ONTARIO POWER GENERATION

Records File Information:
See Guidance Section

OPG-FORM-0076-R003*

Type 3 Business Case Summary

Final Security Classification of the BCS: **OPG Confidential**

To be used for investments/projects meeting Type 3 criteria in OPG-STD-0076.

Executive Summary and Recommendations					
Project #:	16-34000	**Title:**	Darlington Auxiliary Heating System Project		
Phase:	Execution		**Release:**	Partial	
Facility:	Darlington		**Records File:**	D-BCS-00120.3-10003	
Class:	Capital		**Investment Type:**	Regulatory	

Project Overview

We recommend the release of $33,027 k ($ [redacted] base costs plus [redacted]).

This release will fund the engineering, procurement and construction of the new DNGS Auxiliary Heating System (AHS) Boilerhouse Facility. The project scope is to construct a new Boilerhouse and subsequently demolish the existing Construction Boilerhouse (CBH).

Approval of this request will bring the total to date funding to $40,463k including contingency of $ [redacted] The total project is currently estimated to cost $45,607k ([redacted]). The new AHS Available for Service is currently planned on or before Apr 1st, 2015; prior to the 2015 Station Vacuum Building Outage (VBO) planned to start on Apr 3rd, 2015, to provide steam for TRF processes and heating to the station.

The business objective of this Regulatory project is to provide a source of reliable back-up steam to the Darlington Nuclear Generating Station (DNGS) main heating steam header to support irregular operating conditions in the event when all four turbine units are shut down in the winter to mitigate potential major equipment damage due to freezing. This will be achieved by replacing the existing original Construction Boilerhouse (CBH) with a new facility that can, in the event of a four unit shutdown, provide reliable back-up steam at a sufficient capacity to provide the required calculated equivalency (110,000 kg/hr) of steam lost from the turbine units. This back-up steam will contribute significantly to maintaining the temperature inside the Powerhouse and Tritium Removal Facility/Heavy Water Management Building (TRF/HWMB) above 10°C to prevent impairment of essential systems due to freezing.

The Investment Type of this Project is Regulatory to mitigate the concerns found in a Regulatory Action Request. A long term action plan to address the legacy issues is in place, of which this project is a key component with an objective of determining and implementing the most viable alternative to the current CBH.

The previous Full Definition Release BCS funded the modification planning and detailed engineering of the new AHS Boilerhouse, and preparation and submittal of this Partial Execution Release BCS.

This Partial Execution Release BCS will fund the engineering, procurement and construction of the new AHS Boilerhouse, and preparation and submittal of the Full Execution Release BCS. The Full Execution Release BCS, scheduled for Q1 of 2014, will fund subsequent demolition of the existing CBH, and close-out of the project. Estimated completion date for project close-out is Dec 30th, 2016.

This project is categorized as an ongoing operational support Campus Plan project required to meet the additional extended Darlington station life. The project funding will be accommodated within the Darlington Refurbishment Infrastructure Program. The on-going operating costs will be funded from Darlington station OM&A.

*Associated with OPG-STD-0076, Developing and Documenting Business Cases

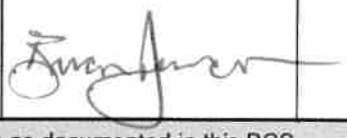
Type 3 Business Case Summary

Project Cash Flows									
k$	LTD	2012	2013	2014	2015	2016	2017	Future	Total
Currently Released	1,429	2,677	3,330						7,436
Requested Now	-	(1,033)	10,762	23,298					33,027
Future Required	-			2,317	2,625	202			5,144
Total Project Cost	1,429	1,644	14,092	25,615	2,625	202			45,607
Ongoing Costs	-								
Grand Total	1,429	1,644	14,092	25,615	2,625	202			45,607

Estimate Class:	Class 3	**Estimate at Completion:**	$ 39,056 k
NPV:	$ (29,490) k	**OAR Approval Amount:**	$ 45,607 k

Additional Information on Project Cash Flows (optional):

Grand Total does not include ongoing operating costs (Darlington Station OM&A).

Approvals			
	Signature	**Comments**	**Date**
This BCS represents the best option to meet the validated business need in a cost effective manner.			
Recommended by: Brian Duncan SVP, Darlington Project Sponsor		None	Oct 29/2012
I concur with the business decision as documented in this BCS.			
Finance Approval: Donn Hanbidge Chief Financial Officer Position per OPG-STD-0076			Nov 9/12
I confirm this project will address the business need, is of sufficient priority to proceed, and provides value for money.			
Approved by: Tom Mitchell President and CEO Position per OAR, per OAR 1.1			12 NOV 12

ONTARIO POWER GENERATION

Records File Information:
See Guidance Section

OPG-FORM-0076-R003*

Type 3 Business Case Summary

Final Security Classification of the BCS: **OPG Confidential**

Business Case Summary

Part A: Business Need

Business Need:

Under normal or abnormal operating conditions, the temperature inside the DNGS Powerhouse, TRF/HWM Building and other support buildings is required to be maintained, to prevent freezing. This is achieved using the existing heating steam system and local electrical heating equipment. Section 11.3.1 of the Darlington Safety Report, requires that a system be in place to prevent equipment and line freezing in the event of a design-basis four unit shutdown in the winter.

The current approach is to use the Construction Boilerhouse to provide back-up heating steam. The design basis for the Boilerhouse is to provide sufficient heating steam to maintain the station above 10°C when all operating units are shutdown. This project is not a reaction to post-Fukushima planning.

