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DND: Chiller Replacement to Reduce CFC Emissions 16 - 33631

Full Release (Phase 1) Business Case Summary D-BCS-73910-10002-R002

1/ RECOMMENDATION:

Approval of this Phase 1 Full Release is requested, to:

- Reduce the total project cost from previously-estimated 23.245M$ to 14.9M$ (Capital).
- Increase the approved amount from 6.369M$ to 10.44M$ for this Phase 1
- Purchase 11 chillers all at once instead of individually, thereby achieving significant price savings
- Install three chillers under this phase and the remaining eight in Phase 2.
- Complete the detailed engineering and procure the materials for the additional scope to improve the chiller system performance

The business objective of this project is:

- To replace the 11 existing chlorofluorocarbon (CFC) based water-cooled chillers at Darlington with units that use an approved refrigerant by January 1, 2015 in order to comply with Environment Canada's 2003 Halocarbon Regulations.
- To improve the performance of Darlington chiller systems at low load conditions.

A partial release of $6.4M was approved in May, 2006 to complete the detailed engineering, procure 2 chillers and install the T-pipe tie-ins. The detailed engineering is scheduled to be completed by Q4 2007.

During the detailed engineering, it was realized that significant savings in design/engineering costs could be realised and the costly installation strategy was not necessary if the manufacturer were to supply the chillers with the same power voltages and nozzle orientations as the present ones, i.e. custom-make the chillers to fit OPG's specific needs. The preferred manufacturer agreed to this, while also offering a significant discount if all 11 chillers are procured at the same time.

In addition, a close examination was made of certification/registration requirements. It was found that the requirements originally proposed are not necessary and thus additional savings were realized. Specifically:

- CNSC Code & Classification and TSSA Registration were exempted per newly issued N-PROC-MP-0040 and 0082.
- CRN for individual component within the chiller package is not required since the Darlington chiller system is not a registered system.
- PEO stamps on vendor's drawings are not required.

As a result, it is now estimated that the project can be completed for 14.9M$ (Capital). The experience gained during the installation of first three chillers will be used to estimate the remaining work for the Phase 2 Release.

$000's (incl contingency)	Funding	LTD 2006	2007	2008	2009	2010	2011	Later	Total
Currently Released	Partial	2,889	3,480						6,369
Requested Now	Full - Phase 1		(2,075)	3,046	1,200	1,200	700		4,071
Future Funding Req'd	Full - Phase 2				1,800	1,660	1,000		4,460
Total Project Costs		2,889	1,405	3,046	3,000	2,860	1,700	-	14,900
Other Costs									-
Ongoing Costs									-
Grand Total		2,889	1,405	3,046	3,000	2,860	1,700	-	14,900
Investment Type: Sustaining		Class: Capital		(IEV) Impact on Ec Value: (8,778)		IRR: N/A		Discounted Payback: N/A	

Submitted By:

Wayne Robbins 2007-05-07

W. Robbins Date:
Senior VP Darlington

Finance Approval:

2007-05-18

J. Beech Date:
VP, Nuclear Finance

for.

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

T. Mitchell 2007-05-31

T. Mitchell Date:
~~Executive Vice President &~~ CNO

2/ BACKGROUND & ISSUES

Regulation Requirement

Halocarbons are chemical substances that include, among other components, halogen (bromine, chlorine and/or fluorine) and carbon. They are used specifically as refrigerants in air-conditioning and refrigeration systems, fire extinguishing agents in fire extinguishing systems and blowing agents in the manufacture of foams and as solvents. Halocarbons pose a double-edged environmental problem. Firstly, most of them contribute to the depletion of the stratospheric ozone layer. Secondly, they are greenhouse gases which contribute to climate change. Hydrocarbons are identified by an alphanumeric code, with R-11 being the most common refrigerant in use.

Environment Canada's 2003 Federal Halocarbon Regulations mandate the phase-out of equipment containing CFCs. The following specific excerpts of the regulations apply:

- "Effective January 1, 2015 no person shall operate or permit the operation of any chiller [containing CFCs]" (Section 20)
- Between January 1, 2005 and December 31, 2009 an overhauled/recharged chiller is allowed to operate for one year from the date of charging. An overhaul does not constitute the replacement of parts in the course of OPG's normal maintenance.
- The one-year grace period for repairs disappears on January 1, 2010.

The Ontario Government is seeking to phase-out CFC refrigerant on January 1, 2012, 3 years earlier than Federal Regulation. This change impacts the TRF chiller which is under Ontario Provincial jurisdiction.

