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ONTARIOPOWER GENERATION

Lessons Learned Report

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Revision: R00	

Title:
D2O STORAGE AND DRUM HANDLING PROJECT: MODIFICATION PLANNING LESSONS LEARNED REPORT

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Revision Summary

Revision Number	Date	Comments
R00	2013-02-27	Initial issue

1.0 BACKGROUND

1.1 Project Background

The project scope is to build a facility for the storage of 2,100 m^3 of D_2O in tanks, including a drum cleaning, testing and handling area and consolidated office space for the Tritium Removal Facility (TRF) staff. The planned in service date is April 15, 2015. Of the 2,100 m^3 of D_2O storage to be provided, 1,700 m^3 is mandatory support of core scope for Darlington Refurbishment (a value enhancing project). The remaining project scope provides needed D_2O management operational improvements.

This project is currently executing a Full Definition release to complete scope definition, modification planning, and detailed engineering. This work is considered Phase I of a three phase engineer, procure and construct (EPC) contract.

The project is also executing a Partial Full release in parallel to complete ordering of long lead materials, such as Nuclear Class III tanks and pumps, and the start of site preparation activities upon approval of the Darlington Refurbishment Environmental Assessment.

The Modification Planning phase was substantially completed at the end of December, 2012.

1.2 Scope of Review

The scope of this lessons learned review is Contract Award and Modification Planning activities from July-December 2012.

Subsequent Lessons Learned Report(s) will be issued for this project as the work progresses.

1.3 Participants

A lessons learned workshop was held on February 5, 2013 with the following participants. The project sponsor or delegate was also invited however declined due to a conflict.

Refurbishment Engineering:

Chris De Vaal, Section Manager Refurbishment Design Engineering

Stuart Harris, Refurbishment Design Engineering Manager

Brian Krystolovich, Design Team Leader

Neil Mitchell, Vice President Nuclear Refurbishment

Marcel Poirier, Nuclear Refurbishment Design Engineering

Mike Ismail, Engineering Lead

Projects & Modifications:

Peter Moore, Project Leader

Julian Read, OPG Modification Team Leader

EPC Vendor:

Jason Burnett, Project Manager RCM Technologies

Bruce Smith, Project Manager Black & McDonald Ltd.