The current Construction Boilerhouse (CBH) facility was originally placed in service at the time of site construction in the early 1980's. This existing Boilerhouse has a total capacity of supplying up to approximately 45,000 kg/hr steam. The oil-fired boilers are used infrequently and were obtained at the time from other former Ontario Hydro construction projects. Electric boilers are also incorporated and provide the majority of the steam supply. The boilers and related equipment have received only limited and intermittent maintenance. The condition of the remaining systems, structures, and components has been assessed under Component Condition Assessments (CCA's). The piping and pipe supports require immediate field work. Other components require attention within the next 1-5 years.

The current CBH facility at Darlington cannot continue to provide this capability because:

- It is past its useful end of life.
- It does not have sufficient installed capacity.
- The current building and oil feeder piping does not meet the current code requirements.
- It was never designed as a permanent system or structure hence it is costly to maintain (foundation upgrades, pipe maintenance in pits, etc.)
- It does not meet the reliability requirements of an unavailability target of 1×10^{-2}.

Major activities and deliverables completed under the November 2010 Developmental BCS Release include:

1. A Gap Analysis Report was issued to determine whether the previous recommendation of constructing a new Auxiliary Heating Steam Facility was still feasible when the new requirements that were identified in the GOTHIC Analysis and revised Project Charter were considered.
2. Design Requirements were revised to specify the technical requirements for new AHS system taking into consideration future uses of heating steam such as the new Water Treatment Plant and D2O Storage Facility.
3. Black Start Option Benefit Cost Analysis and Economic Risk Assessment.
4. New AHS Nuclear East Facilities/DNGS Operations & Maintenance system responsibility memo.
5. Front End Planning, Project Execution Plan (PEP), and preparation of Developmental Release BCS.

Major activities and deliverables completed under the October 2011 Developmental BCS Release include:

6. Completed Civil, Mechanical, and Electrical ground scanning and drawing review of new AHS proposed site.
7. Completed Preliminary Geotechnical Analysis at the building site.
8. Completed a GOTHIC Analysis of the previously omitted site facilities to identify areas of vulnerability that will remain after implementation of this project. Identified vulnerable areas in both commissioned GOTHIC Analysis reports may still require some type of temporary or permanent mitigation to be implemented for provision of supplementary heat in order to prevent equipment and line freezing in the event of a design-basis four unit shutdown in the winter; however, mitigating measures are not included in this project's scope.
9. Performed ultrasonic thickness condition assessment/inspection of the existing steam/condensate piping located in Unit 1 and Unit 3 to evaluate whether it will reach station EOL in 2055.
10. Prepared and issued EPC RFP, evaluated submitted Proposals, negotiated and selected successful proponent.
11. Front End Planning, Project Execution Plan (PEP), and preparation of Full Definition Release BCS.

Major activities and deliverables planned for the Sep 2012 Full Definition BCS Release include:

12. Award EPC contract to successful ES MSA vendor for new AHS Boilerhouse.
13. Complete Modification Planning and Detailed Design for new AHS Boilerhouse.
14. Complete Geotechnical Investigation at the building site for new AHS Boilerhouse.
15. Identify Long Lead material items for new AHS Boilerhouse.
16. Front End Planning, Project Execution Plan (PEP), and preparation of Partial Execution Release BCS.

ONTARIO POWER GENERATION

Records File Information:
See Guidance Section

OPG-FORM-0076-R003*

Type 3 Business Case Summary

Part B: Preferred Alternative

Description of Preferred Alternative: Construct New AHS Facility

This option is recommended. The new AHS system shall be designed to an unavailability target of 1 x 10^{-2}, as well as a required heating steam rate of 110,000 kg/hr as specified in the Design Requirements. A quantity of two oil fired, water tube boilers are considered the best selection for boilers of this size and capacity. The total on-going operating costs are currently estimated at $350k per year. This on-going operating cost is not incremental, and is equal to the current operating costs of the CBH.

The Scope of Work proposed under this Partial Execution Release BCS is summarized below:

- New AHS Boilerhouse:
  - *EPC Contract Phase 2 Release Deliverable:*
    - Site preparation – Relocate and/or mitigate affected buried services in Owner Only construction island.
  - *EPC Contract Phase 3 Release Deliverables:*
    - Procure all materials,
    - Install AHS Facility and Building Services including tie-ins,
    - Install AHS Process and ancillaries,
    - Install Station System tie-ins, and
    - Commission AHS Facility and Process.
    - AFS for new AHS Facility and Process.
- Preparation and issuance of EPC Request For Proposal, and evaluation of submitted Proposals for Demolition of existing Construction Boilerhouse (CBH).
- Front End Planning, preparation of Full Execution Release BCS, and Project Execution Plan (PEP)

The priority of the project is tied to the next station Vacuum Building Outage and the results of the CCAs. The Charter stated expected objective is that the AHS shall be Available for Service prior to the next station Vacuum Building outage in April 2015. The strategy to maintain the existing Construction Boilerhouse as identified in the CCAs shall take into consideration the schedule for completion of the new AHS, to minimize the required maintenance work in the existing boilerhouse.

Deliverables:	**Associated Milestones (if any):**	**Target Date:**
This Release:	***This Release:***	***This Release:***
New AHS - Modification Planning Complete	New AHS-Prelim Design Complete	Apr 16th, 2013
New AHS - Long Lead Items Procurement Initiated	New AHS-LLM. Items PO Awarded	Jun 3rd, 2013
New AHS - Detailed Engineering Complete	New AHS-Detailed Eng Complete	Oct 22nd, 2013
New AHS - Installation and Comm. Planning Complete	New AHS-Start of Construction	Jan 23rd, 2014
Full Execution Release BCS OAR Approved	Full BCS OAR Approved	Apr 30th, 2014
New AHS - Installation and Commissioning Complete	New AHS-Final AFS	Apr 1st, 2015
Future Releases:	***Future Releases:***	***Future Releases:***
Full Execution Release BCS OAR Approved	Demo CBH-EPC PO Awarded	May 30th, 2014
Demo CBH - Modification Planning Complete	Demo CBH-Prelim Eng Complete	Aug 29th, 2014
Demo CBH - Detailed Engineering Complete	Demo CBH-Detailed Eng Complete	Feb 13th, 2015
Demo CBH - Demolition Planning Complete	Demo CBH-Start of Demolition	Aug 14th, 2015
Demo CBH - Demolition Complete	Demo CBH-Final AFS	Dec 31st, 2015
Plan Complete	Plan Complete	Dec 30th, 2016

ONTARIO POWER GENERATION

Records File Information:
See Guidance Section

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Type 3 Business Case Summary

Part C: Other Alternatives

Base Case: Status Quo – No Project

The option of Status Quo (Do Nothing) is not recommended. The existing Construction Boilerhouse does not meet a unavailability target of 1×10^{-2}. Additionally, the condition of the systems, structures and components has been assessed under CCA's which indicate that the piping and pipe supports require immediate field work. Other components require attention within the next 1-5 years. Furthermore, the existing boilerhouse only supplies 45,000 kg/hr steam, while the new Design Requirements indicate the back-up steam required is 110,000 kg/hr.

Alternative 2: Delay Work – Delay Construction of New AHS Facility

This option is not recommended. The priority of the project is tied to the next station Vacuum Building Outage and the results of the CCAs. The project is required to be completed prior to the next station Vacuum Building Outage in 2015 to provide steam for TRF processes and heating to the station. In addition, delaying this project will result in significant OM&A costs (foundation upgrades, pipe maintenance in the pits, etc.) to the existing boiler house identified in the CCAs. This alternative was considered and eliminated, therefore, not included in the financial evaluation.

Alternative 3: Boiler Rental

Boiler rental from an external company is not recommended. Two different options of Boiler rental were preliminarily examined; delivery of portable boilers during an emergency situation and on-site rental units.

The most critical disadvantage of delivery during an emergency situation is the high potential for significant delays before full capacity steam is available and provided for use in the plant, due to reliance on an external company and the logistics involved in mobilization, transportation to site, and set-up in an emergency situation. Estimates range from 24-36 hours before the boiler units reach site, plus additional connection time before steam will be available.

Further disadvantages include:

- High stresses induced in boiler components and structures due to difficulties in alignment during installation or sagging foundation over time,
- Portable boilers generally have horizontal cylindrical design to allow transportation on highways, and as a result, may require larger footprints than stationary boilers, and
- Capacity of a portable boiler is currently limited to about 34,000 kg/hr (for highway transportation), hence 3-4 units would be required to satisfy the required demand.

Although larger portable boiler units are available for rental and could be transported by freight for installation on-site, this alternative is also not desirable due to the following:

- The boilers would still require a small enclosure and heat tracing on the feed water piping for protection from the elements,
- Portable boilers and equipment on the skid would not be tagged to OPG standards. As such, a contract with a third party would be required for maintenance and operation (approximately $200-400K / year, budgetary), and
- Rental costs for the required size / number of portable units is estimated at approximately $180K/month ($2.2M / year), depending on the length of the contract.

Furthermore, similar to the recommended option, boiler rental will still require installation of steam, condensate, fuel and demineralized water tie-ins to the station and possibly installation of new electrical lines to support the rental units.

Alternative 4: Construct New AHS Facility with Black Start Capability

This alternative was considered and eliminated. This would add approximately $20M to the total initial project costs of Alternative 1, plus an additional $0.75M in maintenance costs per year totalling ~ $45M from 2015 to 2055. Two independent assessments were obtained: an economic risk assessment performed internally by Nuclear Finance, and a Black Start economic assessment performed externally, which both concluded that it is not economically justified to include a Black Start capability into the new AHS. This alternative is, therefore, not included in the economic analysis of this BCS.

Alternative 5: Refurbish Existing Construction Boilerhouse

Similar to the Base Case, Refurbishment of the existing Construction Boilerhouse is not recommended based on the fact it does not meet the minimum unavailability target, nor does it supply the required amount of steam per the Design Requirements.

Alternative 6: Alternative Fuel Supplies

Alternative fuel supplies were examined for the AHS including electric, gas, and electric/oil combination fired boilers. These types of boiler facilities are not recommended. The cost to install new electric transmission lines and a switchyard, or natural gas transfer lines to site is in excess of $6M (per preliminary estimates). Dealing with two types of technology for combination boilers adds further logistical and cost concerns. Considering the Boilerhouse facility does not operate frequently, the additional costs associated with installation are not justified.

*Associated with OPG-STD-0076, Developing and Documenting Business Cases

ONTARIO POWER GENERATION

Records File Information:
See Guidance Section

OPG-FORM-0076-R003*

Type 3 Business Case Summary

Alternative 7: Co-Generation Plant

A Co-Generation plant is not recommended due to the high initial investment cost of approximately $100M. There are also no corporate drivers to support this alternative at this time. Additionally, it is unlikely that real estate would be available at Darlington to site the co-generation plant in such a way that the steam transmission lines can be kept reasonably short. Delays due to likely need for an environmental assessment will make meeting the project schedule impossible.

Part D: Project Cash Flows

k$	LTD	2012	2013	2014	2015	2016	2017	Future	Total
Currently Released	1,429	2,677	3,330						7,436
Requested Now	-	(1,033)	10,762	23,298					33,027
Future Required	-			2,317	2,625	202			5,144
Total Project Cost	1,429	1,644	14,092	25,615	2,625	202			45,607
Ongoing Costs	-								
Grand Total	1,429	1,644	14,092	25,615	2,625	202			45,607

Estimate Class:	Class 3	**Estimate at Completion:**	$ 39,056 k	**OAR Approval Amount:**	$ 45,607 k

Additional Information on Project Cash Flows (optional):

Grand Total does not include ongoing operating costs (Darlington Station OM&A).

Part E: Financial Evaluation

k$	Preferred Alternative - New AHS Facility	Alt 3 - Boiler Rental	Alt 5 - Refurb Boilerhouse	Alt 6 - Alternate Fuel	Alt 7 - Co-Gen Plant
Project Cost	(37,627)	(47,581)	(42,609)	(46,090)	(121,432)
NPV (after tax)	(29,490)	(46,654)	(34,574)	(35,993)	(89,217)
Other (e.g., LUEC)	N/A	N/A	N/A	N/A	N/A

Summary of Financial Model Key Assumptions (see Guidance on this Type 3 BCS Form):

(1) Discount rate of 7%.

(2) Escalation rate of 2%.

(3) Interest rate of 5% on capital costs.

(4) Ongoing Operating & Maintenance Costs used for NPV calculations are based on Project high level estimates. Operating & Maintenance Costs that are not incremental were not included in the NPV calculations.

(5) The NPV values are after tax $2012.

(6) Project Costs include demolition costs.

Type 3 Business Case Summary

Part F: Qualitative Factors

Another benefit associated with the project includes:

- Mitigate increased risk during refurbishment for reliable and sufficient heating steam in the event of a four unit outage, as there will be extended durations where two units are shutdown for scheduled refurbishment activities, effectively increasing the likelihood of a four unit outage. A Station Containment Outage (SCO) is currently scheduled for 2022 during refurbishment; therefore, the AHS will be required to provide steam for TRF processes and heating to the station during that time period.

Part G: Risk Assessment

Risk Class	Description of Risk	Risk Management Strategy	Post-Mitigation	
			Probability	Impact
Cost	The Plant system tie-in assumptions stipulated in the SOW for Steam / Condensate / Demin Water / Fuel maybe determined to be inadequate when calculated volume/capacity is developed during detailed design. It is already known that the Steam line is inadequate for the new capacity, however, the final design configuration to provide the optimum routing cannot be determined during the conceptual phase of the project.	Accept: Assigned $3M Specific Contingency based on 3rd Party Estimates for postulated possible design alternatives.	High	Medium
Scope	The pending revision to the ECC Risk Based Process to replace or include the existing FMOD process may introduce additional scope into the contract due to additional requirements that are not currently required per FMOD.	Accept	Medium	Medium
Schedule	When excavating for Building or Plant Systems unexpected buried services, and/or unidentified items could be discovered by Contractor.	Accept: EPC Contractor to engage FE immediately upon discovery of any buried services / unidentified items not marked in the field or shown on site drawings/plans.	Medium	High
Resources	OPG resources (Ops, Maint, Design, FE, CMO, Security, RP, etc.) unavailable to provide support during entire ~ 2 year execution period.	Mitigate: 1. Communicate and engage affected OPG work groups well in advance to ensure support will be available during the required time. 2. Schedule tasks where possible when resources will be available. (i.e. outside of planned outages)	Low	High
Quality/ Performance	QS process to be performed by FE for EPC vendor's is new role for OPG. Issues may arise due to unfamiliarity with the process and expectations. Procedure may be revised to address identified issues.	Accept: Current assumption is oversight will be in accordance with OPG's Contractor Quality Surveillance Procedure.	Medium	Medium
Technical	Potential for issues pertaining to changes in code requirements at the tie-ins where new piping connects to old existing piping.	Accept: Reconcile any identified code issues as required during detailed design.	High	Medium

Type 3 Business Case Summary

Scope	As a result of the Sewage Treatment Plant being decommissioned, the new AHS may not be able to discharge (blowdown & condensate) to the municipality and may need to run piping and tie-in to inactive drainage (inside the Station) or Condenser Cooling Water (CCW) resulting in additional design/scope/schedule impact.	Accept: EPC Contractor to establish during modification planning and detail design stages requirements to comply with MOE Environmental Compliance Approval(s)/Condition(s).	Medium	High
Schedule	The Installation / Commissioning of the AHS is not completed before the start of the 2015 Station Vacuum Building Outage AFS. (no later than Mar 31, 2015)	Mitigate: Existing CBH to remain in-service until after new AHS has been successfully AFS'd / turned over.	Medium	High
Scope/Cost	Cost of EPC contract increases due to discovery work or work not captured in Scope of Work or contract assumptions.	Accept: Discovery issues/items to be resolved via Change Management Process as necessary.	Medium	High
Schedule	Excavation under the Security Fence - Potential for a variety of issues (including voids) and delays when routing the steam, condensate, demin, and fuel under the Security Fence.	Accept: 1. Incorporate OPEX to help mitigate potential issues to extent possible. 2. Allow adequate time to resolve any discovery issues in installation schedule.	Medium	High
Scope	Due to unknown conditions (below grade) extra work might be required to repair or support the existing underground service tie-ins.	Accept: EPC Contractor to identify / resolve Potential Issues regarding tie-in connections during Detailed Design. If deemed additional scope it will be resolved via Change Management Process (CCA) as necessary.	Medium	Medium
Schedule	Improper storage of materials or equipment onsite/offsite by contractor may cause damage either physically or by exposure to harsh environmental conditions.	Transfer: 1. Contractors responsibility per ES MSA. 2. Prior to OPG acceptance (AFS) all equipment must be in good working condition. 3. Once AFSd, 2 year warranty in effect per ES MSA agreement. In the event of failure, 2 year warranty clock restarts again upon replacement / repair.	Low	Medium

Type 3 Business Case Summary

Schedule	Delays in material procurement (by contractor, subcontractor and/or OPG) causing installation delays. This includes qualified vendors being on the OPG ASL for EPC contracts.	Transfer: 1. Contractors responsibility per ES MSA. 2. EPC Contractor to develop a Procurement Plan which will include Long Lead Items and equipment procurement specifications, during the modification planning phase. 3. Contractor to ensure materials are ordered well in advance to support implementation schedule.	Low	Medium
Schedule	Delays to project schedule due to regulatory approvals taking longer than required.	Mitigate: 1. Initiate communications with regulatory agencies in advance of formal submissions to seek agreement in principle with proposed pending changes. 2. Stage EC releases to provide adequate time for regulatory agencies to review and respond to submissions to align and meet project schedule.	Low	Medium
Schedule	Weather conditions cause unforeseen delays during installation.	Mitigate: 1. EPC Contractor to factor Heat Stress and "average" Weather Conditions into schedule. 2. EPC Contractor to factor potential dewatering activities into schedule.	Low	Medium
Technical	Final Specifications for interfacing Projects do not meet the AHS demand. (i.e. New Water Treatment Plant, Domestic Water Upgrade, or site Electrical Upgrade)	Mitigate: Co-ordinate with interfacing projects to ensure the needs of the AHS are clearly identified and incorporated.	Low	Medium
Resources	EPC Contractor does not resource Project adequately resulting in delays.	Transfer: 1. OPG to award contract as early as practical and avoid to the extent possible any subsequent delays as phased work is released to contractor. 2. Contractor is responsible to work with Union Halls and staff project appropriately to support execution schedule.	Medium	Medium

Additional Risk Analysis:

See Risk Management Plan in the Project Execution Plan for more detail.

Type 3 Business Case Summary

Part H: Post Implementation Review (PIR) Plan		
Type of PIR	**Target Project In Service Date**	**Target PIR Completion Date**
Simplified	2015-04-01	2016-12-30

Measurable Parameter	Current Baseline	Target Result	How will it be measured?	Who will measure it? (person/group)
Provide heating steam flow rate of 110,000 kg/hr as per Design Requirements.	45,000 kg/hr	110,000 kg/hr	Acceptance of commissioning results and subsequent successful AFS of new AHS.	Performance Engineering /Operations & Maintenance / Project Design
Identify all susceptible equipment and components vulnerable to freezing in the vulnerable areas identified by the GOTHIC analysis.	Current revision of GOTHIC analysis identifies all areas of the plant which are vulnerable, but does not identify the susceptible equipment and components in those areas.	Identify all process equipment vulnerable to freezing and complete walkdowns and document susceptible equipment and components in these areas.	Acceptance of revised GOTHIC analysis report and subsequent identification of affected equipment in vulnerable areas before AFS.	Projects Design
Reliability requirements satisfied.	Does not meet requirements.	1×10^{-2}	Design Acceptance of vendor submitted analysis report.	Projects Design

Part I: Definitions and Acronyms	
AFS	Available for Service
AHS	Auxiliary Heating System
ASL	Approved Suppliers List
BCS	Business Case Summary
CBH	Construction Boiler House
CCA	Component Condition Assessment
CMO	Contract Management Office
COMS	Constructability, Operability, Maintainability, Safety
DNGS	Darlington Nuclear Generating Station
DR	Design Requirements
EC	Engineering Change
ECC	Engineering Change Control
EOL	End of Life
EPC	Engineer, Procure, Construct
ES MSA	Extended Services Master Service Agreement
FE	Field Engineering
FMOD	Facilities Modification
GOTHIC	Generation of Thermal Hydraulic Information for Containments
HWMB	Heavy Water Management Building
JSA	Job Safety Analysis
MOE	Ministry of Environment
OPEX	Operating Experience
OPG	Ontario Power Generation
OPS	Operations
PDRI	Project Definition Rating Index
PEP	Project Execution Plan
PSVS	Power House Steam Venting System
QS	Quality Surveillance
RAB	Reactor Auxiliary Bay
RFP	Request for Proposal
RP	Radiation Protection
SOW	Scope of Work
TH	Turbine Hall
TRF	Tritium Removal Facility
VBO	Vacuum Building Outage

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Type 3 Business Case Summary

For Internal Project Cost Control

Type 3 Business Case Summary

Appendix A: Summary of Estimate										
Project Number:	16-34000		**Facility:**	Darlington						
Project Title:	Darlington Auxiliary Heating System Project									
Estimated Cost in k$										
	LTD	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Future**	**Total**	**%**
OPG Project Management & Support	804	252	856	970	715	132	-	-	3,729	8%
OPG Engineering	378	125	199	181	126	52	-	-	1,061	2%
Permanent Materials	-	-	3,429	6,650	74	-	-	-	10,153	22%
Design and Construction (Contracts)	[redacted]									
Consultants										
Other Contracts/Costs										
Interest										
Subtotal										
Contingency										
Total	**1,429**	**1,644**	**14,092**	**25,615**	**2,625**	**202**	**-**	**-**	**45,607**	**-**
Removal Costs Included	-	-	44	414	1,396	149	-	-	**2,003**	**4%**

Notes			
Project Start Date	2006-03-23	**Project Completion or In-Service Date**	2015-04-01
Interest Rate	5.0%	**Escalation Rate**	2.0%
Definition Cost Included	$ 45,607 k	**Estimate at Completion**	$39,056 k

Prepared by:		Approved by:	
Ricardo Fiorini	2012-10-29	George Makdessi	2012-10-29
Project Manager, Darlington Projects	YYYY-MM-DD	Manager, Darlington Projects	YYYY-MM-DD