In addition, the poor performance of the existing 3-way control valve is identified as impacting the chiller operating at the low load condition. Darlington requested to replace the 3-way valve and its controller in order to improve the performance of chiller system.

Project Scope

Darlington has total twelve (12) chillers inside operating island. One of TRF chillers was replaced with a chiller using R-134a as refrigerant in 2002 through Project # 31531. This project will replace Darlington's eleven (11) R-11 refrigerant water-cooled chillers with R-134a refrigerant water-cooled chillers:

- 2 chillers (2x100% configuration) in Central Service Area (CSA) provide cooling to CSA and Main Control Room (MCR). CSA chiller is in-service year-around and has no off-season.
- 8 chillers (2x100% configuration) in Reactor Auxiliary Building (RAB) provide cooling to RAB and the instruments for shutdown system. RAB chiller is off-service from November to April.
- 1 chiller (2x100% configuration) in Tritium Removal Facility (TRF) provides cooling to Heavy Water Management Building (HWMB). TRF chiller is off-service from November to April.
- Eleven (11) 3-way control valves and controllers for each of new chillers.

A revised Project Execution Plan is projected to be approved in Aug. 2007.

The chiller installation includes the removal of the existing chillers, at a total value of $330K. There is no significant salvage value to be realized from the existing/old chillers due to the age of the equipment and the phase-out of R-11 refrigerant.

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Technical/Design Requirements

The eleven chillers and other required materials were originally estimated to cost 4.4M$, however the lowest acceptable bid came in at 5.8M$. As a result of challenging the technical/design requirements, the following changes have significantly reduced the cost of 11 chillers down to $3.5M:

- Canadian Registration Number (CRN) for each individual Pressure Boundary (PB) component in the chiller package is not required per CSA B51 (PB Code) since Darlington chiller system is not a registered system. However, the vendor shall supply Darlington the chiller with one CRN per CSA B52. (Refrigeration Code)
- The requirement for vendor's drawings to be PEO stamped was eliminated from the Technical Specifications as per N-LIST-01300-10000.
- Due to the changes above, OPG is able to look for a proposal directly from the chiller manufacturer, instead of seeking the proposal through a commercial grade dedicator.

Optimized Installation Strategy

We optimized the new installation strategy as per the following changes, resulting in a reduction in the estimated installation cost from $8M to $3.4M:

- Based on a Constructability Operability Maintainability and Safety (COMS) screening conducted at the scoping phase in 2004, we had planned a costly strategy to install T-pipe tie-ins and "3rd chiller" (to provide backup during the installation) for the replacement of the 2 CSA chillers. Now, based on keeping the chiller physical configuration the same, thereby reducing installation duration and risks, we are able to replace the 2 CSA chillers without having to use a backup. The stakeholders agreed to proceed with this new installation strategy by re-assessing the COMS requirements.
- We requested the vendor to supply the chillers with the same power voltages and similar nozzle orientations, which will minimize the field work.

As a result of this installation strategy change, we are able to lower the estimated engineering cost from $4.1M to $3.6M and project management cost from $1.4M to $1.1M respectively due to:

- The detailed design schedule (design agency) being shortened by 4 months (Fixed price)
- The work load of OPG project team being significantly reduced.

Installation Schedule

We will use the chiller off-season, November to April, to replace RAB chillers. Two RAB chillers were selected as part of the scope of Phase I to gain installation/commissioning experience and confirm the installation cost. In addition, the TRF chiller will be replaced in Phase I to ensure that Darlington will comply with Ontario CFC regulation. The following is the planned chiller replacement schedule:

2008	Q1 2009	Q1 2010	Q1 2011
2 RAB chillers (Q1) 1 TRF chiller (Q4)	1 CSA chiller and 2 RAB chillers	1 CSA chiller and 2 RAB chillers	2 RAB chillers

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3/ ALTERNATIVES AND ECONOMIC ANALYSIS

$ 000's	Choose One	Alt 1 (Recommended)		Alt 2	Alt 3	Alt 4	Alt 5
		Full Cost	Incremental Cost	Delay			
Revenue							
Project Cost		(11,603)		(13,066)			
NPV (after tax)		(8,778)		(8,950)			
Impact on Economic Value (IEV)		(8,778)		(8,950)			
IRR%		N/A					
Discounted Payback (Yrs)		N/A					

Stop the Project - Not Recommended

We do not recommend stopping this project as OPG must demonstrate to the public that the company is environmentally responsible and complies with all Federal and Provincial Environmental Regulations.

