EA was performed including the installation of groundwater monitoring wells in 2009 in order to start baseline monitoring in early 2010.

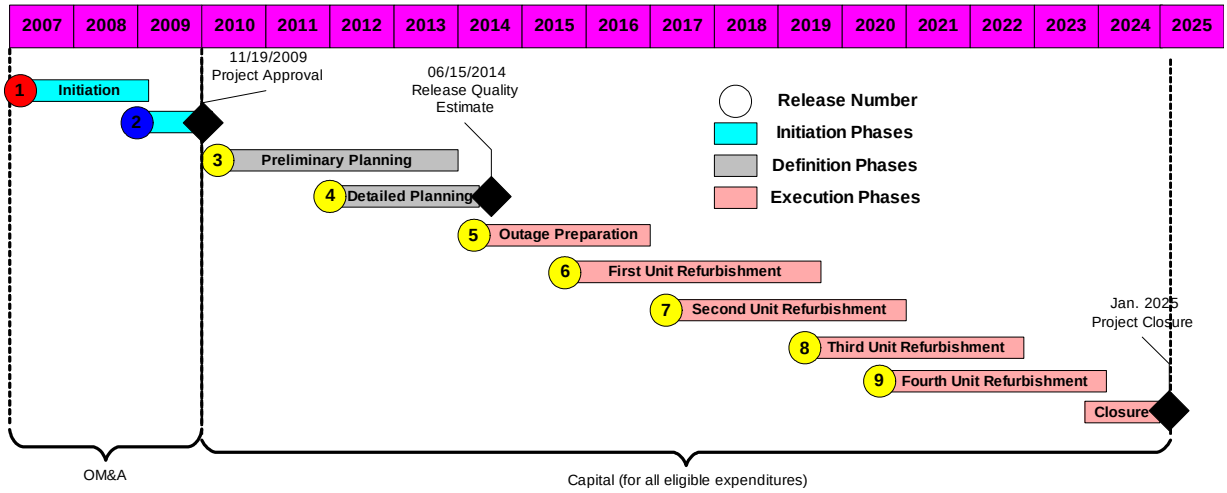
Based on the feasibility work completed to date OPG prepared an economic feasibility assessment of Darlington Refurbishment and a preliminary release business case. In November 2009, OPG's Board of Directors approved the overall timeline and release strategy for the Darlington refurbishment project as well as an initial release of funds for preliminary planning, including the development of required infrastructure, within the project definition phase.

On February 16, 2010, OPG announced its decision to proceed to the detailed planning phase for the mid-life refurbishment of the Darlington Generation Station.

2. Update on Planning Activities

The project is transitioning from the Initiation phase (completed in 2009) to the Preliminary Planning phase consistent with the following release strategy:

Figure 1: Overview of the Darlington Refurbishment Release Strategy



The work within the preliminary planning phase formally commenced as of January 1, 2010. This phase includes the following work programs:

- Establishment of the Project Management organization for the Definition phase of the project.
- Key vendors short listed or selected for the Engineering and Detailed Planning phase (Release 4).
- Confirm contracting strategies for balance of plant and execution phase work.
- Completion of the ISR, to assess key safety factors against modern codes and standards including review and acceptance by the Canadian Nuclear Safety Commission (CNSC). Identified issues would be assessed for inclusion in the refurbishment project scope.
- Completion of the Environmental Assessment and obtaining acceptance by the CNSC.
- Infrastructure planning and design completed. Contracts issued for initial infrastructure projects, including the Training and Mockup Building, Water and Sewer work.
- Development of a Human Resources and Labour strategy for the project.
- Confirmation of Cost Recovery and Financing means for the project. Finalize financing arrangements and cost recovery arrangements with required internal and external parties.
- Full development of all project controls governance. Further development of the project schedule, cost estimate, Project Controls, metrics and reports.

UPDATE ON THE DARLINGTON REFURBISHMENT PROJECT

The following sections summarize the status of the key work programs within the Preliminary Planning Phase of the project:

a. **Project Management and Planning**

Project Management Organization

Key roles required for the preliminary planning phase of the project have been established. All positions are currently filled except the Director of Construction and the VP of Refurbishment. These positions will be filled in 2010.