Type 3 Business Case Summary

Appendix B: Comparison of Total Project Estimates										
Phase	Release	Date (YYYY-MM-DD)	Total Project Estimate in k$ (by year including contingency)						Later	Total Project Estimate
			2011	2012	2013	2014	2015	2016		
Initiation	Developmental	2006-03-23	23,505							23,505
Initiation	Developmental	2010-11-08	4,627	3,062	13,122	11,989	13,043	251		46,094
Definition	Developmental	2011-10-04	1,521	1,130	10,537	19,018	5,946	464		38,616
Definition	Full	2012-09-17	1,429	2,677	14,425	23,821	3,023	190		45,565
Execution	Partial	2012-11-01	1,429	1,644	14,092	25,615	2,625	202		45,607

Project Variance Analysis					
Estimated Cost in k$					
k$	LTD	Total Project		Variance	Comments
		Last BCS	This BCS		
OPG Project Management & Support	804	3,480	3,729	249	Last BCS slightly underestimated FTEs required for supporting groups. Resources were increased slightly to account for correct FTEs.
OPG Engineering	378	1,112	1,061	(51)	Last BCS slightly overestimated FTEs required for OPG Engineering. Resources were decreased slightly to account for correct FTEs.
Permanent Materials	-	9,834	10,153	319	Cost of permanent materials increased slightly due to the change in EPC contractor selection.
Design and Construction (Contracts)	[redacted]				New AHS EPC contract costs increased ($804k) due to a change to a better qualified EPC contractor per bid evaluation process. Cost estimate of demolition EPC contract was reduced by $800k to account for reduction in demolition scope. Last BCS included cost of Geotechnical Investigation in the 'Other Contracts/Costs' section.
Consultants					No Change.
Other Contracts/Costs					Geotechnical Investigation costs moved to 'Design and Construction (Contracts)'.
Interest					Interest decreased slightly due to change in project costs and cashflows.
Subtotal					
Contingency					Contingency calculated using Extensive Risk Management Strategy (Monte Carlo Analysis) for Partial Execution Release. Contingency calculated using Minor Risk Management Strategy (Qualitative Risk Analysis) for Full Execution Release (Future). See Risk Management Plan in PEP.
Total	**1,429**	**45,565**	**45,607**	**42**	
Removal Costs Included	-	2,664	2,003	(661)	Removal costs decreased due to reduction in demolition scope (i.e. no switchyard removal).

Type 3 Business Case Summary

Appendix C: Financial Evaluation Assumptions

Key assumptions used in the financial model of the Project are (complete relevant assumptions only):

Project Cost:

(1) Installation, and commissioning estimates do not change significantly from Phase 1 of EPC contract to Phase 2 and 3 of EPC contract outside of allotted contingency.

(2) Detailed design, material, installation, and commissioning estimates do not change significantly from 3rd party estimates when existing CBH Demo EPC RFP is issued.

(3) Sufficient funds in the portfolio.

Financial:

(1) Discount Rate of 7%.

(2) Escalation rate of 2%.

(3) Interest rate of 5% on Capital costs.

(4) Ongoing Operating & Maintenance Costs used for NPV calculations are based on Project high level estimates.

Project Life:

(1) New AHS system process equipment shall be designed for a minimum life of 25 years.

(2) The new Boilerhouse building, structures, and services shall be designed for a minimum life of 35 years.

Energy Production:

(1) The AHS system shall be designed to be available for a maximum of 6 days after full steam output is achieved.

(2) The new AHS system shall be designed for unavailability target of 1×10^{-2}.

Operating Cost:

(1) The total on-going operating costs for the new AHS Boilerhouse are currently estimated at $350k per year. These costs were not included in the financial evaluation as they are not incremental operating costs.

Other:

(1) The new AHS will remain classified as a non-Safety Related System.

Attach further detail as appropriate from the Financial Evaluation spreadsheet.

(N/A)

Appendix D: References

D-BCS-00120.3-10013 – Developmental BCS

D-BCS-00120.3-10002 – Full Definition BCS

Type 3 Business Case Summary

This Guidance section should be deleted prior to submission of the BCS.

Guidance for Completing this Type 3 Form:

Always use the latest revision of the Form!
Verify this is the latest revision through PowerSearch,
or Finance BCS Toolkit intranet website.

Final Security Classification

Determine the Final Security Classification of the BCS from the drop-down list before both the Executive Summary and Recommendations and Part A. Refer to OPG-STD-0030 Classification, Protection and Release of Information.

Executive Summary and Recommendations

Records File Information

Refer to OPG-PROC-0019, Records and Document Management for the requirements and expectations of record filing after the BCS is submitted.

The SCI used for record filing should be:

- *00120.3* for Nuclear BCSs.
- *08707.021* for BCSs of all other business units and corporate groups.

Submitted BCSs shall also be filed according to local BU governance, which may require different SCIs.

Project Overview

State the following:

- What needs to be done and why it needs to be done.
- When the investment/project will be completed.
- Key business objectives.
- Expected benefits of the investment/project.
- Whether the investment/project is within the original scope as specified in the approved Business Plan and/or Life Cycle Plan.
- Brief history of previous releases.
- Level of confidence for current request.
- If critical to the decision, any constraints on the investment/project or its timing.

Project Cash Flows

This table in the Executive Summary and Recommendations section is the same as the table in Part D: Project Cash Flows. See guidance for Part D: Project Cash Flow.

Approvals

Provide the title and name of the individuals making the three required signatures: the Project Sponsor, the individual providing Finance Approval, and the Approver of the BCS per the OAR. The Comments cell is to allow brief hand-written comments. For example, "see comment on Part D", which would refer to a hand-written comment later in the BCS document. These comments would be minor in nature; otherwise a reviewer would require revisions to the BCS before signing the document.

Type 3 Business Case Summary

Business Case Summary

Part A: Business Need

This section describes the business needs or opportunities that gave rise to the investment. It provides background and context for the investment including: the investment's purpose, what's driving the investment, why the investment needs to be addressed now, what are the impacts of not proceeding, key assumptions, identification of any subsequent commitments or obligations, and the benefits or constraints that the investment will create. Provide studies, experience or lessons learned from similar investments, if available. If this submission relates to a subsequent approval, provide a quick overview of investment history.

If the investment is a subset of a program, or if the issue to be addressed is symptomatic of a broader issue that requires additional response, provide the context and identify the related response, whether planned or anticipated.

Part B: Preferred Alternative

This section describes expected business results and objectives, including resourcing requirements, when the investment will be completed, and any major milestones. The proposal section must put the investment into the proper context by providing the link between the investment and the business strategy for the asset and/or other planned investments in that asset.

Describe the link between this investment and business strategy or other investments. Disclose if the resourcing is in place. Alternatively, if the investment is not in the business plan, or if the scope has changed relative to the Business Plan, reasons for the change(s) must be provided.

State the expected benefits and what is being delivered, without specifying vendor name(s). Describe briefly project execution strategy, regulatory approvals, third party agreements, project management, and basis for the cost and schedule contingencies, if applicable. Highlight any constraints on the investment or on its timing, and any constraints or obligations created by the investment.

Deliverables

In the Deliverables section, list the project deliverables and target completion dates, including associated milestones (such as unit in-service dates and external or regulatory milestones).

Part C: Other Alternatives

This section describes viable alternatives considered, including associated risks. At minimum, include a Base Case: Status Quo – No Project. Other alternatives may include:

- Deferring the project.
- Different means to meet the same business need.
- Completing partial scope.
- Alternatives with additional scope.

Part D: Project Cash Flows

This table in Part D: Project Cash Flows is very similar to the table under Project Cash Flows in the Executive Summary and Recommendations section.

This table provides a yearly breakdown of estimated project costs, including amounts currently released from earlier BCSs if applicable, the new amounts being requested now in this BCS, and estimated future requirements not currently requested. Contingency shall be included in these amounts.

The new amounts being requested are for actual work to be completed and for any costs that will be committed to through that work. For example, if an equipment purchase is bundled with a maintenance contract for a committed period, the committed payments under the maintenance contract must be included in the current request. Ongoing Costs include any costs related to the investment that would not be part of the project budget, including ongoing incremental operating costs, and acquisition of inventory.

The Future column is the sum of expected future cash flows beyond the last year shown in the table.

Type 3 Business Case Summary

Estimate Class

Estimate Class is a cost estimate classification system developed by the Association for the Advancement of Cost Engineering International (AACE) which defines the estimate "quality" based on the input information used and the project's stage of development. AACE uses five estimate classes with Class 5 being the least accurate, and Class 1 being the most accurate.

Estimate Class	Class 5	Class 4	Class 3	Class 2	Class 1
Phase	**Identification**	**Initiation**	**Definition**	**Execution**	**Execution**
Level of Project Definition (%)	0% to 2	1 to 15	10 to 40	30 to 75	65 to 100
Expected Accuracy Range (%)	-50 to +100	-30 to +50	-20 to +30	-15 to +20	-10 to +15

OAR Approval Amount

For BCSs up to and including Definition Phase work, the OAR Approval Amount is the cumulative total actual and committed cost to date, not the estimated total investment/project cost. For Execution Phase BCSs or BCSs that cover multiple phases including Execution, the OAR Approval Amount is the estimated total investment/project cost, including cumulative cost to date.

Additional Information on Project Cash Flows (optional)

Relevant information such as the delta between approved business plan cash flows and requested release may be entered into this open-field table cell.

Part E: Financial Evaluation

This section describes and compares the key alternatives considered. Only the most relevant alternatives shall be listed in this table for comparison. The analysis includes financial evaluations, economic analysis, and comparisons of the alternatives based on total project cost, after-tax NPV, and any other financial metric deemed appropriate by the project sponsor (e.g., IRR, discounted payback, etc.) The BCS Financial Evaluation Model is available on the Finance website and is updated periodically to help facilitate financial analysis. Attach further detail as appropriate from the Financial Evaluation spreadsheet.

Summary of Financial Model Key Assumptions

List key assumptions used in the Financial Evaluation. For Part E, provide a brief summary of the most important assumptions that are listed in Appendix C.

Part F: Qualitative Factors

Qualitative factors gained (or lost) from the investment and how an initial specification will be measured within the post implementation review (to the extent feasible). Qualitative factors could include: sustainable energy development impacts; community, government, and customer relations; staff relations issues, technical or operational considerations, reliability, health and safety issues, and other intangibles.

Part G: Risk Assessment

This section identifies the risks associated with the investment and the plans to manage or mitigate these risks. Refer to OPG-STD-0062, Project Risk Management Standard and local business unit standards for guidance on completing and documenting risk assessments. Each BU can add risk areas specific to its business.

Extra Risk Classes may be added by changing "Other" to a specific risk class and/or inserting extra rows to the table.

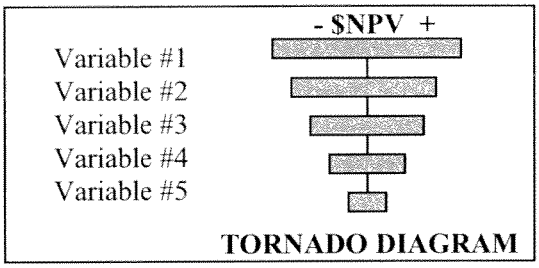
The Risk Analysis section discusses, as appropriate for the project, quantitative risk factors that relate to the project financial evaluation, including considerations such as:

- Present and discuss material impacts/consequences of variations in the basic assumptions, e.g., price of electricity used for revenue, sales forecast, service life, etc. Discuss likelihood of occurrence.

- Based on risks identified and mitigation measures implemented, indicate whether the financial analysis completed for the recommended alternative includes the contingency required for OPG residual risks, and their impact on the estimated in-service date.

- The extent of the risk assessment and the risk analysis techniques employed should be commensurate with the magnitude of the cash flows and the degree of uncertainty associated with the critical assumptions upon which the investment is based.

- For Major Projects, the risk analysis section will typically include sensitivities of the investment to various risk factors or scenarios, and a discussion of their likelihood of occurrence. A convenient way of presenting the results of the risk assessment on the variability of the NPV to changes in the critical variable is to include a graph or tornado diagram as shown below.



- For larger investments, more advanced risk analysis techniques such as Monte Carlo may be suitable. These techniques require analysts with appropriate training; contact your local Finance support to discuss applicability and to arrange Finance analytical support if required. The limitations of Monte Carlo or any other risk assessment technique must be considered in their application, and require a time commitment from the project team and stakeholders to develop and estimate model inputs.

Part H: Post Implementation Review (PIR) Plan

PIR plan is a succinct description of the project benefits using measurable parameters. The PIR plan should clearly specify what is to be measured, who is responsible for measuring it, and when the measurement should take place, along with any requirements for establishing pre-project baseline information for comparison purposes.

Extra PIR metrics may be added by inserting extra rows to the table.

The PIR plan should contain the following five main elements:

- What: Key deliverables or benefits of the project clearly defined in measurable parameters, including a clear description of the reference or baseline from which the incremental benefits or changes due to the project are to be measured.

- How: A brief description of how each parameter is going to be measured.

- Who: The name of the group, department, or individual that will be measuring the benefits.

- When: When the measurement of the benefits will take place.

In addition, the Project Sponsor and key stakeholders may specify other items such as the types of lessons learned and recommendations to be captured during the execution of the PIR.

Part I: Definitions and Acronyms

Define key technical terms and list acronyms to assist reviewers of the document.

Appendix A: Summary of Estimate

Note: All content from Appendix A onwards, including this Guidance section, contains a level of detail that is intended for OPG internal use only and should be removed before a copy of a BCS is released to an external party.

To assist the reviewer in understanding the cost estimate in the BCS, this table provides a breakdown of various cost components by year, with explanatory notes as appropriate.

Note: The label "Project Completion or In-Service Date" is intended to provide flexibility for projects that do not have a specific "In-Service Date", such as engineering studies in future decisions or for future regulatory documents.

Appendix B: Comparison of Total Project Estimates and Project Variance Analysis

This section provides the history of past releases and their associated estimates, with explanations of changes as appropriate.

Appendix C: Financial Evaluation Assumptions

This section is intended to provide a reviewer with an overall understanding of the key assumptions used in the financial evaluation, to help a reviewer confirm that relevant drivers and appropriate assumptions were used in the analysis. The main considerations in the economic evaluation of the alternatives are outlined below:

Cost and Schedule Estimates

The work breakdown structure (WBS) of the project usually provides detailed information on the cost of the project and should be referred to while estimating the costs and schedule. Best practices in project cost and schedule estimating should be applied wherever possible including using lessons from similar experiences and benchmarks. Requests for quotations from competitive sources are another option to obtain detailed estimates. Schedule and cost estimates must obtain stakeholders' inputs and be reviewed by the key stakeholders of the project before being finalized.

Taxes

All investments must be assessed on an after-tax basis. Users will be required to properly classify the capital assets for Capital Cost Allowance (CCA) purposes. The financial evaluation model provided on the Finance website will compute the initial income tax impacts for most types of investments; the model also contains the latest CCA rates for most types of investments. For further information on CCA, sales taxes and tax shields, please contact your local Finance support group.

Cost of Capital

An appropriate cost of capital or discount rate must be used to ensure that an adequate return is provided to shareholders. For investments related to the manufacturing and processing of electricity for regulated nuclear and base-loaded hydroelectric facilities, the discount rate is generally lower than for unregulated facilities. This is partly due to regulated assets having a more predictable revenue stream, and hence lower risk than unregulated generation facilities.

For projects and business opportunities that are clearly outside of OPG's core business, or are not related to the manufacturing and processing of electricity, the project's cost of capital should be used, instead of OPG's cost of capital. Updated rates for OPG's core business are posted in the BCS Financial Evaluation Model. Contact Investment Planning for assistance.

Revenue Forecasts

The revenue forecast from generation assets must be based on the OPG System Economic Values (SEVs). The appropriate SEVs for the applicable time frame are selected based on the characteristics of the generation asset being evaluated (e.g., peaking vs. baseload). Contact your local Finance support group for further guidance on using SEVs.

Appendix D: References

The reference documentation and attachments contain the detailed numbers, calculations, and any other analysis done probing the need and substantiating the justification for the investment. This documentation includes: cost estimates, financial evaluation sheets, risk assessment tables, modeling assumptions, project execution plan, technical studies, and any other specific studies related to the investment.

Type 3 Business Case Summary

Additional Attachments

Additional documents be prepared as separate documents and enclosed with the BCS for reviews and approvals (e.g., multiple file attachments to e-mails).

The final signed version of the BCS may then be combined with all the attachments in a single PDF file.