To do nothing will force OPG to replace the existing R-11 chillers when they are broken down. As well OPG would face the environmental penalty after the regulation effective January 1, 2015 and would be forced to replace those R-11 chillers any way at much higher cost.

Alternative 1 - Replace eleven R-11 chillers and eleven 3-way control valves - Recommended

We recommend this alternative as it allows us to procure all 11 chillers and start replacing the existing R-11 chillers in order to comply with the halocarbon regulatory deadline of January 1, 2015. The strategy is to install three chillers, then learn from this release and obtain a Phase 2 release to install the remaining eight chillers. This alternative also makes an emergency replacement possible if any of the existing R-11 chillers fail prematurely since all 11 new chillers will be stored in OPG's warehouse.

Alternative 2 - Delay Project - Not Recommended

We do not recommend delaying this project. Although it's possible to delay the chiller replacement once a chiller has failed, the delay will be for a maximum of 2 years. The consequence of this alternative will be that:

- There will be no one-year grace period (refer to Glossary) after January 1, 2010. Any failed chiller must be replaced, instead of having it overhauled or recharged.
- A temporary chiller is required since the lead time is about one year to deliver a chiller. It will cost more to order one chiller and the additional costs in engineering and temporary tie-in for a temporary chiller.
- We are not able to conduct an emergency replacement of a chiller if an existing chiller needs to be overhauled/ recharged since there are no new chillers available. In this case, we have to install a temporary chiller (an off-the-shelf chiller) to meet the need of the emergency before the Darlington specified chiller is delivered and installed.

Alternative 3 – Do Less - Not Recommended

We do not recommend doing less since all eleven (11) R-11 chillers must be replaced in order to comply with Federal and Provincial Environmental Regulations.

Alternative 4 – Do More - Not Recommended

We do not recommend doing more as the scope of this release aligns with the project objective addressed in Project Charter.

Alternative 5 – - Not Recommended

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4/ THE PROPOSAL

The major project deliverables for this project are as follows:

This Release:

- Procurement of all 11 chillers and 11 3-way control valves with controllers.
- Complete the detailed engineering for replacing of 3-way control valve.
- Revision of Project Execution Plan NK38-PEP-73910-10001
- Installation/commissioning of 2 RAB chillers and 1 TRF chiller
- Declaration of 2 RAB chillers and 1 TRF chiller in service
- Full Release BCS Phase 2.

Release Phase 2:

- Revision of Project Execution Plan NK38-PEP-73230-10001
- Installation/commissioning 11 3-way control valves
- Installation/commissioning of the remaining 2 CSA chillers and 6 RAB chillers.
- Declaration of the remaining 2 CSA chillers and 6 RAB chillers Available for Service
- Declaration of 11 3-way control valves Available for Service
- Post Implementation activities
- Project close-out

5/ QUALITATIVE FACTORS

- The addition of refrigerant leak detection and an alarm system will provide an automated early warning system. These additions have a positive benefit to worker and environment health and safety and also on equipment health monitoring.
- Improvement of equipment reliability due to new technology with commensurate reduction in ongoing maintenance and spare parts.

6/ RISKS

Description of Risk	Description of Consequence	Risk Before Mitigation	Mitigating Activity	Risk After Mitigation
Cost				
Since the detailed engineering has not been completed to date, the detailed installation scope has not been finalized.	The cost estimate in Project Cost Summary needs to be adjusted.	**Medium**	1) The cost will be adjusted at Phase 2 BCS as per actual Phase I installation cost. 2) $350K general contingency is available.	**Low**
The vendor drawings are not available.	1) The design agency may claim delay charges due to a lack of vendor's information. 2) The milestone of issuing DCP packages may be missed.	**Medium**	1) Actively support Supply Chain to get the the chiller PO issued ASAP. 2) Intend to introduce incentive or penalty into the PO to encourage the vendor submit the drawing as early as possible. 3) Reserve $100K specific contingency for delay charges.	**Low**
Scope				
The poor performance of the existing 3-way control valve/controller has been identified as a contributing factor to poor chiller performance at low load, however, replacement alone may not be sufficient to allow reliable operation at low load.	Additional modifications may be required impacting both cost and schedule.	**Medium**	1) Detailed investigation into the low load performance issues will be conducted. The most cost effective solution will be adapted. 2) Reserve $100K specific contingency for the additional engineering.	**Medium**
See Cost and Technical				
Schedule				
Very tight installation window.	The installation will be delayed one year if the off-season is missed.	**Low**	Expedite completion of RAB chiller DCP.	**Low**
Long lead time required for chiller delivery, which impacts	The off-season will be missed if the chillers are not delivered.	**Low**	Expedite delivery of 2 RAB chillers to meet installation schedule.	**Low**