A human resources and labour strategy for the project will be developed in 2010. This strategy will address the organizational needs, including structure and size, based on the selected contract strategy as well as the labour strategy for all contract resources.

Project Governance

In June, 2009, the Darlington Refurbishment Program document, the Darlington Refurbishment Project Execution Plan (PEP), and the Project Controls program were all issued. The PEP has been updated in October, 2009 to incorporate the latest information. The Darlington Refurbishment Project Charter and a number of Project Controls procedures have been developed and issued in June and July.

In 2010, as part of the preliminary planning phase, additional governance will be developed and new processes and tools will be implemented to support the project. The initial focus will be in the area of scheduling, scoping, estimating, and project performance management.

Project Planning

Based on information received from the Retube and Feeder Replacement study and operating experience (OPEX) from Bruce Power and Pt. Lepreau, the current planning assumption is that the most likely critical path duration of each unit refurbishment is approximately 36 months, with a 16 or 19 month overlap to ensure that only two units are in a refurbishment state at any point in time. The overall refurbishment window is 88 months. The reference start date remains at October 2016. This schedule will continue to be refined as the technical studies and regulatory work programs are completed, risks are assessed, and detailed schedules and cost estimates are developed.

The following table summarizes the current refurbishment start dates and overall durations in use for planning purposes.

Unit	Start of Refurbishment Outage	Finish of Refurbishment Outage	Duration (months)	Overlap on Previous Unit
1st	**October, 2016**	September, 2019	36	
2nd	February, 2018	January, 2021	36	19
3rd	September, 2019	September, 2022	36	16
4th	January, 2021	**January, 2024**	36	19
		Unit Outage Months	144	
		Refurbishment Window	88	

The Darlington first unit outage reference plan of October 2016 is based on maximizing the economic benefit from the Darlington units. There is only a medium confidence level that the fuel channels in Darlington units can achieve 210,000 EFPH, which results in a first unit outage of October 2016 (at about 185,000 EFPH).

In the event that new information comes to light which indicates that 210,000 EFPH cannot be achieved with high confidence, the Refurbishment project needs to be prepared to start the first unit refurbishment outage sooner or adjust the refurbishment schedule to accommodate (i.e. increase the overlap period of multi-unit refurbishments). Currently the refurbishment schedule is based on a 36 month unit outage and two units in a refurbishment state at any point in time, with the second unit starting refurbishment once the first unit feeders are removed; any increase in overlap will increase the complexity of the project and increase project risk.

Due to the need to effectively perform complete front-end planning for a complex refurbishment outage, including the need to fully test tooling and train workers prior to working on the reactor face, analysis indicates that the outage could be advanced up to one-year, i.e. first unit refurbishment outage commencing in October 2015.

In response to this risk, the Darlington Refurbishment project is advancing its planning to be ready to proceed with the first unit outage as early as October 2015, if required. This requires the advancement of a number of infrastructure improvements, i.e. the Training and Mock-up facility for tooling testing and training for the Retube and Feeder Replacement contractor, development of project offices, security buildings, waste management facilities, and contractor facilities. The timely submission and CNSC acceptance of the EA is also critical in Management's ability to meet the advanced timeline. The EA approval is required prior to commencing construction on many of the facilities required by the refurbishment project.

Contract Strategy

A preliminary contract strategy was prepared in December 2009. A cross-functional sourcing team has been established to further develop the contract strategy and assist the Nuclear Refurbishment organization with the execution of the strategy, including the selection of major component suppliers.

Contract strategy finalization and selection of a contract partner for the Re-tube and Feeder Replacement work is a pre-requisite to proceeding to the detailed engineering and planning phase. This program is currently tracking to plan with a Cross-Functional Sourcing Team kickoff meeting held on February 12th, 2010.

b. **Technical Scope**

In June 2008, based on a review of the expected life of the critical components and their current life cycle plans, the CEO approved the reference outage scope and schedule as an initial planning assumption for the Darlington NGS Refurbishment project. Technical assessments of the major refurbishment components as well as plant condition assessments commenced to support the refinement of the project scope and cost.

Steam Generators (SG)

As recommended by Management in April, 2009, steam generator (SG) replacement has been excluded from the reference outage scope; however, an SG primary side boiler clean is included in the scope of the project.