Stephen Tutsch, Modification Team Leader RCMT

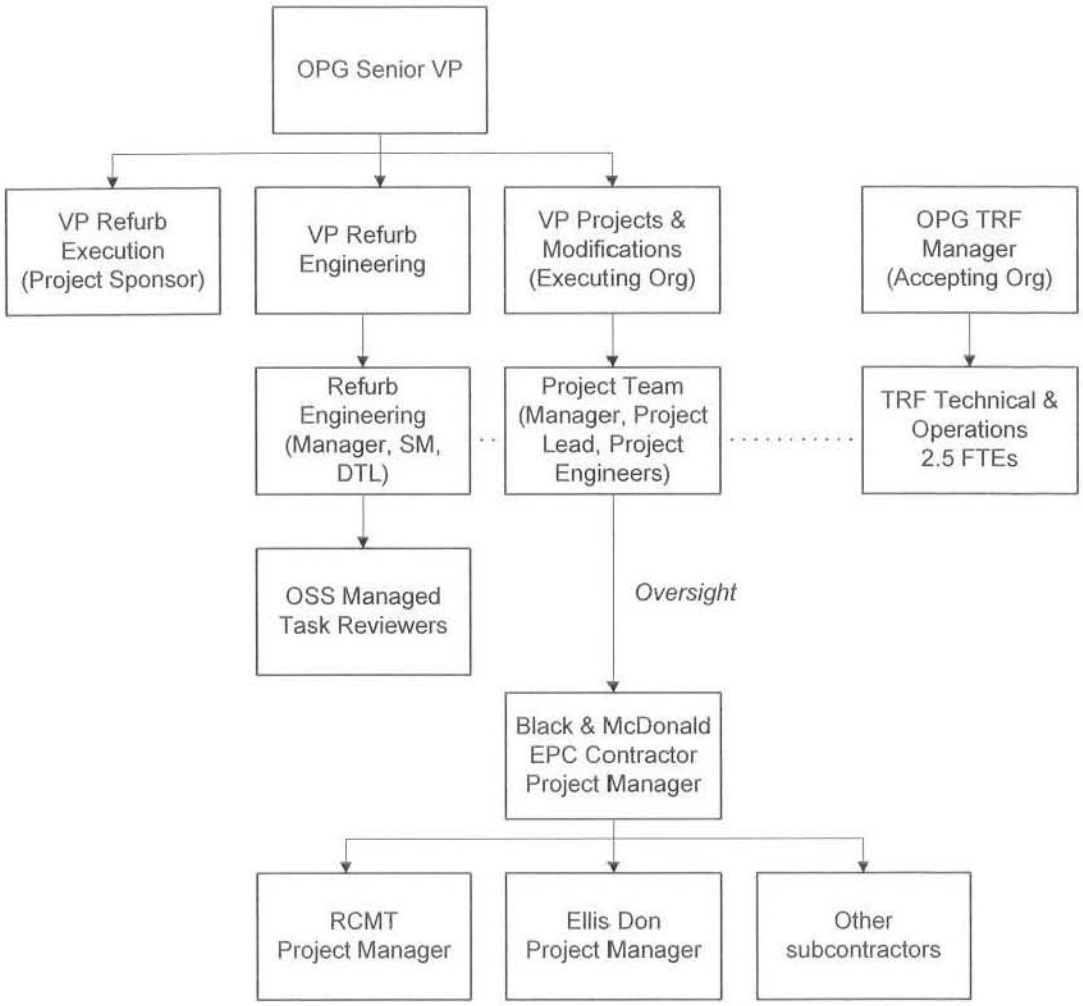
Tritium Removal Facility:

Glen Barton, TRF Operations

Nicole Go, TRF Lifecycle Projects

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The overall project organization is shown below. For specific roles, see the Project Management Plan NK38-PLAN-38000-0434605.



3.0 LESSONS LEARNED

3.1 Cost

Lessons learned are listed in order of highest to lowest impact.

#	Issue Summary	Background	Recommendation	SCR (if applicable)
C1	Positive involvement of expert stakeholders	The TRF technology, design and operational details are unique in the OPG fleet and perhaps the world. As a result this project is utilizing a strategy of expert stakeholder complete integration into the project team. TRF staff has dedicated 2.5 FTE's to the project and do not simply review submittals, but are proactively engaged, attend most project meetings, and meet with the EPC vendor frequently. As a result there has been excellent involvement from the key stakeholder and many examples of good input and "catches" which prevent errors or omissions from propagating very long into the design cycle, preventing future rework and costs.	Other projects, especially those involving unique technologies, consider following this approach.	n/a
C2	Expectations of expert stakeholder involvement	As per C1 above, TRF stakeholders are intimately involved in the project. However, there was inadequate definition by the project team of the level of the support expected. At the start of the project the stakeholder reviewed all submittals and details. It was realized that certain submittals were being commented on, for example the Design Plans, which was not required, resulting in inefficient use of the resource and generating additional work for the EPC Contractor.	The corollary of C1 above is stakeholder involvement must be fine tuned to ensure the most efficient use of the resource.	n/a

3.2 Schedule

Lessons learned are listed in order of highest to lowest impact.

#	Issue Summary	Background	Recommendation	SCR (if applicable)
S1	Quality and timeliness of schedule from EPC Contractor was not to expectations.	Lack of a quality, accepted schedule until late in Modification Planning. Schedule lacked integration between EPC vendor groups (construction, engineering). Apparent causes: 1. There was flux in the B&Mc project manager position for 2 months until the permanent project manager joined the project. 2. The Scope of Work required a Class 3 schedule for Phase I (Engineering) and Class 2 for the Overall Project at time of contract award. Typically a Class 3 schedule is developed by the contractor as part of its bidding process for the project, or by the project team during the initial phases of planning. In hindsight there was not enough information known to require a Class 3 at the time of bidding. Class 3 should have been requested for Modification Planning, Class 2 for Detailed Engineering, updated to Class 3 upon completion of Mod Planning. Level 3 for all of detailed design was not realistic for a project of this complexity. 4. Lack of resources initially – permanent project manager and dedicated B&Mc schedule analyst. 5. Integration between RCMT/ED/B&Mc scheduling	1. Projects should consider, and challenge, Contractor's "readiness to execute" and resources at the RFP stage. 2. Consider requested granularity of schedule at contract award, based on project complexity. Acknowledge any unrealistic expectations. 3. Scope of payment milestones need to balance SMART (Specific, Measurable, Achievable, Realistic, Timely) expectations with the state of scope definition.	D-2012-08890

		processes/software was not ready at contract award. 6. Prescription of milestone deliverables i.e. which exact EC's were to be included in each milestone, was too specific can caused churn as some EC's were added and others deleted during Modification Planning.		
S2	Modification Planning Milestone missed	BCS committed date of October 29, 2012 for the Modification Planning Complete (DES) milestone was missed. A recovery TCD of November 21, 2012 was targeted as part of the recovery plan. This recovery date and subsequent recovery was missed. The milestone was completed on Dec 20, 2012. Apparent causes: 1. The original contract start date was early June, 2012 and contract was not signed until July 5, 2012 which used up some float. 2. Quality issues (see Lesson Learned Q1) impacted schedule. 3. Milestones were fixed and were not allowed to float "from APO" (award of purchase order). 4. Mandated milestones rather than planned based on OPEX.	Approximately 2 months was allotted for Modification Planning, which eventually took 6 months. Even with the avoidable quality issues the schedule was not realistic. Essential to have credible schedule and to escalate when required. Oversight required to prevent quality issues which had a large impact.	D-2012-10298
S3	Positive effect of implementing project staffing plan	Following a benchmarking trip in 2011 to Bruce Power to study their Heavy Water Storage Project implementation, a staffing plan was developed which included 2.5 dedicated FTE's from TRF and up to 6 FTE's for design oversight. As a result of funding and implementation of the plan, the significant workload of submittal reviews has been managed successfully. All but 2 cases were completed within the prescribed turnaround time.	Use of OPEX, consultation with stakeholders, "acknowledging reality" that the work could not be managed with existing resources, and execution of the plan "making it happen" in this case was successful.	Self Assessment NO11-000423 SCR: N-2011-04605
S4	Lack of workstations for EPC contractor	Once a permanent project manager was assigned and work control SPOC joined the project, there were requests for a	On large projects EPC contractors need a site presence, which requires	n/a

	presence at Darlington site	workstation at Darlington site which went unfulfilled due to difficulty in finding available real estate.	assignment of workstation(s) at site.	
S5	Positive effect of Scope of Work terms concerning submittals	The Scope of Work specified that no more than 4 design ECs per discipline were to be submitted at one time. This contributed to most of the 10-day turnaround periods being met by OPG and also 3-day turnaround adherence on dispositions by RCMT.	Contract terms should not just specify turnaround times for submittals, but how many submittals may be processed at one time.	n/a

3.3 Quality

Lessons learned are listed in order of highest to lowest impact.

#	Issue Summary	Background	Recommendation	SCR (if applicable)
Q1	Initial design quality concerns	Two key documents were rejected by OPG due to quality concerns: 1. The first Modification Design Requirement (MDR) submitted on 7/18/12 rejected due to noncompliance with new N-INS-00700-10007 and with historical expectations of MDRs. 2. Modification Outline for EC 118632 was rejected due to insufficient detail in solution and justifications, and incorrect conclusion of an RRAM was possible. Apparent causes: 1. This was one of the first EPC projects requiring engineering vendor to produce MDR and there was little transition period for this change in strategy. 2. Time pressures were involved i.e. 2 months to complete Modification Planning.	1. As per engineering directive, vendors will not produce MDRs in the future. 2. Projects should be cognizant of time pressures. 3. Managerial "courage" to recognize when schedule is unrealistic for the required deliverable and to escalate.	N-2012-03854, N-2012-03914, D-2013-01651, D-2013-01653

		3. Vendor had limited experience producing OPG MDRs. 4. Expectations re: N-INS not clear in contract documentation, no example MDR based on new N-INS. 5. Lack of acknowledgement by team that schedule for MDR was unrealistic. Note, following the Mod Planning activities in 2012, Construction Services Mod Outline first submittal in 2013 was considered very high quality.		
Q2	Modification Outlines did not initially take advantage of ECC process and "EPC" nature of the contract strategy.	Two MOs were planned and were eventually split into 5 in order to classify appropriately in terms of risk. Apparent Causes: 1. From initial proposal, MO's and MDR were planned from an Engineering perspective not a holistic (engineering, construction) perspective. "E" part of planning was activated before "PC". 2. OPG Project Team could have escalate risk of the plan more effectively and that the contractor required help. 3. Time pressure to complete Mod Planning within 2 months did not allow much time for planning the work. 4. Proposal did not include funding for construction input in Phase I.	1. The goal to allow EPC contractors to decide "how" to do the work. This strategy should include "show me" how the plan will work, not rely completely on the Contractor to develop/execute the plan. 2. Critical need for a strategic plan before starting work. 3. Going forward OPG will produce MDRs/MOs to lay groundwork for plan prior to EPC start. 4. Senior leadership present at the lessons learned workshop emphasized that project teams have the option to put work on hold until a strategic plan is in place, and this will be supported by the management team.	N-2013-00847
Q3	Consolidation of OPG comments on submittals	OPG comments on submittals were initially not consolidated resulting in additional time/effort on part of the EPC vendor to resolve duplicate or conflicting comments. Cost change order resulted.	Comments must be consolidated among all OPG stakeholders reviewing documents before leaving OPG. This is the role of the new Engineering Lead	N-2013-00848

			on the D2O Storage Project.	
Q4	Overall quality of OPG comments on submittals	Some OPG comments on deliverables were out of discipline, in the form of information requests, or preferential in nature.	Discipline in commenting and enforcement by Project Manager is required. Reviewers only comment for their discipline. Reviewers should be aware of the EPC model which holds vendor responsible for how to execute the work. Stop submittal review and escalate if required.	N-2013-00848
Q5	Integration of EPC Contractor's Proposal	The original Proposal provided by the successful EPC Contractor was not well integrated; for example sections submitted by the prime and subcontractors conflicted. This was a precursor to integration problems seen later, as in Lesson Learned S1 & Q2.	Pay attention to quality of proposal as it can be a precursor for later issues.	n/a
Q6	EPC vendor "Learning organization" area for improvement on submittals	Frequently, the same errors appeared on submittals which were generic issues already subject to comment on previous submittals. This was caused by multiple preparers, schedule pressure, and parallel work.	EPC vendor has accepted coaching. This is an area to be considered for increased oversight.	n/a
Q7	Enhanced COMS deficiency	COMS deficiency: critical design attributes and characteristics of the design for enhanced COMS are required. This was deficient in a COMS package submitted to OPG.	1. Critical attributes and characteristics should be provided in advance of COMS meetings as applicable. 2. MP-0090 has been revised regarding critical design attributes to allow to not do enhanced COMS/AFS for items clearly not commissionable.	Project Oversight Report #31555-007
Q8	Positive effect of proactive coordination with OPG stakeholders	There were many good examples of EPC contractor personnel being proactive regarding coordination and walkdowns with OPG stakeholders.	This positive result requires timely training/access for vendor personnel.	n/a

Q9	Project Oversight Plan execution area for improvement	Due to the schedule and volume of submittals the documenting of oversight executed under the Project Oversight Plan sometimes taken a lower priority and can be improved.	More attention to detail needed in documenting the oversight that is being performed.	N-2012-05614, N-2012-05956, N-2012-06082

3.4 Process

Lessons learned are listed in order of highest to lowest impact.

#	Issue Summary	Background	Recommendation	SCR (if applicable)
P1	Code Classification risk for Long Lead Materials (LLM)	In order to maintain the schedule, LLM (tanks) had to be ordered prior completion of flow diagrams and therefore prior to obtaining code classification from the CNSC. Tank order had to be placed at some risk.	Schedule / plan early. Identify and track risks.	n/a
P2	Expectations around quality i.e. "what good looks like" and OPG governance	OPG governance sometimes vague and open to interpretation. Expectations on quality or rigour differ from manager to manager. For example, acceptance of the Modification Outlines. Apparent causes: 1. OPG Refurbishment Engineering staff turnover at start of project (DTL, section manager) contributed. 2. OPG is utilizing a new COIR and EPC strategy/ expectations.	Utilize DTL, Engineering Lead, and Refurbishment senior advisor to resolve interpretation. Rollouts have been completed with EPC vendors and additional rollout is warranted. Consider providing "client rep" at vendor site to do in-line reviews, identify issues early, and improve communication.	n/a

P3	Management of challenge meeting process vs. verification process	Final verification of an MDR is a design activity only, however all stakeholders were initially allowed to review during this cycle. Stakeholder input should have been via the challenge meeting. Also, the challenge process was not fully complete (comments resolved) prior to final verification – normal process not followed.	For MDR development, a challenge meeting should be held to incorporate all stakeholder input, and this process should be completed (comments resolved) prior to final verification by Engineering only.	N-2013-00850
P3	Deviation from normal Comment & Disposition process.	Due to the challenging schedule and volume of comments on deliverables like Modification Outlines and MDRs, the project deviated from normal Comment & Disposition process. This involved generating/resolving comments in a face to face session outside normal documented Comment & Disposition Sheet process after submission. This deviance evolved due to sometimes unclear comments by OPG, and unclear dispositions by RCMT, which meant OPG could not rely on simply signing the Comment & Disposition Sheet to trust that a comment would be incorporated to the reviewer's satisfaction.	The model used by this project going forward will be face to face discussion of comments generated as part of oversight, in a proactive way before final submittal of a document. After submittal, specific, high quality comments, and specific dispositions are required for process to run efficiently.	n/a
P4	COMS process issue	One scoping COMS for entire project caused problems. For example, OPG DCC group involvement was missed and had to be captured later. Apparent cause was that related to Lesson Learned Q2, initially there was one Mod Outline which was later split into 5, after Scoping COMS was completed.	Going forward, the MP-0090 process allows challenge meeting to serve as scoping COMS. Implement COMS in manageable chunks.	N-2013-00851
P5	OPG templates area for improvement	Ability to track changes on ECC forms such as Mod Outline, and OPG Comment & Disposition Sheet (CDS) would save a lot of time. CDS template was converted to an Excel sheet that was much more user friendly.	Projects would benefit from revised templates to allow tracked changes, spell check, etc.	N-2013-00853

3.5 Other

Lessons learned are listed in order of highest to lowest impact.

#	Issue Summary	Background	Recommendation	SCR (if applicable)
O1	Rollout of EPC strategy area for improvement	Expectations surrounding interface with EPC Contractors and EPC strategy could have been rolled out better within OPG, eg. Stakeholder groups not willing to work directly with EPC Contractor (instead, only through OPG Project Representative), and adherence to contractual 10 day turnaround times.	New strategy/ process did not have transition time. Need more project level communication with station, for example at station POND or PHC meetings.	n/a
O2	COMS quorum issue #1	OPG failed to achieve quorum for one COMS meeting and several nearly had to be cancelled due to quorum issues except for last minute "heroics" of the team. Apparent causes: 1. Station Operations in particular did not have the resources to provide support for the volume of COMS meetings. Since then 2 staff have been provided to support projects. 2. COMS process originally had a very short notification of 2-3 days, which has since been improved to 10-15 days.	Ensure COMS meetings notifications are sent and all material provided at least 10 days in advance. An overview sheet with all COMS, and where a particular COMS fits in to the project, was beneficial. 3-way Communication with invitees to ensure attendance.	D-2013-00065, D-2013-00825
O3	Issue Tracking File (ITF) area for improvement	Issue Tracking File (ITF) not kept up to date with statuses and all issues (for example COMS issues).	Critical to keep ITF up to date to ensure issues are identified and closed. For complex projects with large ITF, method to actively track is required i.e. workdown curve or other	D-2013-01004

			metrics.	
O4	COMS quorum issue #2	Quorum was failed to be achieved for one COMS meeting due to lack of attention to detail in scheduling the meeting. There are usually "fringe" stakeholders who only interact with the project for one COMS and require attention to detail in identifying and ensuring attendance. Or, SSC's for which responsibility is not well defined within OPG; for example yard drainage.	1. Attention to detail is required for some stakeholders who only interact with the project for one COMS, or for SSC's for which responsibility is not well defined. 2. More attention to detail with nuances such as which COMS Station Ops should attend vs. TRF Ops.	D-2012-10297, D-2013-00825

4.0 COMMUNICATIONS PLAN FOR THE LESSONS LEARNED REPORT

This Lessons Learned Report shall be communicated in accordance with N-MAN-00120-10001-RISK-06 *Darlington Refurbishment Lessons Learned and OPEX Management.*

5.0 CONCLUSIONS

In conclusion, the most impactful lessons learned are summarized here. Additional lesson learned report(s) will be required throughout the project lifecycle.

1. ***#C1 & S3 Staffing plan and positive involvement of expert stakeholders.*** Due to the relative uniqueness of the TRF, and lessons learned from other Utilities around EPC Contractor oversight, the project benefitted from dedicated design oversight and expert stakeholder resources to review submittals and provide oversight. However, the expert stakeholder oversight must be carefully controlled and targeted for maximum efficiency.

2. ***#S1 Quality and timeliness of schedule from EPC Contractor was not to expectations.*** Challenge Contractor's readiness and resources at RFP stage. Carefully consider requested schedule granularity at contract award. The granularity of deliverables specified within payment milestones needs to be balanced with the state of scope definition at time of award.

3. ***#S2 Modification Planning Milestone missed.*** After Modification Planning was complete, the team recognized that even with the avoidable quality issues, the schedule for Modification Planning had not been realistic. Essential to have credible schedule and to escalate when required. Properly delivered oversight required to prevent quality issues which had a large impact on missing milestone.

4. ***#Q1 Initial design quality concerns.*** Be cognizant of time pressures and exercise managerial "courage" to recognize when schedule is unrealistic for the required deliverable and to escalate. As per engineering directive, vendors will not produce MDRs in the future.

5. ***#Q2 Modification Outlines did not initially take advantage of ECC process and "EPC" nature of the contract strategy.*** There is a critical need to have a strategic plan before starting the work. Project teams have the option to put work on hold until a strategic plan is in place, and this will be supported by the management team.

6. ***#Q3 & Q4 Quality of OPG comments on submittals.*** Comments from OPG must be consolidated among all stakeholders reviewing a submittal and vetted properly for quality – in discipline, specific, non preferential in nature.

Appendix A: Acronyms

COIR:	Contract Owner Interface Requirements
COMS:	Constructability, Operability, Maintenance, Safety
EC:	Engineering Change (package)
ED:	Ellis Don
EPC:	Engineer, Procure, Construct
FTE:	Full Time Equivalent
MDR:	Modification Design Requirement
MO:	Modification Outline
OSS	Operational Support Services
PHC:	Plant Health Committee
POND:	Plan of the Next Day
RCMT:	RCM Technologies Canada
RRAM:	Reduced Risk Modification
SSC:	System, Structure, or Component
TRF:	Tritium Removal Facility