on first installation.				
The new TRF chiller (RFU1, replaced in 2002) currently has difficulty running at low load condition.	The chiller to be replaced (RFU2) may not be allowed to shut down for replacement as per the scheduled period, Q4 2008.	**Medium**	1) Test run RFU1 in Q4 2007 to verify the low load ability. 2) If RFU1 can't meet the low load requirement, the replacement will re-schedule during next TRF outage, Q1 2009.	**Low**
Resources				
Availability of the installation team and commissioning team	The installation/commissioning will not happen if resources are not available.	**Low**	1) Work with Contract Management Office to select an installation team in order to commit to the installation labour. 2) Schedule the commissioning tasks in IPG to reserve the Mechanical Maintainer resource. (Commissioning team)	**Low**
Technical				
Low Load Operation Project team has identified that the capacity of the existing chillers is about 40% higher than that required during normal operation. However, the stakeholders would like to keep capacity of the new chillers the same as the existing one in case of any emergency event.	When the chiller is operated at very low load (<10%), some components, such as 3-way control valves, controllers etc, in the chiller system may be operated beyond the design margin leading to chiller trips.	**Medium**	See scope risk	**Low**
Chiller Performance	The new chiller may not achieve the capacity specified.	**Low**	1) Project team will witness the tests to ensure that the new chillers achieve the capacity 0% ~ 100% (RAB & TRF chillers) and 10% ~ 100% (CSA chiller) specified by the manufacturer. 2) The manufacturer will provide a performance test report for each individual chiller.	**Low**
Operator and Maintainer training	The commissioning may be delayed if Operator and Maintainer are not familiar with the new chillers	**Medium**	1) Project Team has reserved 40 hours of basic training, provided by the manufacturer, in order for the Operators to initially startup a	**Low**

			chiller and the Maintainers to conduct basic maintenance before the first chiller is commissioned. Additional training will be provided as required. 2) The manufacturer will provide a service engineer to supervise the initial settings and commissioning for each chiller.	
Regulatory				
CRN is required as per refrigeration code CSA B52. (Refrigerant loop)	The chiller cannot be operated without a valid CRN.	**Low**	1) Vendor is required to supply the chiller with a valid CRN. 2) The preferred vendor York has the experience to apply CRN for its customers.	**Low**
Environmental				
Refrigerant leakage	The chemical impacts the environment.	**Low**	A refrigerant leakage detection and alarm system is provided for each chiller.	**Low**
Health & Safety				
Workplace injury or serious MRPH event.	The event may impact project schedule and costs.	**Low**	Work to be performed per existing OPG safety rules, procedures and OH&SA regulations. Any non-standard conditions will be identified via workplans and pre-job briefings.	**Low**
Large amount refrigerant leakage that may pose an increased risk to station staff.	Potentially create a chemical hazard to the staff who are working in the mechanical room.	**Low**	The refrigerant leakage detection and alarm system is interlocked with the mechanical room ventilation fan system. The ventilation fan system will automatically activate to reduce the refrigerant concentration when the refrigerant leakage reaches the set point.	**Low**
Investment				
No risk is identified.				

7/ POST IMPLEMENTATION REVIEW PLAN

Type of PIR:	Targeted Final AFS Date:	Targeted PIR Approval Date:	PIR Responsibility (Sponsor Title)
Simplified	May 2011	Dec 2011	Manager Performance Engineering

Comments:

	Measurable Parameter	Current Baseline	Targeted Result	How will it be measured?	Who will measure it? (person / group)
1.	Environment Canada's 2003 Halocarbon Regulations	Will not be in compliance with the regulations after 2014.	Comply with the regulations	The new chillers with approved refrigerant in service	All AFS signatories sign-off "Declaration of Available for Service" N-FORM-10091.
2.					
3.					
4.					
5.					