Fuel Handling

The Fuel Handling Component Condition Assessment (CCA) was completed in December 2009. Based on the number of fuelling cycles, the report indicated that the fuelling machine head pressure boundary components will reach the end of their design life in 2023. However, a preliminary assessment has indicated that further analysis can be performed to show that these major

components of the fuelling machine will have sufficient fatigue life to reach the proposed life extension. Re-analysis and re-registration with the regulatory authority is required.

Fuel Machine bridges and carriages need to be overhauled during the refurbishment outage. An overhaul of various mechanical components and possible replacement of ball screws may also required.

Fuel Handling trolleys need to be overhauled for life extension, including replacement of power and signal cables as well as some mechanical components.

Turbine/Generators

CCAs related to the Turbine Generator and auxiliaries are also complete. The final report was completed in February 2010 and indicated the following scope:

1. Upgrade the analogue turbine supervisory, control and generator excitation systems to digital controls. The current components are obsolete and technical support is becoming limited.

2. Replace / upgrade hydrogen gas cooling, stator water cooling and generator seal oil systems.

3. The generator stators are to be rewound for life extension. A single midsection can be purchased to enable swap out of the stators in subsequent units.

Re-tube and Feeder Replacement

The technical assessment for pressure tubes, calandria tubes, and feeders is complete. Information from these reports has been used to determine the project's critical path (approximately 36 months). Refurbishment is proceeding with plans to perform a chemical decontamination of the reactor to reduce radiation levels for the reactor face work.

A full-size mock-up is required at least 24 months prior to the start of the refurbishment outage to test tooling and train staff. Insufficient tooling testing and training time has resulted in critical path delays, during execution, for current ongoing refurbishments.

Balance of Plant Condition Assessment

An assessment on the condition of the "balance of plant" systems was planned to be completed in 2009. Due to a breach of contract, the contractor was suspended and subsequently terminated. OPG developed a strategy to complete this work in-house.

As of January 31, 2010, OPG met its target of preparing over 1,200 balance-of-plant condition assessments. This achievement was accomplished through dedicated team effort between the Darlington station and Nuclear Refurbishment. The cost of this program was approximately $4.0M lower than planned due to the decision to perform this work in-house.

The CCA's will now be reviewed and used as a basis to develop the balance-of-plant refurbishment scope.

c. **Environmental Assessment**

OPG will assess whether there is any significant impact on the environment due to the refurbishment and continued operation of Darlington for an additional 30 years. The Environmental Assessment will commence in 2010, however, data sampling is currently underway in preparation for this work. Initial baseline data has been reviewed and gaps have been identified. Further work in the areas of groundwater quality and flow rates, storm water mapping, and socio-economic studies are needed.

Nuclear Refurbishment plans to take advantage of the results of the EA completed for the Darlington New Nuclear project in order to submit the EA to the CNSC by December 2011. Approval is anticipated by the by the fall of 2012.

d. **Integrated Safety Review (ISR) Update**

An assessment of key safety factors against modern codes and standards is underway. The CNSC has accepted July 31, 2008 as the code effective date for the ISR review. A contract was released in January 2009 to complete 76 ISR code reviews by the end of 2009; this work was completed in November 2009.

Preparation of Safety Factor Reports is commencing. RFP's for contracts on the Plant Design, Equipment Qualification, Ageing and Actual Conditions of Systems, Structures, and Components, Emergency Planning, and Safeguard Assessments safety factor reports are in progress.

The Darlington A Risk Assessment (DARA), Level 3, is a required input for the ISR and EA programs. The DARA Project is on the refurbishment projects critical path to meet the submission dates of the EA. The project is currently on track to submit DARA Level 3 results to the Refurbishment project, for inclusion in the EA and ISR, by March 31, 2011. The two projects continue to work together to ensure an integrated approach to meeting the station and the refurbishment milestones related to DARA. The Nuclear Refurbishment project is integrating the DARA schedule with the refurbishment schedule to ensure appropriate levels of monitoring and oversight for this critical path activity.

An Integrated Implementation Plan (IIP), which defines the scope of the refurbishment outage and is the basis of a release quality cost and schedule, must be approved by the CNSC prior to commencing with the refurbishment outage. The Integrated Implementation Plan (IIP) governance was issued in September, 2009.

e. **Budget Update**

In the 2009 to 2013 Business Plan, the Board of Directors approved a budget of $38M over the 2008 to 2009 period for the planning activities phase of the project, of which $30.3M is allocated to the 2009 work program. Additionally $7.7M was incurred in 2008.

The 2009 expenditures on the project are $8.8M under plan at year end, resulting in life-to-date expenditures, as of December 31, 2009, of $29.3M for the Darlington Refurbishment Planning Activities Project. The 2009 under-expenditures are due to lower spending on the Plant Condition Assessment work (-$5.9M), deferral of other contract work (-$1.7M), scope reduction on the Steam Generator Study (-$0.7M) and other internal labour or contract costs (-$1.4M); partially offset by addition of new work (+$0.4M), and higher costs related to the Re-tube and Feeder Study (+$0.5M).

3. Update on Infrastructure Planning

In February 2010 OPG announced its decision to commence the definition phase of the Darlington Refurbishment project. Capital funding has been released to develop required infrastructure to support the Darlington Refurbishment and post-refurbishment operations period.

A Darlington Master Campus Plan working team was established in December to provide oversight to the infrastructure improvements required in support of the Darlington Refurbishment project as well as in support of the required infrastructure for an additional 30 years of post-refurbishment operations. The team continues to meet on a regular basis and is developing an overall plan to meet the infrastructure requirements.

Funds for the infrastructure development in support of refurbishment were approved at the November, 2009 Board meeting, however, the project stated that a Business Case Summary (BCS) would be prepared for each facility to be constructed from those funds. A business case summary has been prepared for the Training and Mock-up Complex ("TMB").

a. **Training and Mock-up Complex**

A Training and Mock-up facility is required in support of the re-tube and feeder replacement contractor. The contractor will require a facility to perform testing of its tooling and training of staff, in advance of the start of the first unit outage. Based on lessons learned from refurbishments at Bruce Power and Pt. Lepreau, a minimum of two years of re-tube and feeder replacement tooling development, testing, and training is required on a full-size mock-up to avoid critical path delays during the refurbishment outage. As a result, Management is recommending the development of a Training and Mock-up Complex ("TMB") on OPG owned lands in the Clarington Energy Centre to the west of the Darlington NGS site.

This multi-purpose TMB will meet the needs and timeline of the Darlington Refurbishment project, including an information centre, training and security in-processing centre, a full-size mock-up, tooling, and testing facility for fuel channel and feeder replacement work in preparation for refurbishment execution, a warehouse to store refurbishment materials, and an office area to accommodate the off-site project management team.

Upon completion of the refurbishment project, the TMB will be turned over to the Inspection, Maintenance, and Commercial Services organization to consolidate their operations within the Darlington area.

A Training and Mock-up Complex partial release business case summary ("BCS") has been prepared by Management. Management is requesting approval of the BCS including a partial release of funds in the amount of $18.4M in order to proceed with a subdivision agreement with the Municipality of Clarington as well as the construction of site services (water, hydro, sewer, roads, etc.).

Over the next six months, the project team will develop a detailed specification for the Training and Mock-up Complex, tender and select an EPC contractor to design and construct the facility. A full release BCS will be prepared by the end of 2010. On this timeline, Construction would commence by mid 2011 and be complete by mid 2013 meeting the timeline requirements of the Darlington Refurbishment project.

4. Budget Update

In the 2009 to 2013 Business Plan, the Board of Directors approved a budget of $38M over the 2008 to 2009 period for the planning activities phase of the project, of which $30.3M is allocated to the 2009 work program. Additionally $7.7M was incurred in 2008.

The 2009 expenditures on the project are $8.8M under plan at year end, resulting in life-to-date expenditures, as of December 31, 2009, of $29.3M for the Darlington Refurbishment Planning Activities Project. The 2009 under-expenditures are due to lower spending on the Plant Condition Assessment work (-$5.9M), deferral of other contract work (-$1.7M), scope reduction on the Steam Generator Study (-$0.7M) and other internal labour or contract costs (-$1.4M); partially offset by addition of new work (+$0.4M), and higher costs related to the Re-tube and Feeder Study (+$0.5M).