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

- CFC – Chlorofluorocarbon
- CRN – Canadian Registration Number
- PEO – Professional Engineer of Ontario
- CSA – Canadian Standard Association
- PB -- Pressure Boundary
- CSA – Central Service Area
- RAB – Reactor Auxiliary Building
- TRF – Tritium Removal Facility
- COMS -- Constructability Operability Maintainability and Safety
- PB code (CSA B51) – Governing requirement for Pressure Boundary system
- Refrigeration Code (CSA B52) – Governing requirement for refrigeration system
- Evaporator – Heat exchanger, in which refrigerant cools down chilled water
- Condenser – Heat exchanger, in which refrigerant is cooled by water or air
- Water-cooled chiller – Refrigerant is cooled by water
- Refrigerant loop – A closed refrigerant loop inside chiller, including compressor, refrigerant sides of evaporator and condenser, etc.
- Chiller Package –Chiller mechanical package, including refrigerant loop, evaporator and of condenser, etc.
- R-11 – CFC based refrigerant
- R-134a – Approved non-ozone depleting refrigerant without phase-out time
- Federal Halocarbon Regulation – Phase-out CFC based refrigerant equipment on January 1, 2015.
- One-year grace period – Overhauled/recharged chiller can only be allowed to operate for one year from date of charging effective from January 1, 2005 to December 31, 2009.
- T-pipe tie-in – A new system will tie-in to the existing system through a T-pipe.
- "3rd chiller" configuration –Due to project scoping phase and conservative approach, an installation strategy was proposed to
    - Install T-pipe tie-ins first.
    - Install a new chiller (3rd chiller) at new location with new piping system, new power/instrument cables, new monorail, new plinth etc. before replacing the 2 existing CSA chillers.
    - Replace one of the existing CSA chillers with a new one.
    - Dismantle another existing CSA chiller and associated piping, cabling etc.

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Appendix "B" Project Funding History

$ 000's			Previous Releases (incl contingency) Cumulative Values								
Release Type	Month	Year	2004	2005	2006	2007	2008	2009	2010	Later	Total
Developmental	April	2004	520								520
Interim	Feb.	2005		620							620
Interim	Jan.	2006			300						300
Partial	May	2006	500	576	3,367	1,926					6,369
Choose											0
Choose											0
Choose											0
Choose											0

LTD Spent	Dec	2006	501	576	1,812						2,889

Comments:

The development funding was approved for Project # 16-38433. Project number changed because the funding changed from OM&A to Capital.

Appendix "C" Financial Model – Assumptions

Project Cost Assumptions:

- The additional scope is added to this project as per request of project sponsor.
- The detailed engineering for the chiller replacement packages has been completed at about 80% and the cost for Design Agency is fixed.
- The additional scope will be initiated from the problem identification process.
- The chillers proposed by the manufacturer meet the technical requirements.
- OPG has received the quotation for the chillers.
- Project has a budgetary quotation for the installation cost. The installation cost will be adjusted at Full BCS Phase II as per the actual installation cost.

Financial Assumptions:

- NPV discount rate = 7%

Project / Station End of Life Assumptions:

- Station end of life at 2018

Energy Price / Production Assumptions

N/A

Operating Cost Assumptions

- The new chillers have the same operability as the existing ones. Operating costs for the new chillers will be the same as the existing ones or slightly lower.

Other Assumptions:

- For Alternative 2, a 2-year delay: it is assumed that a failure would occur, necessitating purchase and installation of a temporary chiller at a cost of 500K$.

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Full Release (Phase 1) Business Case Summary D-BCS-73910-10002-R002

Attachment "A" Project Cost Summary

$000's Capital	LTD Prior Yr 2006	This Release 2007	This Release 2008	Future Release 2009	Future Release 2010	Future Release 2011		Later	Total
Project Management (OPG)	450	153	157	120	120	110			1,110
Engineering & Drafting (OPG)	487	176	80	65	65	70			943
Material			1,077	1,345	1,355	760			4,537
Installation – PWU, BTU		40	230	215	195	80			760
Contract - Design	1,807	500	180	35	45	48			2,615
Contract - Installation			700	720	720	442			2,582
Contract - Other		40							40
									-
									-
Interest (Capital Project Only)	145	196	172	100	60	40			713
Project Costs (excl contingency)	**2,889**	**1,105**	**2,596**	**2,600**	**2,560**	**1,550**	**-**	**-**	**13,300**
General Contingency		200	350	400	300	150			1,400
Specific Contingency		100	100						200
Project Costs (incl contingency)	**2,889**	**1,405**	**3,046**	**3,000**	**2,860**	**1,700**	**-**	**-**	**14,900**
2007-2011 Business Plan		583	4,500	4,000	3,850	4,019			16,952
Variance to Business Plan	**2,889**	**522**	**(1,904)**	**(1,400)**	**(1,290)**	**(2,469)**	**-**	**-**	**(3,652)**
Committed Cost									-
Inventory Write Off Required									-
Spare Parts / Inventory									-
Total Release (excl contingency)	**2,889**	**1,105**	**2,596**	**2,600**	**2,560**	**1,550**	**-**	**-**	**13,300**
Total Release (incl contingency)	**2,889**	**1,405**	**3,046**	**3,000**	**2,860**	**1,700**	**-**	**-**	**14,900**

Ongoing OM&A (non-project)									-
Removal Costs (incl in above)			**90**	**90**	**90**	**60**			**330**

Basis of Estimate					
Design Complete	Up to - 40%		Quality of Estimate	Release + 15% to - 10%	
3rd Party Estimate	Yes	OPEX used	Yes	Lessons Learned	Yes
Reviewed by Sponsor	No	Budgetary Quote(s)	Yes	Phase 1 Actual Used	N/A
Similar Projects	Yes	Contracts in place	No	Competitive Bid	Yes

Variance to Business Plan

The estimated variance(s) to the 2007-2011 Business Plan will be addressed through the portfolio management process. A PCRAF will be approved by May 2007.

Reviewed By:

M. Guy
Project Manager

APR 26 2007
Date:

Approved By:

T. Chong
Eng & Mods Manager (Strat IV)

26 Apr 2007
Date:

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Attachment "B" Project Variance Analysis

Capital	LTD Dec 2006	Choose One: Last BCS May 2006	Choose One: This BCS Apr 2007	Variance	Comments
Project Management (OPG)	450	1,395	1,110	-285	Less work load due to the change of installation strategy
Engineering & Drafting (OPG)	487	1,794	1,143	-651	Less work load due to the change of installation strategy
Material		4,458	4,537	79	With additional 11 3-way control valves and controllers
Installation – PWU, BTU		2,470	760	-1,710	Less work load due to the change of installation strategy
Contract - Design	1,807	2,364	2,415	51	Includes the estimate of the installation, commissioning and close-out support.
Contract - Installation		5,543	2,582	-2,961	Less work load due to the change of installation strategy
Contract - Other			40	40	Third Party Cost estimate
				0	
				0	
Interest (Capital Project Only)	145	1,577	713	-864	Reduction in total execution costs.
Project Costs (excl contingency)	**2,889**	**19,601**	**13,300**	**-6,301**	
General Contingency		**3,644**	**1,600**	-2,044	The installation has been simplified
Specific Contingency				0	
Project Costs (incl contingency)	**2,889**	**23,245**	**14,900**	**-8,345**	
Committed Cost				0	
Inventory Write Off Required				0	
Spare Parts / Inventory				0	
Total Release (incl contingency)	**2,889**	**23,245**	**14,900**	**-8,345**	
Total Release (excl contingency)	**2,889**	**19,601**	**13,300**	**-6,301**	

Ongoing OM&A (non-project)				**0**	
Removal Costs (incl in above)		**0**	**330**	**330**	**Removal costs: $30K/chiller**

Comments:

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Attachment "C" **Key Milestones**

Completion Date			Description
Day	Mth	Yr	
29	06	2007	LLA - Long Lead Time Material Contracts Awarded
15	10	2007	DCP - Issue DCP package for RAB chillers, detailed engineering completed.
07	11	2007	DCP - Issue DCP package for TRF chillers, detailed engineering completed.
07	12	2007	DCP - Issue DCP package for CSA chiller, detailed engineering completed.
30	11	2007	ICA - Award Installation labour (2 RAB & 1 TRF) contract
14	12	2007	PTA - Ready for installation, work package assessed and ITP issued - U1-RFU1
11	01	2008	PTA - Ready for installation, work package assessed and ITP issued - U2-RFU1
04	02	2008	SOI - Start of Installation of U1-RFU1 chiller
10	03	2008	SOI - Start of Installation of U2-RFU1 chiller
30	03	2008	DES -- Preliminary Engineering for 3-way valve completed
20	06	2008	AFS - Declaration AFS for U1-RFU1 chiller
20	06	2008	AFS - Declaration AFS for U2-RFU1 chiller
31	10	2008	FR2 - Full Release BCS Phase II Approved
03	11	2008	SOI - Start installation of TRF chiller
23	12	2008	DCP -- Detailed enginnering for 3-way valve completed.
26	06	2009	AFS - Declaration AFS for TRF chiller

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

Comments: