ONTARIOPOWER GENERATION

Lessons Learned Report

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Title: PICKERING SALLY PORT PROJECT 25609 - LESSONS LEARNED REPORT

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PICKERING SALLY PORT PROJECT 25609 - LESSONS LEARNED REPORT

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Revision Summary

Revision Number	Date	Comments
R000	2013-02-27	Initial issue.

1.0 BACKGROUND

This lessons learned report pertains to modifications to the Pickering Sally Port. These modifications are part of the Pickering Physical Barrier System (PBS) (Security Fence) project (25609). As a result of a root cause investigation (Refer to SCR P-2012-09332, classification "B2"), a management action tracking assignment (A/R 28147716-01) has been accepted by the Project to conduct a lessons learned report on the installation phase of these modifications.

On June 5, 2012, while installing Pickering Sally Port modifications, a jack hammer made contact and punctured a conduit wall while removing concrete next to a 600 V power panel. An adjacent conduit was just missed by a cut off saw from the previous shift. There was no damage to the electrical cables or electrical contact to the Contractor's Worker. The event was rated a high MRPH which could have resulted in a severe or fatal injury to the worker.

On the previous evening shift, the Contractor's crew has started repair work of a crack in concrete in an area adjacent to planned modifications. The crack had been identified during a walkdown between the day foreman and the sub-contracting engineer. The walkdown was organized to review pending field changes as the modifications could not be installed as per the design. The day foreman took away from his dialogue with the engineer to proceed with concrete chipping, despite the work not being within the current work scope. Direction was then given to the night foreman, who then directed the crew members. Although the presence of nearby conduits was known, both the night foreman and the laborers proceeded to executing the work without question. The Contractor did not contact, nor obtain OPG confirmation/approval prior to undertaking the repair work.

An Excavation Activity Card (EAC) had been approved and released as an "information only" card with the understanding that this was to obtain work authorization only. No notes were identified to that effect on the EAC. OPG's scanning did not identify the conduits. As per the contract, the Contractor was to perform an independent scan prior to starting field work. The Contractor's night crew did not know that the EAC was to get work authorization only and proceeded to excavate. It was not communicated to them that they were to get an independent scan.

The instructions on the EAC were not adhered to. All work was to be executed by "Hand digging" and "Vacuum truck only". Compliance to the instructions on the EAC would not have allowed for the removal of the concrete. Revisions to the EAC were not sought. It was identified during the interview process by OPG and the Contractor that this type of work "needed to be done this way to proceed" and "that it had always been done this way in the past". The night crew did not challenge the instructions on the EAC through conservative decision making and proceeded to perform a saw cutting and "jack hammering" activity on subsequent shifts.

The root cause investigation identified two root causes and one contributing cause:

Root Cause #1: Contractor Safety Culture/Analysis has not been driven to consistently use human performance tools and follow site safety principles. Numerous opportunities were missed by the contractor staff, contractor management, and OPG oversight that could have prevented this event.

Root Cause #2: Project Execution Expectations and Accountabilities for Key Positions were not properly established and communicated to enable effective monitoring / decision making across all shifts. This led to contract deliverables, work release process and the work area not being safe stated prior to executing work.

Contributing Cause #1: No procedural requirements existed for the handling of concrete modifications outside of the powerhouse. This cause contributed to confusion on how to handle the concrete modifications.

While SCR assignments are assigned to address these causes under A/R 28146175, separate management actions were assigned to address recurrence control, including an assignment to complete this lessons learned report.

NOTE: This report does not address directly the root causes of the event, nor assess the effectiveness of the actions taken to correct the identified root causes. This will be done at a later date as part of the SCR effectiveness review process.

The Sally Port modifications have been installed and commissioned, and the AFS is scheduled for March 2013.

A lessons learned report addressing the full scope and life cycle of the PBS Project (25609) will be prepared during project closeout 4Q 2013.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Position	Role/Responsibility
Project Manager (PM) Amar Sood (OPG)	Overall project accountability. Accountable for safe, compliant, cost effective implementation of the project.
Contract Owner (CO) Amar Sood (OPG) Kevin Tomassi (B&M)	Overall contract accountability.
Project Leader (PL) Francis Davis (PBS Project) Silviu Olariu (Joined PN Sally Port team, post event for additional over-sight)	Accountable for schedule and budget adherence. Acts on behalf of and in concert with the PM for Contract Management. Provides support to MTL as required. Maintain Project documentation.

Position	Role/Responsibility
Modification Team Leader (MTL) Gary Chan (OPG)	Manage engineering aspects of the project. Represents the project team in the field.
Cost and Schedule Analyst Pat Byrne	Accountable for overseeing project costs and updating schedules and budgets.
Design Team Leader (DTL) Todd Johnstone (OPG) Bart Tomcezyk (RCMT)	 Ensures design requirements are met. Accepts design deliverables on OPGs behalf. Perform ECC DTL role and produce ECC design deliverables.
Contract Administrator (CA) John Snow (Primary) Shawn Pollett (Evening shift)	Administrates contract with B&M.
Contract Monitor (CM) Po Loon Cheng (Days) Ted Rooney (Evenings)	Monitor contract with B&M
Field Engineering (FE) Juan Garcia/Barry Gilbert	Ensure modifications are installed as per OPG QA/QC program/standards.

3.0 LESSONS LEARNED

3.1 Project Management

The following project management governance was in effect at the time of the event and was reviewed as part of this lessons learned report, refer to Appendix A for gap analysis results:

- N-PROC-AS-0039, Project and Portfolio Management (SUPERSEDED)

No deficiencies were noted as it pertains to this procedure. The appropriate funding (BCS) and Project Execution Plans (PEP) were in place, and qualified CO, CA and CM were assigned to the project team. At the time of the event, oversight of project activities were informally carried out by the PM and MTL via schedule, cost and milestone completion reviews, field walk downs to resolve various installation issues, and weekly project progress meetings.

Two new standards have since superseded this procedure:

- N-STD-AS-0028, Project Management Standard
- N-STD-AS-0030, Project Oversight Standard

These new standards define the responsibilities of the Project Manager including the need to document the project oversight strategy for all phases of the project, and define roles and responsibilities in a Project Oversight Plan (POP). In compliance with the new standard, POPs have been developed for the remaining work for Sally Port modifications, and PBS project, refer to 8690-PLAN-61400-00017 and 8690-PLAN-61400-00016 respectively.

3.2 Contract Management

The following contract management governance was in effect at the time of the event and was reviewed as part of this lessons learned report, refer to Appendix A for gap analysis results:

- FIN-MAN-CM-001 Contractor Management Process Manual (ISSUED)

Applicable project and contract management governance was in the process of being revised at the time of this event. From the review of relevant documentation and interviews, it is clear that there was confusion pertaining to the completion of the FIN-MAN-CM-001 forms. New standards pertaining to Project Management, Contract Management, Project Oversight and Field Engineering were issued in June 2012. Supporting guides, manuals and forms would not be issued until the latter end of 2012, and some job aids are still pending.

A review of the contract management binder found that not all FIN-MAN forms pertaining to this part of the project and contract were completed. In some instances substitutions were made, for example meeting minutes, walk downs, and emails in lieu of some of the forms. However, these substitute records were not filed in the project files or binder, and notations as to the deviations in the project files or binder were not documented. Retrieval of these records was difficult, as most were stored in the PL, CA, or COs e-mails.

The Roles and Responsibility for Contractor Management (FIN-FORM-CM-019-Job Aid VII) was completed but not signed off or dated by the CO, CA or CM. Although there is evidence that efforts were made to reach consensus among the project team with respect to roles and responsibilities (ie multiple rounds of review and comments on the completed form), it does not appear that concurrence by CO, CA and CM was obtained. Specific roles and responsibilities instructions pertaining to the Contract were only partially captured in the form. Contractor responsibilities for design, and construction requirements identified during the RFP process were noted on the matrix, however, responsibilities and limitations pertaining to dig cards, and independent scanning were not. There is no evidence that the roles and responsibilities form was kept current or formally reviewed with project stakeholders such as Project staff (including those on night shift), the Contractor and Field Engineering.

A signed Contract Management Plan (FIN-FORM-CM-013-JOB AID I) was not completed by the CO. As part of the CMP, a communication plan should have been

prepared to outline what information was required by who, the frequency of meetings and follow-up, and the types of reports/information required. The root cause investigation highlighted the weakness in communication between organizations (Contractor and OPG) and from shift to shift. The majority of Project and Contractor staff assigned to the project worked days and were very familiar with the work. However, it doesn't appear that the Contractor's night shift, or the CA and CM assigned to provide oversight during the evening shift had been adequately briefed on all of the details of the work.

Note: Included in the SCR assignments to address the root cases, is an action for P&M to establish, issue and communicate expectations and accountabilities for all key project execution positions and ES-MSA vendor. This includes how functions within P&M Division will work together to effectively manage projects, see A/R 28146175-16.

3.3 Lessons Learned and Opportunity for Improvement

The Project Manager must ensure that all project and contract documentation is complete and appropriately signed-off.

The Project Manager must ensure that project files/records are complete and kept current at all times.

Key project documentation such as roles and responsibilities need to be documented and agreed to prior to start of execution, formally reviewed on a regular basis with project Stakeholders (on all shifts), and updated as needed through out the execution of the project.

Contract communication plans (part of CMPs) need to consider how information is effectively transferred from one shift to the next. This is especially important when work is being executed on multiple shifts or the back shift, but project support is offered predominantly only on days, or provided in a limited capacity on the back shift.

There is a need to clearly communicate expectations with respect to compliance to governance during transitions from exiting governance to new governance, especially if implementation will take place over several months.

The FIN–MAN and supporting forms address the complete life cycle of a contract. Although this governance is no longer mandated by Nuclear governance, it is still a useful reference and can be used as input documents for the Project Oversight Plan (POP) and the Contract Management Plan (CMP).

3.4 Recommendations

Specific to the PBS Project, a more in-depth review of remaining new contracts (PBS gaps) documentation should be completed to ensure compliance to the latest governance changes. This includes ensuring Contract Management Plans and Roles and Responsibility are defined and documented.

As per the A/R, the scope of this lessons learned report was limited to the Sally Port modifications under PBS project 25609. Other projects were not reviewed as part of this report. It is recommended that reviews of other projects be conducted to determine if similar conditions exist and assess the level of compliance to the new governance. It is recommended that this be made a "focus" area for 2013 departmental self-assessments, refer to N-PROC-RA-0097 Self-assessments. A "Snapshot" self assessment approach is recommended.

3.5 SCRs Submitted to Document Events

This lessons learned report was prepared to address management action tracking assignment 28147716-01, resulting from SCR P-2012-09332, *Conduit Hit with Jack Hammer*. A comprehensive SCR review will be completed as part of the PBS project 25609 close-out lessons learned report.

3.6 Action Requests to Implement Changes

Action requests will be raised up on endorsement of recommendations of this report by PMOC.

4.0 COMMUNICATIONS PLAN FOR THE LESSONS LEARNED REPORT

This lesson's learned report is to be presented to the Project & Modification Oversight committee. This report will be distributed to all Project Managers with an expectation to provide a roll-out to their staff.

5.0 CONCLUSIONS

This lessons learned report was prepared as part of the recurrence prevention control actions for SCR P-2012-09332, *Conduit Hit with Jack Hammer*. As part of the gap analysis process, some weaknesses were noted with respect to the Sally Port specific project contract management documentation, and confusion over compliance expectations during transition to new governance. More oversight and better communication could have prevented some of the noted issues.

6.0 REFERENCES

[R-1] SCR P-2012-09332, B&M PO#206862 Conduit Hit With Jack Hammer At ASB Sally Port

[R-2] A/R 28146175 (SCR Type) - B&M PO# 206862-0001 Conduit Hit With Jack Hammer P-2012-09332

[R-3] A/R 28147716 (MGMT Type) - Management Actions From P-2012-09332 Investigation

[R-4] N-PROC-AS-0039, Project and Portfolio Management

[R-5] FIN-MAN-CM-001, Contractor Management Process Manual

[R-6] N-STD-AS-0028, Project Management Standard

[R-7] N-STD-AS-0029, Contract Management Standard

[R-8] N-STD-AS-0030, Project Oversight Standard

[R-9] N-PROC-RA-0097 Self-assessments

[R-10] 8690-PLAN-61400-00016, PBS Project – Project Oversight Plan

[R-11] 8690-PLAN-61400-00017, PN Sally Port – Project Oversight Plan

Appendix A: Gap Analysis Evaluation of Project Interfaces and Execution Oversight of Installation Phase of Sally Port Modifications

No	Governance	Requirements/Expectations in Governance	How obligations were met for PN Sally Port	Deficiency	OFI and Action Plan
1	N-PROC-AS-0039 **Project And Portfolio Management** (Superseded 5-Dec-2012 by N-STD-AS-0028)	**1.7.3.1 Major Interfaces and Handoffs in the Project Definition Phase** (3) Project Manager should acquire agreement regarding the appointment of staff to the Contract Management roles of Contract Owner, Contract Administrator, and Contract Monitor.	Project completed the appointment using FIN-FORM-CM-019 "Roles and Responsibilities Matrix for Contractor Management".	No deficiencies noted.	None noted.
		1.7.4.2 Major Interfaces and Handoffs in the Execution Phase - Detailed Engineering and Pre-Installation (b) When ECC is governed by N-PROC-MP-0090, the Project Manager should ensure the Engineering Specification (N-TMP-10019) Sections of design requirements and test requirements are forwarded as construction and installation prerequisite work to Field Engineering (Installation) for the development of the Quality Surveillance Plan in accordance with N-PROC-AS-0069, Field Engineering Installation Quality Process and N-PROC-AS-0074, Contractor Quality Surveillance. (d) For work performed under OPG's QA Program, Field Engineering should create the Comprehensive Work Packages (CWP) or Fabrication and Installation Package Release (FIPR) and ITP(s), while the Project Manager issues the DWI(s).	Project followed the ECC process governed by N-PROC-MP-0090. The installation work was performed under OPG's QA/QC Program. Field Engineering created CWP, FIPR and ITP's as required.	No deficiencies noted.	None noted.

No	Governance	Requirements/Expectations in Governance	How obligations were met for PN Sally Port	Deficiency	OFI and Action Plan
		1.5.5.1 Major Interfaces and Handoffs in Project Installation and Commissioning Project Manager should monitor and facilitate the progress of the project management activities described below that are delivered from other organizations. (a) Physical Installation of the Project (1) FLM Construction, Field Engineering (Installation), Contract Monitor, and Contract Administrator should provide oversight to the installation of the project, in accordance with the schedules, Work Plans, DWIs, FIPRs, CWPs, and contract documents. The Contract Administrator should process any approved Contract changes.	CA, CM were assigned to both shifts and provided oversight.	No deficiencies noted.	None noted.
2	FIN-MAN-CM-001 **Contractor Process Management Manual**	**How to Use This Manual** This manual allocates a section for each of the stages in the Contract Management Process and lists the steps and sub-tasks that are to be carried out for each stage. ***Every step and sub-task is mandatory unless stated otherwise***. Therefore the manual may not be scaled by eliminating steps or sub-tasks but may be scaled by adjusting the time and effort spent on each step or sub-task. Individual sites may introduce flexibility by developing site-specific job aids. **STEP 1.3 – ESTABLISH CONTRACT REQUIREMENTS** ***Accountable*** – Contract *Owner*, Supply Chain Start preparation of an OPG Contract Management Plan (CMP)	Some forms completed. Not all forms signed-off to indicate concurrence or agreement reached among Project Team members (CO, CA and CM). Does not appear PL, MTL or other Project Team members questions the lack of complete records. Substitute documentation available to demonstrate intent of requirements have been met, see below.	Partial compliance to the requirements (forms) of this manual. Confusion with respect to compliance to this manual as it was being phased out and new Nuclear specific governance was being introduced at the time of the event.	Need to clarify with staff expectation WRT compliance to governance during transitions from old to new governance. Need to determine if a similar condition(s) exists on other projects and correct as necessary. Snap shot self-assessments would be an appropriate method to quickly determine this.

No	Governance	Requirements/Expectations in Governance	How obligations were met for PN Sally Port	Deficiency	OFI and Action Plan
2	FIN-MAN-CM-001 ***Continued***	A CMP records planning and post-award decisions that shall be used by OPG to monitor the contract. It is both a communication and control tool. It can become a key factor in dispute and event resolution. • Completed detailed CMPs shall be registered in PASSPORT for Nuclear BU. **Note:** The CMP shall be documented in either one of three ways: 1. Specific CMP 2. *Project* Execution Plan 3. Job Aid I.	A Contract Management Plan was not completed for this portion of the project, nor included in the Project Execution Plan.	A fully signed Contract Management Plan was not in place for this portion of the project.	There are opportunities for improvement in this area. The FIN-MAN-CM-001 should be reviewed in detail and better understood by the Project Team. A signed and issued Contract Management Plan should be put in place by the Contract Owner using Job Aid I.
		All forms are mandatory and shall be completed and filed unless otherwise noted. All worksheets associated with the forms are mandatory unless substituted with equivalent worksheets approved by the *Business Level Authority* or delegate such as the BU SPOC for Contract Management. • FIN-FORM-CM-001: Form 1 – Contract Planning Confirmation • FIN-FORM-CM-003: Form 3 – Contract Work Release • FIN-FORM-CM-007: Worksheet A – Generic Requirements for Contract Requirements Document	Partially filled-in, not signed-off. Not completed for this phase of the project. However, kick-off meeting held prior to start of field activities. Not completed. However, detailed scope of work prepared (P-SOW-61400-00001).	Using some forms, and substituting with others. There were special provisions/agreements pertaining to design deliverables and dig cards documented in RFP proposal clarification memo's and e-mails. These were not captured in the Job Aid forms, ideally these should have been documented in CMP or the Roles and Responsibility Matrix form, and reviewed with key project	There are opportunities for improvements in this area. Because substitutions are being made where practical, there should be additional reviews (such as a snap shot Self-assessment) for this projects and others to ensure the FIN-MAN forms or substitutions are being consistently and appropriately applied.

No	Governance	Requirements/Expectations in Governance	How obligations were met for PN Sally Port	Deficiency	OFI and Action Plan
		• FIN-FORM-CM-008: Worksheet B – Contract Safety Hazards Evaluation	Not completed.	Stakeholders.	
		• FIN-FORM-CM-009: Worksheet C – Contract Environmental Aspect Evaluation	Not completed.		
		• FIN-FORM-CM-011: Worksheet E – Contract Work Release Worksheet	Not completed. However, mark-up meeting and project Kick-off meeting held.		
		• FIN-FORM-CM-012: Worksheet F – Contract Inspection Checklist	Not completed. However, CA conducting field walkdowns, CM providing daily oversight of field activities, as noted in daily log. Project action tracking log used to document various installation issues and recovery plans.		
		• FIN-FORM-CM-013: Job Aid I – CMP	As noted above, not complete.		
		• FIN-FORM-CM-014: Job Aid II – Contract Administrator and Monitor Qualifications	Not completed. However both the CAs and the CMs held valid TIMS Quals at the time (Qual ID 30285 and 30286 respectively).		
		• FIN-FORM-CM-015: Job Aid III – Safety Certification for Rented or Contractor's Equipment	Form was completed, and rental equipment certificates attached. Copy of form not		

No	Governance	Requirements/Expectations in Governance	How obligations were met for PN Sally Port	Deficiency	OFI and Action Plan
			filed in project files. CA had copy of completed form.		
		• FIN-FORM-CM-016: Job Aid IV – Contract Change Authorization	Contract Change Requests received and approved. CCAs not generated for changes.		
		• FIN-FORM-CM-017: Job Aid V – Contract Monthly Safety Incidents	Not collected on an individual basis, submitted monthly by the Contractor.		
		• FIN-FORM-CM-018: Job Aid VI – Notice of Construction Contract Completion	To be completed once work is complete.		
		• FIN-FORM-CM-019: Job Aid VII – Roles and Responsibilities Matrix for Contractor Management	The PM appointed the roles of CO, CA and CM to the project using Job Aid VII. Although numerous rounds of reviews, the form was not signed-off. There was not evidence that the evening shift alternate CA and CM had reviewed the Roles & Responsibility matrix.		
		• FIN-FORM-CM-020: Job Aid VIII – Daily Log	Daily Log book filled out daily by CM.		

No	Governance	Requirements/Expectations in Governance	How obligations were met for PN Sally Port	Deficiency	OFI and Action Plan
	FIN-MAN-CM-001 Contractor Process Management Manual	**WORK PROTECTION CODE REQUIREMENTS** **For *Owner Constructor*:** Is OPG going to provide Qualified Staff to act as HoR and/or Maintenance Authorities *(Nuclear Only)* where appropriate? If "No" • OPG Contract *Owner* shall ensure the contractor is aware of the need to resource the *project* to meet HoR and/or MA requirements. • OPG Contract *Owner* shall ensure that the contractor is aware of the training requirements that shall be met to qualify their staff as HoR and/or MA *(Nuclear Only)* where appropriate. • OPG Contract *Owner* shall ensure the contractor is aware of the requirements to have all contract staff who shall be working under the protection provided by Work Protection" be "Worker" qualified. • OPG Contract *Owner* shall ensure that the contractor is aware of the lead time required to schedule and receive the necessary HOR and MA (if applicable) training. • OPG CA shall plan to ensure all contract *Supervisors* who shall be supervising staff working under the protection provided by Work Protection receive the Worker training. • OPG CA shall ensure the additional contractor training requirements are properly resourced and scheduled in advance of the work to be performed.	Verification of qualifications of Contractor staff against TQD-501 completed by CA prior to Contractor mobilizing on site. Expectations also re-enforced during Mark-up meeting	No deficiencies noted.	None noted.

No	Governance	Requirements/Expectations in Governance	How obligations were met for PN Sally Port	Deficiency	OFI and Action Plan
	FIN-MAN-CM-001 Contractor Process Management Manual	**ROLES AND DUTIES UNDER OHSA** **OPG as *Owner-Constructor* [Duties of *Project Owner* and *Constructor*]** Ensure that: • Measures and procedures prescribed by the OHSA and Regulation are carried out on the construction project. • Every employer and worker on the construction project complies with the OHSA and the Regulations. • The health and safety of all workers on the construction project is protected. **The following provides more detail as to how OPG would demonstrate Due Diligences as required by OHSA. OPG as *Constructor* (*Construction Projects*)** Typically, OPG is the *Constructor* for all *construction projects.* As the *Constructor,* OPG shall exercise the following due diligence when contracting: • Appoint *competent persons* as *Project/Contract Managers, Site CAs* and/or *Site Monitors.* These shall be appointed in sufficient numbers to execute OPG's duties as the *Constructor.* • Identify all legal requirements applicable to the *contracted work.* While detailed knowledge of these requirements may not be reasonable (i.e., for highly specialized work), some knowledge is required in order to assess the *contractor's EH&S management system.*	The contractor's safety plan # 48155331, Sally Port Physical Barrier System Project, dated December 5, 2011 was reviewed by OPG Contract Administrator. Qualified CAs and CMs provided oversight of both shifts. Duties included field observations, attending PJBs (every other day) and participation in the weekly project status meeting, and miscellaneous meetings regarding installation issues (including PCC). Pre-qualification of the Contractor and subs was completed as part of the bid process. The scope and installation method was reviewed in detail at the Mark-up meeting held May 22, 2012. Notice of project was filed as part of the PBS project submission.	No deficiencies noted.	None noted.

No	Governance	Requirements/Expectations in Governance	How obligations were met for PN Sally Port	Deficiency	OFI and Action Plan
		• Pre-qualify all *contractors* and sub-contractors to confirm they have an operational EH&S management system and acceptable EH&S performance. The EH&S policy, programs and procedures shall address hazards specific to the *contracted work*. • As the *Constructor*, implement an EH&S management system to assess and control OH&S hazards. This EH&S management system shall address the hazards specific to the *construction project*/project site and should include rules, procedures, training, a work site inspection process, a *contractor* monitoring process, a *contractor* disciplinary process, etc. • As required, file completed registration and notification forms with the MOL. • Confirm *contractor* employees have been provided with appropriate instruction, training and orientation. Document all training delivered with appropriate signoffs. • Conduct job site meetings to organize work, familiarize *contractors* to the hazard of the *project* site and outline OPG's expectations (i.e., compliance with all legal requirements, JSAs, housekeeping, etc.). Pre-job briefings and expectations, *project* site hazards and any changes to equipment, people, procedures or the work environment.	Kick-off meeting, site walk-down, and weekly status meetings held. Verification of qualifications of Contractor staff against TQD-501 completed by CA prior to Contractor mobilizing on site. CM walking down the work site daily, and attending Contractors PJB meetings every other day. Any deficiencies addressed immediately.		

No	Governance	Requirements/Expectations in Governance	How obligations were met for PN Sally Port	Deficiency	OFI and Action Plan
		• Monitor *contractors* to confirm they have adequate numbers of competent *supervisors* and processes for monitoring compliance. • Inspect the work site and monitor *contractor* performance with sufficient frequency to ensure compliance. Confirm commercial terms and conditions allow for termination of a *contractor* for non-compliance. Establish clear disciplinary and termination processes. Document all verbal and written warnings. ***Constructor's Supervisor* (Where OPG is the *Constructor*)** OPG shall appoint a person to this role. A single person such as a CA or a Contract Monitor who is physically located at the job site can fulfill these duties in the case of a smaller *project*. O.Reg. 213, S.14 (2) also allows the "*Constructor's Supervisor*" to appoint an "assistant who is a competent person". This person supervises the work on the *project*, not the contractor's workers. Direct supervision of the contractor's workers is provided by the contractor, not OPG.	Qualified and experienced PM, CA and CM were assigned to the project.		

ONTARIO POWER GENERATION

Lessons Learned Report

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Title:
PHYSICAL BARRIER SYSTEM – LESSONS LEARNED REPORT

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PHYSICAL BARRIER SYSTEM

N-LLD-61400-10001 R000

Project Number: 10-25609
PEP Number: N-PEP-08160-10000

2015-02-27

Internal Use Only

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Revision Summary

Revision Number	Date	Comments
R000	2015-02-27	Initial Issue

Executive Summary

The Physical Barrier System (PBS) is an integrated security system enveloping the Protected Area (PA) at Pickering and Darlington Nuclear Generating Station. This system is comprised of a physical delay barrier and a full complement of detection and assessment devices that annunciate in the Security Monitoring Room (SMR). This system increases the amount of time site security has to intercept potential adversaries in the event of an attempted breach.

The PBS was declared to be functional on December 31, 2008. The system is considered by both Nuclear Security and the Canadian Nuclear Safety Commission (CNSC) as a credited site security measure and is treated accordingly, including response to alarms and provision of compensatory measures in the event of equipment repair or maintenance activities.

Project Milestones which were established in Business Case Summary (BCS) and Project Execution Plan (PEP) were not realized, and needed one Superseding Business case and two variance memorandum to achieve the project completion.

The PBS at Pickering and Darlington were declared partially available for Service (AFS) in August 2009. The partial AFS transferred the responsibility of operation and maintenance to station personnel with the support from Projects until the Final AFS after commissioning was completed. Commissioning was completed at Pickering and Darlington in April 2011 and July 2011 respectively. The Final AFS was delayed due to additional deficiencies found at both sites, forcing an additional Partial AFS.

Final AFS for the PBS were accomplished at Pickering and Darlington on November 30, 2012 and September 21, 2012 respectively.

The UPS was relocated and Final AFS completed November 2, 2012.

The Installation and Commissioning of the Sally Port at Pickering was completed and the Final AFS was completed on February 20, 2013.

Gaps in the requirements were identified during a CNSC Security Audit on 15 October 2010 and minor and deficiencies found at the final AFS walk down were completed under separate contracts on the 15 December 2013.

The cost of project management and installation/commissioning support by OPG was higher than expected, due to less than adequate oversight of the commercial vendor performance, coupled by changes in the design of some systems to meet regulatory and code requirements.

Following the declaration of final completion of the EPC contract between OPG and the primary contractor Safeguards Technologies LLC, a legal claim was filed against OPG by the Design subcontractor (IBI group) for scope of design services rendered for the interface and tie-in of the power infrastructure.

All Design EC's associated with the Enhancements to meet the CNSC audit findings were declared in service in February 2014.

The project is presently in the close-out of service provider purchase orders and discovery issues to ensure configuration management requirements are met. Project EC's scheduled to close on April 30, 2015

1.0 BACKGROUND

As a result of the events of September 11, 2001, the Nuclear Safety and Control Act and Nuclear Security Regulations were updated, through order #28074760, to assure the Canadian public that enhanced physical protection measures are in place at Nuclear Generating stations. To meet the regulations, a delay barrier between the public domain and the Protected Area (PA) boundary was installed. This barrier is referred to as the Physical Barrier System (PBS).

In May of 2007, the Design Authority for the security systems approved a Work at Risk Release (WARR) for the installation of the system outside the protected areas by Safeguards Technologies LLC based on an Engineering, Procurement and Construction (EPC) contract. This WARR approval did not include OPG's power supplies, controls and interface installations as they were installed in accordance with the Risk Based Engineering Change Control (ECC) process.

1.1 PURPOSE

The Physical Barrier System (PBS) is one of the components of an overall protection strategy designed to prevent unauthorized access to sensitive areas at nuclear facilities. This new system consists of a physical delay barrier as well as supporting intrusion detection and assessment components, including lighting to provide adequate delay such that Nuclear Security can intercept an attempted breach.

1.2 DEFINITIONS, ABBREVIATIONS AND ACRONYMS

BCS – Business Case Summary
CNSC – Canadian Nuclear Safety Commission
ECC- Engineering Change Control
EPC- Engineering, Procurement and Construction
DNGS- Darlington Nuclear Generating Station
NSO – Nuclear Security Officer
OPG – Ontario Power Generation
OPEX – Operating Experience
PA – Protective Area
PEP – Project Execution Plan
PBS – Physical Barrier System
PNGS – Pickering Nuclear Generating Station
SCR – Station Condition Record
SMR – Security Monitoring Room
SMS – Security Management System
STL – Safeguards Technology LLC
UPS – Uninterruptable Power Supply
WARR- Work at Risk Release
WEI – Wardrop Engineering Inc (Tetra-Tech)

1.3 PROJECT FUNDING HISTORY

The initial Partial BCS was released in May 2003 for scope definition and engineering. In February 2007 a second Partial BCS was approved to support EPC contract estimates and life to date charges. In May 2007 an additional Partial BCS was approved to support a directive amendment # 2 to the contract.

A Superseding BCS was approved on April 28, 2010 to provide additional funding for Commissioning and close outs, Installation of PBS in Sally Port at Pickering, Relocation of Uninterrupted Power Supply (UPS) at Pickering, Work analysis and engineering reports to address maintenance access, snow removal etc.

On September 27, 2013 a settlement to the claim was reached with the sub contractor, which resulted in additional cost charged to the project.

On January 24, 2014 an Over variance memo was approved o cover additional cost to facilitate the completing the identified GAPS in the system and to cover the cost of the sub contractor claims.

$ 000's	All Existing Releases (Incl contingency)											
Release Type	Mth	Year	2003 to 2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Partial	May	2003	7,000									7,000
Partial	Feb	2007	7,000	12,000	10,000	8,000						37,000
Partial	May	2007		30,600	14,400	10,000						55,000
Full	May	2008		22,186	20,160	6,322	780					49,448
Superseding	May	2010				47,062	4,711	2,911	2,067	185		56,936
Variance Memo #1	Feb	2013						54,363	3,196	2,577		60,136
Variance Memo #2	Jan	2014						56,936	879	9,321	100	67,236

1.4 PROJECT COST PERFOMANCE

	BCS Total	LTD Actual
Project Management & Support	$ 11,262,548	$ 11,224,976
OPG Engineering	$ 2,853,425	$ 2,876,594
Contract - Design	$ 5,947,933	$ 5,981,905
Contract Installation	$ 42,034,971	$ 41,949,901
Material	$ 1,314,427	$ 1,330,518
Interest	$ 3,722,696	$ 3,779,586
Contingency	$ 100,000	
Total	**$ 67,236,000**	**$ 67,143,480**

2.0 CONTRACT STRATEGY

The delay barrier detection and assessment portions of the PBS (i.e. all equipment outside the PA) were designed and installed to commercial conditions and standards under an Owner's Only contract by Safeguards Technologies LLC (STL), with Design partner IBI Group Inc. Power and control tie-ins to existing OPG infrastructure and ECC treatment (wraparound) of the commercial drawing set provided by STL was prepared by Tetra-Tech (formally WEI) per the Risk Based ECC process. This included Civil, Electrical and I&C Design EC Packages. Installation, tie-ins, and functional checks were completed under OPG oversight in December 2008.

2.1 SCOPE OF WORK

The Project scope was completed based on the approved needs statement as per Project Charter N-PCH-08160-10000 R00 which covered the Design, Procurement and Construction of a land-based PBS at PNGS and DNGS. The PBS includes the following components:

1) A Physical delay Barrier installed near the PA perimeter boundary
2) An intrusion detection system (acoustic, infrared, and pole hardening sensors), integrated into the above delay barrier to detect intruders attempting to enter the PA by breaching the PA boundary
3) An intrusion alarm assessment, consisting of Cameras and lighting systems
4) Computerized Control Centre that receives all Physical Barrier System alarms and interfaces with the existing Security Monitoring System to alert site security personnel (Pickering and Darlington).
5) A Uninterruptable power Supply (UPS) 018-61400-UPS9002
6) Relocation of the existing jersey vehicular barrier system to accommodate all the above
7) Installation of gates and access points through the delay barrier and the vehicle denial barrier as required by design requirements
8) Removal/relocation of field obstructions to accommodate civil installations (Pickering and Darlington)
9) Installed barrier along the existing Protected Area (PA) fence and gate at the Sally Port at Pickering.
10) Perform a work analysis to determine solutions to Maintenance Access and Snow Clearing Concerns at Pickering & Darlington.

2.2 EXECUTION PHASE

The project was broken in (8) eight phases of work as follows:

1) Conceptual Phase – Development of System Requirements
2) Phase 1 – Preliminary Engineering
3) Phase 2 – Regulatory Acceptance
4) Phase 3 – Detailed Design
5) Phase 4 – Procurement
6) Phase 5 – Installation
7) Phase 6 – Commissioning
8) Phase 7 – Training
9) Phase 8 – Project Close-out

3.0 RESULTS

Project Execution Plan N-PEP-08160-10000 measures for evaluation of project performance have been assessed including mitigated risks as follows:

Measure	Performance
The successful commissioning and operation	Criteria satisfied
Maintenance and Operating procedures in place	Criteria satisfied
Availability of Spare Parts	Good
Training of Operations & Control Maintenance	Criteria satisfied
Milestone Dates met	2.5 yrs ≥ Planned
Actual Costs ≤ Planned	38.5% ≥ Planned

Project Milestones which were established at the initial Business Case Summary (BCS) and Project Execution Plan (PEP) were not realized, and needed the approval of Superseding Business cases and variance memorandums to achieve the project completion.

The cost of project management and installation/commissioning support was higher than expected. The primary contributors which extended the schedule by additional two and a half (2.5) years include:

3.1.1 OPG Project Management and Installation Support

a. Adverse weather conditions. - Major construction of the civil/mechanical portions of the fence was in winter 2007; major electrical construction was in the summer of 2008. Productivity and progress was greatly impacted due to snow fall and rain fall within these time periods.

b. The UPS system required relocation from it’s originally location because the initial installation was not in accordance with applicable codes and standard regulations.

Modification did not meet operability and safety requirements, specifically to poor room conditions for protection of the components.

c. The Sally port project was facilitated under a separate EPC contract, and experienced delays due to lack of experience by the contractor and its subcontractors, which created design rework and field execution changes due to lack of oversight and configuration management ordinaries not being adhered to.

d. Discovery of poor workmanship resulting in three month system outage and subsequent delays (Darlington – Reference security condition record #N-2009-06348).

e. During the execution of load verification activity, and field engineering inspections it was determined that a significant portion of the Physical Barrier System installation was non compliant with ESA code coupled with poor workmanship specifically on the perimeter lighting system which presented a personnel hazard. Accordingly, the Physical Barrier System was isolated and three months rework was performed to correct the issue. The vendor coordinated and funded the trades work to repair the deficiencies. This finding resulted in a mandatory extent of condition being performed at Darlington.

f. The poor workmanship was less prevalent at Pickering however similar issues were discovered and had to be corrected.

g. During the system outage at Darlington, five full time Nuclear Security Officers were posted 24 hrs daily as compensatory measures to ensure regulatory compliance and these costs were charged to the project.

h. The system was placed in-service after vendor testing, however without system level testing and without a formal available for service due to a Regulatory Order 28074760 commitment, as such the remaining system optimization and troubleshooting work became substantially more cumbersome to execute as the vendor did not have OPG qualified resources to perform field work and the owner-only construction arrangement was no longer valid. As such, execution of work involved much greater OPG involvement and coordination to execute under the OPG work planning and control process.

i. Nuclear Security Officer compensatory measures costs (charged as over time) were appreciably higher than expected due to the system being placed into service prior to full troubleshooting and commissioning.

j. The PBS was recognized by the CNSC as an in-service security system in December, 2008, therefore any work performed on the system from that point on, for any reason, required the presence of security compensatory measure to ensure the Nuclear Security Regulations were fully met.

k. The costs of the compensatory measures were absorbed by the project as no available for service activity had been performed at this time. The system was stabilized and performed adequately; however additional compensatory measures were required to complete the project as the commissioning was performed.

3.1.2 Engineering

a. The introduction of Project Design External Engineering Service reviews in June, 2009, for all Physical Barrier System and Uninterruptible Power Supply designs and documents introduced significant cost and schedule implications that were not originally anticipated in the Full Business Case Summary.

b. As per original scope description, design reviews were to be performed internally with the Security Projects group. Due to operating experience and a need to improve the rigour and focus of the review process, the design function was moved to Project Design External Engineering Service and design review and acceptance processes which become appreciably more time consuming. As an example, the "Engineering Change Control Wrap" packages for Pickering required dedicated review of two full time engineers a period of 5 weeks to execute, including some overtime work to meet the Pickering partial available for service in December, 2009.

3.1.3 Contract Design

c. The project absorbed substantial incremental design cost for the Physical Barrier System. The interface between Physical Barrier System installation vendor (performing commercial design of the system) and the Engineering Change Control design vendor resulted in additional costs as gaps in ownership and accountability were identified. Further, there had been multiple instances where OPG needed to provide additional funds to Engineering Change Control design vendor to integrate a design revision where there was an error in the base vendor design that needed correction.
d. There were also substantial incremental costs for the Engineering Change Control design vendor related to scope changes for the uninterruptable power supply work. These scope changes were driven by a number of factors, some already documented under the engineering header of this report.

3.1.4 Additional Scope

Following the Commissioning phase, the Final AFS for the PBS were completed at Pickering and Darlington on November 30, 2012 and September 21, 2012 respectively.

The UPS was relocated and the Final AFS completed November 2, 2012.

The Installation and Commissioning of the Sally Port at Pickering was completed and the Final AFS was completed on February 20, 2013.

Open items identified as GAPS from the original specifications, during a CNSC Security Audit on 15 October 2010 and a few minor items identified during final AFS walk down were addressed separately under the Gap Enhancements installation and Commissioning phase and were completed on 15 December 2013.

Schedule and Cost variances were incurred as a result of the following:

a. Late discovery of poor installation workmanship by the EPC contractor at Pickering and Darlington resulting in additional delays in schedule for the completion of commissioning as installation issues had to be corrected on the live running PBS.

b. Late discovery of deficient design provided by EPC contractor resulted in additional 12 weeks of delay and extra efforts by OPG design to undertake extensive analysis. This resulted in modification to certain portions of the fence at Pickering through a third party EPC contractor.

4.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The following is the structure of the project team:

Project Phase/Year	Role	Person
2006 to 2014	Sponsor	S. Harvey, Bob Hagymasy, Paul Nadeau
2006 to 2008	Design Authority	S. Sellers, S. Stock (DN) B. Morrill (PN)
2009 to 2013	Design Authority	Michael Gerard (DN) Gregg McCabe (PN)
2014	Design Authority	Jason Wight (DN) Emily Tarle (PN)
2006 to 2014	Security Projects Manager	John Moore, Ray Balachorek
2006 to 2009	Project/Design Manager	Morad Solaimani, Tammy Jeffs, John Melmer
2009 to 2011	Project/Design Manager	Ryan Smith
2011 to 2012	Project/Design Manager	Amar Sood
2013 to 2014	Project/Design Manager	Scott Ritzie
2006 to 2010	Modification Team Leader	Colin Butt, Silviu Olariu
2011 to 2014	Modification Team Leader	Francis Davis, Gary Chan, Patrick Wai
2006 to 2014	Design Team Leader	Efim Reidiboim, Madhusudan Desai and Todd Johnstone
2006 to 2014	Cost & Schedule Analyst	Ion Secaraanu Yvonne Sauvé Patricia Byrne
2006 to 2014	System Responsible Engineer	Jin Hong (PN) Shiva Shivakumar, Walter Bek(DN)
2006 to 2014	Contract Owner	Ray Balachorek
2006 to 2014	Contract Administrator	John Snow (PNGS) John Gallaher (DNGS)
2006 to 2014	Site Security Manager	D.McBride, Brian Mclellan, Darren Reid(PN) B.Paul, Bart Vos , Dave Flynn (DN)
2006 to 2010	Vendor (Safeguards Technology, LLC) Site Construction Manager	Michael Feinstein, Joe Babajko
2006 to 2010	Vendor (Safeguards Technology / IBI Group) Design Manager	Frank Spitzer
2006 to 2014	Vendor (WEI/Tetra-Tech) – ECC wraparound and Power Tie-ins	Gordon Fountain, Bimal Gandhi

5.0 LESSONS LEARNED

5.1 Lesson Learned Summary

5.2 Lesson 1: Ensure that Design Basis documents are fully signed off and comprehensive prior to performing any detailed design work.

5.2.1 Background

The design subcontractor (IBI group) hired by the main EPC vendor (Safeguards Technology LLC) was not qualified to provide Design Engineering Change packages under the ECC/Risk Based Modification process, therefore an additional contract was initiated to hire an OPG approved design agency (WEI/Tetra-Tech) to complete the ECC wrap-around the vendor's design packages, in addition to completion of service tie-ins.

The detail of design packages submitted for OPG review/acceptance/approval was incomplete, due to the inconsistent information exchange between the EPC vendor and the design agency. Hence, it generated additional review/acceptance/approval iterations which delayed the overall design schedule.

A WARR (Work at Risk Release) process was approved and used for the installation. The design package was released for installation of PBS before the Design Brief was issued.

Project was delayed because of additional civil design verification of support post sizing to suit load and weather conditions.

Significant rework was required at all stages of the project due to Design Agency poor quality Design EC submissions. Additional iterations of Comment and Disposition cycles were required. Field Engineering assessment and subsequent FIC submissions and field delays encountered all contributed to unnecessary cost growth and schedule delays.

Reference for tracking of lessons learned: SCR's – N-2008-06354, N-2008-06204, N-2008-06192, N-2008-06179, N-2008-06159, N-2008-06152, N-2008-06027 and N-2012-04968

5.2.2 Recommendations

The OPG Design group should provide intrusive review of design with respect to the ECC compliance when accepting/approving design produced by design agencies that are not ECC qualified.

The OPG Design group should provide more rigour to review design when accepting design packages released as part of a WARR process

Wherever possible, ensure ECC process is followed and an AFS in conducted before the system is placed into operation. This ensures appropriate oversight of the system to manage change and minimize potential for an adverse condition.

Improved rigor by Design Agency aligned to their QA program during the EC preparation, verification and approvals would mitigate significant cost and schedule impact by improving the overall quality of submitted EC(s)

5.3 Lesson 2: The EPC contract plan for the Installation phase caused some rework with station stakeholder, as it was all performed under a single master work order

5.3.1 Background

A large number of field changes/non-conformances was generated during the installation phase of this project. PBS project installation was done under the contractor's QA/QC (quality assurance/quality control) program where deficiencies were discovered and corrected during the commissioning phase at a much higher cost to OPG.

The project experienced un-expected technical, logistical and resource challenges in some areas of the field work, varying from discovery issues to lack of detailed design documents

Reference for tracking of lessons learned: SCR's – N-2008-06311 and N-2013-03127

5.3.2 Recommendations

Use the OPG's QA/QC program for all installations. Alternatively, clearly specify installation QA/QC requirements to contractors and provide OPG's QS (quality surveillance).

OPG project oversight should ensure that the contractor's planning of work is logically tied to areas where station support is required by using separate work orders or tasks.

Ensure Mod Outlines are written in explicit detail, with any planned deviances from existing governance identified clearly upfront

5.4 Lesson 3: Oversight of vendor quality program in commercial/owners only contract would have added value and minimized rework

5.4.1 Background

Contractor's QA/QC program was never correlated with the OPG requirements mainly because of the commercial type contract and therefore QS by OPG was at best

sporadic, also due to lack of hold points in Comprehensive work plans (CWP) and Inspection test plans (ITP). Because of inconsistent planning and communication between the Contractor and the OPG field team this caused schedule delays and additional cost during installation of the PBS Gap Enhancements

Reference for tracking of lessons learned: SCR's – N-2009-06996 and N-2008-06311

5.4.2 Recommendations

A review and comparison to expectations for CWP's and ITP's which are an integral part of the QA/QC program with the OPG QS requirements would facilitate a more efficient process for field verification and acceptance

Ensure a Quality Surveillance program is set up, for commercial contracts, allowing OPG to have some ability to ensure the vendor quality documentation is sufficient.

5.5 Lesson 4: Stakeholder input should be requested in the early phases of the project

Stakeholders have extremely valid input and as future owners and maintainers of the system, their comments must be given due process

5.5.1 Background

Due to the fast track nature of the project it was difficult to include stakeholders in every communication that had an impact on the final product

Reference for tracking of lessons learned: SCR's – N-2009-04013, N-2011-02039 and N-2011-02259

5.5.2 Recommendations

Improve front end planning and communication with stakeholders and following ECC process from the beginning of the project would mitigate the lack of operation and maintenance knowledge and input

5.6 Lesson 5: Increased OPG oversight requirements and hold points are necessary in ESMSA contracts

ES MSA Contractor – Planning and Assessment process requires more in-depth review and attention.

5.6.1 Background

Comprehensive work plans (CWP) and Inspection test plans (ITP) needed multiple revisions before they could be issued to the field

Reference for tracking of lessons learned: SCR's – N-2008-05085 and N-2009-04430

5.6.2 Recommendations

OPG oversight hold points should be embedded into the Contractor Design Plan

OPG should implement penalties in the ESMSA contract to ensure schedule and approved plans are maintained by the contractor

5.7 Lesson 6: Ensure that every effort is made to negotiate full EPC contracts where the interest and expectations are seamless

The PBS Gap Enhancements was administered as a Procure and Construct, due to the design being completed at an earlier stage by a separate design agency. This placed OPG projects as a broker between the two parties, causing major delays and additional cost to the project

5.7.1 Background

Any discovery issues, deficiencies and field changes, created long delays which resulted in delay charges in addition design charges to correct change papers. If the contract had been a full EPC with OPG oversight this additional cost and schedule delays would have been avoided.

Reference for tracking of lessons learned: SCR's – N-2008-05085, N-2012-04085, N-2013-01184, N-2013-01507, N-2013-02632, N-2013-04298, N-2013-12345, N-2013-15343 and N-2013-19571

5.7.2 Recommendations

Ensure that every effort is made to issue full EPC contracts with qualifications for the ECC process included

5.8 SCRs Submitted to Document Events

Note: The following SCR listing represents trends that affected the project day to day life span, where corrective action and learning was used to improve performance. In Addition Security Protected SCRs (DS2010/2011/2012) covering commissioning challenges and gaps were recorded, trended and addressed on a bi-weekly basis.

DARLINGTON Location

SCR Number	Category	Status	Titles and Description	Actions Taken/Comments
N-2013-00840	D 4	COMPLETE	Project 25609 PBS Design Services Purchase order value increased above the 20% threshold limit	Informed FLM and obtained approval for the change notices in order to avoid a delay in the schedule that would place key milestones at risk. Reviewed the situation with Supply Chain requirements for implementation of an SCR in the case of any increase above 20% of the value of a purchase order
N-2013-01184	D 4	COMPLETE	Missed Key Milestone - Detailed Design complete for PBS gaps - Project 25609	Informed Section Manager and prepared a recovery plan with the Design Agent and the Design Team Lead. New date for milestone was set for April 08, 2013
N-2013-01441	D 4	COMPLETE	Request to reopen previously closed Purchase Order 0198991- Project 25609	Informed FLM and Supply Chain SPOC. Initiated the process to obtain approval to re-open the PO. SCR completed for trending purposes.
N-2013-01507	D 4	COMPLETE	Project 25609 PBS - Missed Key Milestones	Informed Section Manager. Project conducted meetings with Design Management and the working team including the Design Agency and has prepared a recovery plan to maintain the remaining planned milestones for the AFS as per the BCS.
N-2013-01510	D 4	COMPLETE	Project 25609 - Increase in PO value above 20%	Informed Section Manager. Obtained approval from the PMOC and initiated this SCR for trending purposes
N-2013-02632	D 4	COMPLETE	Project 25609 - Design Complete Milestone missed	Informed FLM and discussed with Design Section manager. SCR initiated for trending purposes
N-2013-03127	D 4	COMPLETE	Project 25609 Discovery of incorrect dimensions on drawing in DEC117874 during installation	DTL and DE informed. The FEC conducted a field verification was and FICREQ01 was generated and approved by design. SCR was initiated to document the occurrence.
N-2013-03574	D 4	COMPLETE	Project 25609 - PBS -Delays in preparation of FICREQ04	Informed Section Manager, DTL and the design agency representative. SCR initiated for trending purposes.

SCR Number	Category	Status	Titles and Description	Actions Taken/Comments
N-2013-04298	D 4	COMPLETE	Project Pre-reqs not completed as scheduled - Project 25609 PBS	Informed FLM. Worked with the Contractor with the assistance of the PCC to establish recovery plans for both Darlington and Pickering sites. Filed this SCR for TRENDING purposes.
N-2013-04299	D 4	COMPLETE	Materials not available for Installation - Project 25609 PBS	Informed FLM and Section Manager. Also utilized the support of the PCC to assist the Contractor, and the Project provided the option to request available materials from OPG stores, with the understanding that the Contractor will provide a PCA to credit the project with the cost. Design approved the procurement of QL4 items to be purchase as commercial grade. This SCR has been initiated for TRENDING purposes.
N-2013-04302	D 4	COMPLETE	Project reporting documentation not provided in a timely manner - Project 25609 PBS	Projects has reported the procedural non-conformance to the Section Managers, and have repeat made requests to the PM. This SCR is issued for TRENDING purposes
N-2013-12296	D 4	COMPLETE	Project 25609 PBS - ESMSA Contractor not reporting status to OPG project team	FLM and Contractor PM informed. An additional meeting was conducted with new dates for recovery plans promised for September 5, 2013. This SCR initiated for TRENDING purposes.
N-2013-12345	D 4	COMPLETE	Project 25609 PBS - AFS Milestone dates will not be met as planned	Informed FLM and affected support teams. Conducted reviews of the work load. Contractor has completed recovery plans. This SCR has been initiated for TRENDING purposes.
N-2013-14790	D 4	COMPLETE	Project 25609 PBS - ESMSA Contractor has not provided project management reporting and earned value tools	Informed Management and supervisor. Initiated a meeting with the Contractor Project team to review and correct which has been cancelled on short notice on two occasions.
N-2013-15343	D 4	COMPLETE	Project 25609 - Schedule Delay AFS milestone date change	Informed the PCC, Project Section Manager, and conducted a meeting with the Contract facilitator and field trade supervisors at which time the installation logic was modified to allow some mechanical civil work to be advanced to allow the electrical trades to progress. This resulted in a push of the completion date to October 18, 2013 with the primary goal of maintaining the IOP scheduled window for CM commissioning (contractor to confirm). Commissioning will now be completed October 31, 2013. New AFS date will be November 08, 2013. Contractor has been requested to update and issue the project schedule and provide Projects with a zero $ CTP for approval.
N-2013-19045		FLM	Project 25609 PBS - Installation schedule delays by Contractor	Informed all supervisory personnel. The contractor was instructed to obtain a replacement cable that meets the specified cable. Contractor made the decision to work overtime to complete the terminations. The SCR was inputted for trending p.
N-2013-19571		FLM	Project 25609 – PN Gaps Enhancement – AFS Milestone at Risk	Informed FLM and all affected stakeholders. The SCR inputted for trending.

SCR Number	Category	Status	Titles and Description	Actions Taken/Comments
N-2012-04086	D4	Complete	Increase in PO value above 20%	Initiated SCR for trending only.
N-2012-04085	D4	Complete	Missed AFS Milestone	Initiated SCR for trending only.
D-2011-13825	D4	Complete	Delay in completion of Action tracking – AR28128258-10	AR Extended and new path forward prepared.
D-2011-10613	D4	Complete	Delay in completion of Action tracking	AR Extended and new path forward prepared.
D-2011-08339	D4	Complete	Ambiguity and lack of knowledge demonstrated at the Partial AFS	Initiated SCR for trending only.
D-2011-08338	D4	Complete	Lack of clarity in Design Requirements	AFS report revised to include Action Tracking to investigate, verify and clarify the MDR
N-2010-03215	D4	Complete	Resource Issue – Commissioning start delay	Dedicated CM support provided for commissioning
D-2010-08465	C3	Complete	BOM non-conformance	ROP/TMAX is being updated
N-2009-06996	D4	Complete	Engineering: Physical Barrier System: Discovery of Minor Field Configuration Issues During ECC Wrap of Third Party Vendor Design	To be discussed at MRM, mitigating measures agreed upon with DA.
N-2009-05574	D4	COMPLETE	Miscellaneous - Insufficient Considerations for Snow Clearing/Maintenance Under Heavy Snow or Ice Conditions - PBS Project 10-25609	For areas of concern identified in the minutes, where administrative or soft solutions cannot be used to address the issue, handle each instance independently on an as-needed basis. The work environment/condition will be unique in each instance (ice condition, snow quantity, etc.) and as such shall be addressed directly with the working group and relevant support groups (i.e. conventional safety) if and when the need arises. JEFFST 2009/09/28 Trend Code CF-J - Change Management - implementation of fence had inadequate design considerations from Facilities, ERT, etc. This issue is being managed with cooperation from the station. No further actions within the SCR process. SCR used for lessons learned.
N-2009-04430	D4	COMPLETE	Process Issues: PN PBS: Load Verification: Schedule Delay to	Proceed with work as planned, starting 28JUL. JEFFST 2009/07/27 SCR initiated for trending purposes ad lessons learned - PBS Project 10-25609. No further actions required within the SCR process.

SCR Number	Category	Status	Titles and Description	Actions Taken/Comments
			Unassociated Work Protection Issue	
N-2009-04013	D4	COMPLETE	Human Performance: Pickering PBS: Key Stakeholder Did Not Attend COMS Meeting	Establishment of a means to provide sufficient notice should be given if a resource cannot be provided for critical meetings such as a COMS or AFS, such that alternative arrangements can be coordinated. Justification of absence should also be mandatory such that the reason for late cancellations can be trended and corrected. JEFFST 2009/07/03 Issue has been discussed with applicable management. No further actions within the SCR process. SCR initiated for trending purposes.
N-2008-05085	D4	COMPLETE	Schedule Issues: PNGS Missed Project milestones	WONGED 2008/09/24. No actions required. SCR for trending only.
N-2008-05990	D4	COMPLETE	Security Projects - PN PBS: Insufficient Qty of Cable Specified In DBOM - Design Agency Quality Issue	Expedite the cable procurement (or suitable substitute). SOLAIMAM 2008/10/27 This issue will be discussed in detail with the Design Agency to clarify OPG's expectations that the DA should put in place improved processes to ensure such events are minimized or eliminated. This SCR is for recording the event and is for trending.
N-2008-06027	C3	COMPLETE	Security Projects: Configuration Management, Civil Installations for MSB Manholes Not Properly Documented	Add civil details from the above referenced drawings to EC 97543 to complete work SOLAIMAM 2008/11/03. This is SOP project clean-up work and will be included in the EC 97543 or a minor Civil EC will be initiated to capture the undocumented manholes. Accept as C3 NFE.
N-2008-06152	D4	COMPLETE	Security Projects: PBS: Larger Cable Diameter to PL554S Not Considered in EC Package	As determined, path forward established. Use of splice box to be employed. SOLAIMAM 2008/11/10 No further action required. D4 for trending.
N-2008-06159	D4	COMPLETE	Security Projects: PBS: Fiber Cable Qty Supplied Does Not Match DBOM	Order more cable, verify quantities when requisitioning and at pre-shipping stage. MELMERJ 2008/11/07 Cables ordered.
N-2008-06179	D4	COMPLETE	Security Projects: Fiber Cable Substitution Requires Design Update, PBS Project	Update as-built drawings with change. Field Engineering to accept this resolution. MELMERJ 2008/11/07 Implemented.
N-2008-06192	D4	COMPLETE	Security Projects: PN PBS: Cable Required As One Continuous Length Received in Sections	Buyers to ensure sticky notes are read when placing PO and FE to ensure AAA messages are put in to ensure requirements more materials are clearly identified and known by the participating groups. SOLAIMAM 2008/11/07 No further action required. D4 for trending.
N-2008-06204	D4	COMPLETE	Security Projects: PBS SMR ECs: Late Changes to Vendor Design	Gather additional info from vendor, update design asap MELMERJ 2008/11/07. Initiated.

SCR Number	Category	Status	Titles and Description	Actions Taken/Comments
			Results in Need to Revise Design EC	
N-2008-06311	D4	COMPLETE	600V Distribution panel 2 feeds	OPG's role in this project is under "Owners" only contract necessary notifications as per consultation with Contractor Safety Compliance Office has been issued to the contractor. ESA approved labeling, that has been applied, to mitigate dual feeds.
N-2008-06354	D4	COMPLETE	Security Projects: PN PBS: Change in Cable Running Detail Results in Design Rework, Delay	SOLAIMAM 2008/12/01 The condition has been corrected. This SCR is for trending as D4.
N-2008-06645	D4	COMPLETE	PBS - Materials delivered to the wrong site	SOLAIMAM 2008/12/03 This condition has now been corrected and the project will ensure any transfer of material will follow the relevant procedure. No further action required. D4 for trending.
P-2008-20414	C3	COMPLETE	Unescorted visitor in the un-zoned area	CLARKELI 2008/08/29 Perform an apparent cause assessment to ensure appropriate mitigating measures are in place to prevent repeat events throughout the PBS installation project. Recommend this event be investigated for potential radiation protection violation resulting in S-99 reportable event.

PICKERING Location

SCR Number	Category	Status	Titles and Description	Actions Taken/Comments
N-2012-04968	D4	COMPLETE	Contractor/Design Agency issues – inadequate design & installation non-conformance on EPC contract	SCR issued for trending
N-2012-04879	D4	FLM	Increase in PO value above 20%	SCR issued for trending
N-2011-02768	D4	FLM	Process Issues: Final AFS Delay: PN-PBS – Commissioning Results Identify Approved Design and Commissioning Specification Insufficient	Met with DA and identified discrepancies to determine if Final AFS could be supported. Partial AFS was determined as appropriate path forward and remaining tasks were bounded. Must reassess budgets, timelines, impact of newly identified scope.
P-2011-04437	D4	COMPLETE	Troubleshooting/Commissioning delayed due to Spare Parts/Tools	Security Projects committed to support maintenance as required. Status of parts being monitored.

SCR Number	Category	Status	Titles and Description	Actions Taken/Comments
N-2011-02259	C-NFE	MRM	Process Issue – Entire quantity of Spare parts for PBS unlikely to be on site prior to AFS	Improve the attention to detail of Design agencies in responding to AAA that hang out in PP-Land for too long. Improve emphasis and ownership when obtaining parts to support AFSes, both Supply Chain and Projects. Review ways to improve the accountability in Supply/Design Vendor interface.
N-2011-02039	D4	COMPLETE	Process Issue: DA did not respond to AAA queries – resulted in compressed timeline for expediting Spare Parts	Regular expediting meetings with supply Chain to obtain remaining spare parts in time for AFS.
N-2011-00683	D4	COMPLETE	Commissioning delays due to excessive snow fall	Documented and trended
N-2011-01702	D4	COMPLETE	Commissioning delays due to excessive precipitation.	Timeline for commissioning adjusted through the use of overtime to meet and maintain AFS milestone
P-2011-03763	D4	COMPLETE	Procedural Non-Compliance of MEL update through the ECC Process	ECC process was followed. Design Agency coached and provided corrections.
N-2010-03215	D4	COMPLETE	Process Issues: CM Resources not assigned for DN PBS Commissioning work scheduled to start WW30 of 2010	The issue of resource assignment was escalated and dedicated resources were assigned.
N-2009-06996	D4	COMPLETE	Engineering: Physical Barrier System: Discovery of Minor Field Configuration Issues During ECC Wrap of Third Party Vendor Design	To be discussed at MRM, mitigating measures agreed upon with DA.
N-2009-05574	D4	COMPLETE	Miscellaneous - Insufficient Considerations for Snow Clearing/Maintenance Under Heavy Snow or Ice Conditions - PBS Project 10-25609	For areas of concern identified in the minutes, where administrative or soft solutions cannot be used to address the issue, handle each instance independently on an as-needed basis. The work environment/condition will be unique in each instance (ice condition, snow quantity, etc.) and as such shall be addressed directly with the working group and relevant support groups (i.e. conventional safety) if and when the need arises. JEFFST 2009/09/28 Trend Code CF-J - Change Management - implementation of fence had inadequate design considerations from Facilities, ERT, etc. This issue is being managed with cooperation from the station. No further actions within the SCR process. SCR used for lessons learned.
N-2009-04430	D4	COMPLETE	Process Issues: PN PBS: Load Verification: Schedule Delay to Unassociated Work Protection Issue	Proceed with work as planned, starting 28JUL. JEFFST 2009/07/27 SCR initiated for trending purposes as lessons learned - PBS Project 10-25609. No further actions required within the SCR process.

SCR Number	Category	Status	Titles and Description	Actions Taken/Comments
N-2009-04013	D4	COMPLETE	Human Performance: Pickering PBS: Key Stakeholder Did Not Attend COMS Meeting	Establishment of a means to provide sufficient notice should be given if a resource cannot be provided for critical meetings such as a COMS or AFS, such that alternative arrangements can be coordinated. Justification of absence should also be mandatory such that the reason for late cancellations can be trended and corrected. JEFFST 2009/07/03 Issue has been discussed with applicable management. No further actions within the SCR process. SCR initiated for trending purposes.
N-2008-05085	D4	COMPLETE	Schedule Issues: PNGS Missed Project milestones	WONGED 2008/09/24. No actions required. SCR for trending only.
N-2008-05990	D4	COMPLETE	Security Projects - PN PBS: Insufficient Qty of Cable Specified In DBOM - Design Agency Quality Issue	Expedite the cable procurement (or suitable substitute). SOLAIMAM 2008/10/27 This issue will be discussed in detail with the Design Agency to clarify OPG's expectations that the DA should put in place improved processes to ensure such events are minimized or eliminated. This SCR is for recording the event and is for trending.
N-2008-06027	C3	COMPLETE	Security Projects: Configuration. Management, Civil Installations for MSB Manholes Not Properly Documented	Add civil details from the above referenced drawings to EC 97543 to complete work SOLAIMAM 2008/11/03 . This is SOP project clean-up work and will be included in the EC 97543 or a minor Civil EC will be initiated to capture the undocumented manholes. Accept as C3 NFE.
N-2008-06152	D4	COMPLETE	Security Projects: PBS: Larger Cable Diameter to PL554S Not Considered in EC Package	As determined, path forward established. Use of splice box to be employed. SOLAIMAM 2008/11/10 No further action required. D4 for trending.
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N-2008-06179	D4	COMPLETE	Security Projects: Fiber Cable Substitution Requires Design Update, PBS Project	Update as-built drawings with change. Field Engineering to accept this resolution. MELMERJ 2008/11/07 Implemented.
N-2008-06192	D4	COMPLETE	Security Projects: PN PBS: Cable Required As One Continuous Length Received in Sections	Buyers to ensure sticky notes are read when placing PO and FE to ensure AAA messages are put in to ensure requirements more materials are clearly identified and known by the participating groups. SOLAIMAM 2008/11/07 No further action required. D4 for trending.
N-2008-06204	D4	COMPLETE	Security Projects: PBS SMR ECs: Late Changes to Vendor Design Results in Need to Revise Design EC	Gather additional info from vendor, update design asap MELMERJ 2008/11/07. Initiated.

SCR Number	Category	Status	Titles and Description	Actions Taken/Comments
N-2008-06311	D4	COMPLETE	600V Distribution panel 2 feeds	OPG's role in this project is under "Owners" only contract. Necessary notifications as per consultation with Contractor Safety Compliance Office have been issued to the contractor. ESA approved labeling, that has been applied, to mitigate dual feeds.
N-2008-06354	D4	COMPLETE	Security Projects: PN PBS: Change in Cable Running Detail Results in Design Rework, Delay	SOLAIMAM 2008/12/01 The condition has been corrected. This SCR is for trending as D4.
N-2008-06645	D4	COMPLETE	PBS - Materials delivered to the wrong site	SOLAIMAM 2008/12/03 This condition has now been corrected and the project will ensure any transfer of material will follow the relevant procedure. No further action required. D4 for trending.
P-2008-20414	C3	COMPLETE	Unescorted visitor in the un-zoned area	CLARKELI 2008/08/29 Perform an apparent cause assessment to ensure appropriate mitigating measures are in place to prevent repeat events throughout the PBS installation project. Recommend this event be investigated for potential radiation protection violation resulting in S-99 reportable event.

5.9 OPEX Review Findings

None

5.10 Action Requests to Implement Changes

N/A

6.0 COMMUNICATIONS PLAN FOR THE LESSONS LEARNED REPORT

Roll out to other department project teams

7.0 CONCLUSIONS

Although the PBS was successfully commissioned, it had several issues during design, installation and commissioning. The lessons learned as described in section 3.0 and summarised in section 5.0 along with tracking references can be summarized as follow:

1. OPG Design group should exercise extended review of design submitted for acceptance by design agencies that are not familiar with the ECC process.
2. Use the OPG quality control process even for installations outside the station protected area
3. Assess properly the impact of discovery work
4. Review of contractor's Site Specific Safety Plan (SSSP) and Job Safety Analysis (JSA) in details resulted in good safety performance
5. OPG Design group should exercise extended review of design submitted for acceptance when Work at Risk Release process is used in case of large/extended projects
6. ESMSA QA/QC packages and process requires comparability with the OPG expectations
7. Front end planning must include all stakeholders input
8. OPG oversight hold points should be embedded into the Contractor Design Plan
9. OPG Project manager should monitor oversight activities by discipline and project phase, through tracking of contractor on a regular basis

It is important that these lessons learned are reviewed by the relevant work groups and be incorporated into the planning and the execution of other project.

8.0 REFERENCES

8.1 Project Charter

N-PCH-08160-10000-SHT-010

8.2 Business Case Summary:

N-BCS-08160-10018 (Partial Release)

N-BCS-08160-10026 (Partial Release)

N-BCS-08160-10033 (Full Release)

N-BCS-08160-10035 (Superseding Release)

N-BCS-08160-08160-0454191 (Variance Memo)

8.3 PEP

N-PEP-08160-10000-SHT-016

N-REP-08160-0321496

8.4 Modification Design Requirements:

8300-MDR-61400-10003, DNGS UPS For Security Systems MDR

8300-MDR-61400-10005, DNGS PBS MDR

8690-MDR-61400-00002, PNGS UPS For Security Systems MDR

8690-MDR-61400-00005, PNGS PBS MDR

8.5 Modification Packages (Master EC & Design ECs)

8.5.1 Master EC 93937 Darlington PBS

DEC	Title	Status
94347	DESIGN EC - DNGS Vehicle Barrier Power Supply Reroute	ACTIVE
97460	DESIGN EC - Removal Of Light Pole LT323 West Side	CLOSED
97550	DESIGN EC (ELECT) - DN PBS Communication Power Tie Ins	CLOSED
97551	DESIGN EC (ELECTRICAL) - DN PBS Lighting Power Tie Ins	CLOSED
97552	DESIGN EC (I&C) - DN PBS Interface Tie Ins	CLOSED
100515	DESIGN EC (CIVIL) - DN PBS ECC Wraparound	CLOSED
100520	DESIGN EC (I&C) - DN PBS ECC Wraparound	CLOSED

101254	DESIGN EC (ELECTRICAL) - DN PBS ECC Wraparound	CLOSED
101483	DESIGN EC (SOFTWARE) - DN Physical Barrier System	CLOSED
107355	PROJECT EC – DN Physical Barrier System	H/APPR
107734	DESIGN EC – (Electrical) – DN PBS Lighting Power Tie-ins	CANCELLED
109263	DESIGN EC (CIVIL) - DN PBS As-Built	CLOSED
109264	DESIGN EC (ELECTRICAL) - DN PBS As-Built	CLOSED
109265	DESIGN EC (I&C) - DN PBS As-Built	CLOSED
118819	DESIGN EC (CIVIL) - PBS Modifications For Gaps	CLOSED
118820	DESIGN EC (I&C) - PBS Modifications For Protechs	CLOSED
120179	DESIGN EC (SOFTWARE) - DN Physical Barrier System	CLOSED

8.5.2 Master EC 93338 Pickering PBS

DEC	Title	Status
94583	DESIGN EC - Junction Box Disconnection	CLOSED
96886	DESIGN EC – Relocation of vertical corner	CANCELLED
97543	DESIGN EC (ELECT) - PN PBS Communication Power Tie Ins	CLOSED
97544	DESIGN EC (ELECTRICAL) - PN PBS Lighting Power Tie Ins	CLOSED
97545	DESIGN EC (I&C) - PN PBS Interface Tie Ins	CLOSED
97894	DESIGN EC - Removal Of Power And Panel PL1891 To Heat Trace	CLOSED
100521	DESIGN EC (CIVIL) - PN PBS ECC Wraparound	CLOSED
100522	DESIGN EC (I&C) - PN PBS ECC Wraparound	CLOSED
100809	DESIGN EC (CIVIL) - PN PBS MSB Camera Mounting	CLOSED
101253	DESIGN EC (ELECTRICAL) - PN PBS ECC Wraparound	CLOSED
101484	DESIGN EC (SOFTWARE) - PN Physical Barrier System	CLOSED
104594	DESIGN EC (CIVIL) - PN Manhole Identification	CLOSED
109260	DESIGN EC (CIVIL) - PN PBS As-Built	CLOSED
107340	PROJECT EC – PN Physical Barrier System	APPROVED
109261	DESIGN EC (ELECTRICAL) - PN PBS As-Built	CLOSED
109262	DESIGN EC (I&C) - PN PBS As-Built	CLOSED
110059	DESIGN EC – Removal of Power and Panel PL1891 to heat tracing	CANCELLED
117874	DESIGN EC (CIVIL) - PBS Modifications For Gaps	CLOSED
118821	DESIGN EC (I&C) - PBS Modifications For Protechs	CLOSED
119478	DESIGN EC – PBS Type PII Barrier Enhancement	CANCELLED
119540	DESIGN EC - PN Physical Barrier System Type-P II	CLOSED

8.5.3 Master EC 98138 Pickering UPS For Site Security System

DEC	Title	Status
98932	PROJECT EC – PN UPS for Security Systems	APPROVED
98933	DESIGN EC (ELECTRICAL) PNGS UPS For Security Systems	CLOSED
100494	DESIGN EC- PN Security UPS/ Revised Alarm Requirements	CLOSED
105453	Site Security UPS – Temporary solution for Batteries Ambient	CANCELLED
109471	DESIGN- HVAC For UPS System	CLOSED
109668	DESIGN-ELEC - PN UPS For Security Systems	CLOSED

8.5.4 Master EC 114005 Pickering Sally Port PBS

DEC	Title	Status
115004	DESIGN-CIVIL - PN Sally Port Physical Barrier System	CLOSED
115005	DESIGN-I&C-PN Sally Port Physical Barrier System	CLOSED
115006	DESIGN – ELEC – PN Sally Port Physical Barrier System	CANCELLED
115973	SOFTWARE-PN Sally Port Physical Barrier System	CLOSED
119815	PROJECT EC – PN Sally Port Physical Barrier System	CANCELLED
119887	PROJECT EC – PN Sally Port Physical Barrier System	CLOSED

8.6 Available For Service Reports

8300-REP-61400-10043 DNGS PBS AFS (Final) Report

8690-REP-61400-00062, PBS UPS Final AFS Report

8690-REP-61400-00065, PNGS PBS AFS (Final) Report

8690-REP-61400-00066, R001 PNGS Sally Port PBS – Final AFS Report (Civil/I&C/Software)

8690-CORR-08160-0302060, Memorandum of Understanding - Available for Service - Operational Acceptance Strategy for Pickering Physical Barrier System Project Design ECs 94583 and 97894, (Project 10-25609, Master EC 93338)

8300-CORR-08160-030277, Memorandum of Understanding - Available for Service – Operational Acceptance Strategy for Darlington Physical Barrier System Project Design ECs 93347 and 97460 (Project 10-25609, Master EC 93937)

ONTARIO POWER GENERATION

Lessons Learned Report

Internal Use Only	
Document Number: D-LLD-28110-00001	
Project Number: 16-25619	Project Execution Plan Number: NK38-PEP-28110-0366501
Revision: R000	

Title:
LESSONS LEARNED REPORT: (16-25619) OPERATIONS SUPPORT BUILDING REFURBISHMENT PROJECT (OSB)

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Lessons Learned Report
Operations Support Building
Refurbishment Project

D-LLD-28110-00001-R000

Project Number: 16-25619
PEP Number: NK38-PEP-28110-0366501

2017-10-02

Reference Number: Master EC 122198
Internal Use Only

Prepared by: NOV 8, 2017
Ajoy Mukhopadhyay (OSB close-out only) Projects & Modifications — Date

Reviewed by: NOV 8, 2017
Oliver Hou Design Team Leader (OSB Close-out only) NR Design — Date

Approved by: P. Venkatesh Nov. 15, 2017
Venkat Parthasarathy Section Manager Projects & Modifications — Date

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Revision Summary

Revision Number	Date	Comments
R000	2017-11-01	

1.0 BACKGROUND

The Operations Support Building (OSB) is an important facility at DNGS as it houses technical services that are essential to the business operations of DNGS. These technical services include: Security systems, site IT and telephone network hubs, quality assurance vault, station domestic water piping and radiological public domain access to the powerhouse via the bridge. This facility also provides office and conference room space for 375 employees and various speciality groups inside the DNGS protected area.

An assessment performed by an external engineering firm found that many of the existing building systems were likely to be life expired by 2015.

Several systems were replaced such as the cladding and windows, roof membrane, HVAC system (equipment and ducting), elevator, plumbing, electrical distribution, IT and telephone, cafeteria, furniture, interior furnishings including the carpet and ceiling tiles. Other systems needed to be installed, such as a sprinkler system and interior overhead lighting.

To support the ongoing operations of the Darlington nuclear station over the next 25 years, an upgraded administration facility with the above services/functions was provided under Permanent Modification (PMOD) MEC 122198 with 23 Design ECs.

Since the essential technical services and their support systems housed in the OSB first floor, basement and roof had to remain operational throughout the duration of the OSB refurbishment, the provision of Temporary Modification (TMOD) under MEC 118294 with 4 Design ECs were installed prior to PMOD initiation.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The project was executed by OPG Projects & Modifications group

Sponsor Don Seedman/ Keith Skrepnek NEF Director	**SP**	**Project Leader/ Modification Team Leader** Chris Waugh	**PL/ MTL**	**Field Team Leader – Installation /Commissioning** Greg Goring/Jerry White	**FTLI/C**
Department Manager Rajbir Singh	**PDM**	**Team Member** NEF Control Maintenance CMO OSS Design RCMT (Design Agency) BM (ESMSA EPC contractor)	**TM**	**Design Service Section Manager** John Vuong	**DSM**
Project Manager Stephanie Tham/ Mike Nairne	**PM**	**System Engineer** Ed Loiczli / Din Morrison	**SYS**	**NR Design Manager** Raza Zaidi/Gregg McCabe	**DA**
Design Team Leader Mirza Baig/Oliver Hou	**DTL**	**Cost/Schedule Analyst** Zahur Irfani	**CSA**	**Customer** Al Acorn/ Perry Forbeck	**CUS**

3.0 LESSONS LEARNED

3.1 Cost & Schedule

3.1.1 Background

The importance and effort associated with the OSB Project was undervalued and as a result the cost, schedule and level of work required was not properly considered in the project planning stages which resulted significant cost over run and schedule slipage.

3.1.2 Lessons Learned

Ensure planning phase evaluates accurately all project phases activities in details including design and construction activities in terms of both cost and schedule, validate assumptions, and evaluate risks with mitigating actions.

3.1.3 SCRs Submitted to Document Events

N-2015-03815, N-2015-03814, N-2015-03812, N-2015-02638, N-2015-02506, N-2015-02305, N-2015-02303, N-2014-17560

3.1.4 Action Requests to Implement Changes

Not Applicable

3.2 Interface with other affected project teams

3.2.1 Background

Interface with various work groups at preliminary design stage could have avoided costly design revisions and re-work. (Example: Missed Design Requirement for abondonement of domestic water booster pump, OSB roof design rework, Domestic water supply design rework, several dicrepancies in drawings etc.)

3.2.2 Lessons Learned

Perform interface meetings, field walkdowns with other affected project teams at an early design stage. Project is required to ensure co-ordination between various design agencies are established and interfaces and communication protocols are properly understood. Regular meetings should be held between variuous groups linked to the project to track issues and resolutions.

3.2.3 SCRs Submitted to Document Events

D-2013-23401, D-2013-23399, N-2015-09223, N-2015-22778

3.2.4 Action Requests to Implement Changes

Not Applicable

3.3 Electrical system protection coordination study

3.3.1 Background

During the collaborative review of OSB electrical system protection coordination, OPG Refurbishment Engineering concluded that although upstream 600V buses and MCC voltages are well within the acceptable range of 600V bus votages, all buses and equipment are operating within acceptable voltage limits, and all transformenrs and cables are operating below their respective maximum loading capability, OSB ETAP model is not approved and can not be incorporated into DNGS ETAP model.

3.3.2 Lessons Learned

Electrical Protection Study (*part of NK38-CALC-53300-10002 R002* and drawing *NK38-DRAW-56281-10055*) on OSB Electrical Distribution System needs to be revisited by NR engineering to provide new electrical protection devices/ setting changes/ changes in the breaker as required by ETAP protection co-ordination analysis. (Design Memo: NK38-CORR-50000-0586940)

3.3.3 SCRs Submitted to Document Events

N-2016-24630

3.3.4 Action Requests to Implement Changes

Not Applicable

3.4 Lack of proper co-ordination between Engineering (E) and Construction (C) as part of EPC contract/ Field changes/Rework

3.4.1 Background

EPC Constructor initiated instructions in the field without consultation with EPC design. As a result, there were issues/discussions, design did not accept the modification done in the field without approved change papers in place.

Also, numerous field changes resulted from alterations to the design for ease of constructability. These could have been potentially identified and addressed earlier during COMS walkdown and COMS meeting.

3.4.2 Lessons Learned

When the need for a field change arises, Constructor (C) and Engineering (E) should perfrom joint walkdown, have a thorough discussion and share ideas/alternatives before issuing Field

Initiated Changes (FIC) or performing changes in the field, to avoid work stoppage, re-work and delay. This needs to be reflected through vendor procedural enhancements.

3.4.3 SCRs Submitted to Document Events

N-2015-22416

3.4.4 Action Requests to Implement Changes

Not Applicable

3.5 Interface between different contractors

3.5.1 Background

Some of the modifications of OSB Project were done by two separate design agencies that were both subcontractors to the different constructor. The design agencies did not have a contractual relationship to each other and as a result design information was not shared across the interface. This resulted in misalignment / miscommunications and a lack of definition in the responsibilities and boundaries of the overall design.

3.5.2 Lessons Learned

Project to arrange interface meetings, field walkdowns with various design agencies and contractors at an early design stage and ensure interfaces and communication protocol are properly understood.

3.5.3 SCRs submitted to Document Events

None

3.5.4 Action Request to Implement Changes

Not Applicable

3.6 Lack of Engineering / Technical Review and Oversight by Darlington Facilities.

3.6.1 Background

Lack of Engineering / Technical Review and Oversight during design, installation, testing and commissioning phases by accepting organization (Facilities Maintenance) resulted in serious technical issues and caused schedule delays and cost escalation.

3.6.2 Lessons Learned

Sponsor's organization's engineering / technical review and timely oversight will reduce cost overrun and schedule delay for the project. Involvement with Darlington Facilities earlier in the Design & Construction phase will improve interfacing and identification of field issues upfront.

3.6.3 SCRs Submitted to Document Events

N-2015-25218, N-2015-22778, N-2015-22416, N-2015-09223

3.6.4 Action Requests to Implement Changes

Not Applicable

3.7 Lack of proper work planning resulted delay

3.7.1 Background

Sump pumps terminations in the OSB basement was delayed due to lack of proper work planning and work protection issue. The work required closing of the info centre washrooms and all uphill sewage draining into OSB. Contractor's trade supervisor indicated that they would not perform work until sewage system was properly shutdown. Contractor notified OPG Project contacts for assistance to isolate the system from the Info Centre. Since this requirement was not known to OPG in advance, project was delayed to complete work planning prior to the execution.

3.7.2 Lessons Learned

Identify issues and have path forward with stakeholders during COMS meeting and COMS walkdown. Perform multiple field walkdowns to address and eliminate risk that can result project delay. Work planning with mitigation plan should be in place to address worker's safety concerns at an early design stage.

3.7.3 SCRs Submitted to Document Events

N-2015-26201

3.7.4 Action Requests to Implement Changes

Not Applicable

3.8 Equipment failure

3.8.1 Background

Blown gasket on ASW strainer in OSB basemnt caused water leak. The strainer was installed in the OSB basement room A6 and was part of the Auxiliary Service Water system. It was located at downstream of 0-73810-V108, which was the terminal point between Darlington Operations and the EPC Contractor. This strainer was purchased and installed as part of the OSB Refurbishment Project by the EPC Contractor per design. The strainer was successfully pressure tested to a pressure much greater than the system operating pressure. The apparent cause was that the flange on top of the strainer was not designed properly as per code that resulted premature failure of the gasket.

3.8.2 Lessons Learned

Technical specification and vendor's design need to be validated before procurement of equipment to eliminate equipment failure and avoid significant schedule delay.

3.8.3 SCRs Submitted to Document Events

N-2015-23554

3.8.4 Action Requests to Implement Changes

Not Applicable

3.9 Project Over Variance due to poor quality of EPC design packages, numerous installation quality issue & additional scope resulted in delay in Installation, Commissioning, AFS & Project Closure

3.9.1 Background

The EPC contract value budgeted in the execution-full business case summary (BCS) was $37.7M. Due to numerous EPC issues, the contractor submitted their revised forecast $52.7M. Out of the $15M contract cost variance, $11.7M was attributed to the EPC Contractor underestimating the effort required to complete the contract scope. **OPG was required to pay these additional costs since the contract was cost reimbursable (time & material).** The variance was summarized by the following issues:

1) Significant quality issues, field interferences, missed items and delays with the design packages produced by the EPC Contractor's design agency due to lack of validation of assumptions, flawed defences, and inadequate design quality. This had resulted in materials substitutions, multiple time design revisions, re-work, and reduced efficiency by the construction trades who had to interpret and/or resolve poor design information.

2) The procured equipment and level of construction work required to complete the design revisions increased significantly beyond budget due to the design packages being complex.

3) BU55/BU56 outages during the 2015 Vacuum Building Outage (VBO) resulted in most OSB electrical loads being de-energized which stopped commissioning progress and resulted project delay.

4) The construction work was significantly behind schedule compared to their original plan resulted in additional contractor's project management and engineering field support.

5) Emergent support to OPG CIO was provided by the contractor to resolve Uninterrupted Power Supplies (UPS) in OSB LAN rooms A170 and A171 issues resulted in additional cost to the project.

The remainder of the contract cost variance was linked to contract scope changes, totalling $2.7M. These changes included:

1) Upgrade of motor control electrical distribution equipment

2) Additional cabling and hardware to support changes to IT and telephone requirements

3) Changes to furniture and building layout requirements as requested by building occupants

4) Upgrades to the fire separation of civil structures that were previously hidden

5) Repairs to the exterior walk ways and soffits

6) Other minor architectural, mechanical, electrical changes

7) Discovery and planned remediation of mould

8) Hiring of a commissioning agent to ensure an efficient building start-up, minimizing the impact of commissioning issues on the overall project

9) Additional support from OPG engineering to provide oversight of the EPC contract design subcontractor as they completed the design revisions

10) Replacement of existing insulation on lower ground floor soffit to meet Ontario Building Code

11) Additional EPC scope to replace Electrical Panels (0-56281-DP8 and 0-56281-PLA1) after design was approved

12) EPC Contractor missed their contractual PO commitment to complete the building construction, commissioning, occupancy declaration from Municipality of Clarington and Available for Service (AFS) declaration. Also, Project Closure milestone was missed.

3.9.2 Lessons Learned

The project team should perform weekly reviews of the EPC contractor's project cost, schedule and risks to validate assumptions and to help overcome challenges.

The project should have frequent meetings and walk downs with the project sponsor and other stakeholders to seek early resolution of deficiencies that would otherwise delay eventual turnover of the building to the operations and maintenance team.

The OPG project team should review the EPC scope of work in details with stakeholders, identify issues upfront, and utilize cost effective solutions where possible as follows:

1) The simplification of internal governance documentation requirements to align with commercial building applications

2) Utilizing more cost effective materials

3) Challenge additional scope

The hiring of the expert commissioning agent should yield efficiencies in the commissioning process as well as reduce the impact of discovered challenges when energizing equipment.

The EPC contractor additional claim for Project Change Authorization (PCAs) should always be challenged by the project team. Each and every contract changes with additional cost impact should be flagged to OPG Senior management immediately once the issues are identified, obtain approval before they are implemented in the field and before the project cost exceeds the BCS release amount.

The existing motor control centre (MCC) equipment, circuit breakers and associated electrical equipment that were replaced by the new ones were transferred to the maintenance department as useful spares. This effort may not mitigate the project overruns directly however it was expected to yield overall savings to OPG.

3.9.3 SCRs Submitted to Document Events

N-2013-03827, N-2014-11196, N-2014-12523, N-2014-12558, N-2014-14333, N-2014-16482, N-2014-17560, N-2014-27339, N-2014-27370, N-2014-32161, N-2014-32656, N-2015-01962, N-2015-02058, N-2015-02303, N-2015-02305, N-2015-02506, N-2015-02638, N-2017-02795, N-2015-03412, N-2015-03413, N-2015-03812, N-2015-03814, N-2015-03815, N-2015-04788, N-2015-04806, N-2015-04848, N-2015-05249, N-2015-09223, N-2015-09225, N-2015-09416, N-2015-22416, N-2015-22778, N-2015-22909, N-2017-18362

3.9.4 Action Requests to Implement Changes

None

3.10 EPC Contractor Procurement/ Material Issues

3.10.1 Background

EPC Contractor was unable to procure some of the materials required for the project in sufficient time to complete the installation.

OPG had to free issue numerous components and materials available in the Darlington, Pickering and Central warehouses to the EPC Contractor to keep the installation in progress. The EPC Contractor submitted urgent requests to OPG Supply Chain to have these items released from the warehouse, including transfers from Pickering warehouse.

Also, the OSB project identified several material procurement issues due to lack of EPC Contractor's QA documentation, counterfeit materials, and incorrect materials shipped by the Vendor affecting pipe installation activities.

3.10.2 Lessons Learned

Once the Design Bill of Material (DBOM) is issued, EPC Contractor should start procuring all the necessary materials using their Quality Assurance (QA) program without any delay.

Assistance to be provided by OPG Supply Chain to mitigate material quality impacts, if required.

3.10.3 SCRs Submitted to Document Events

N-2015-22894, N-2015-22892, N-2015-22416, N-2015-20789, N-2015-10831

3.10.4 Action Requests to Implement Changes

None

3.11 Training to Facility Staff

3.11.1 Background

A scope change to the project EPC contract was required to address the proposed Nuclear East Facilities (NEF) training. The sponsor requested a video training option to be added to the original training scope. The video recording sessions would help future NEF operations and maintenance personnel to become familiar with the new equipment and systems in the OSB without having to re-engage vendors to perform additional training.

3.11.2 Lessons Learned

Detail training plan requirement should be discussed with the project sponsor at an early planning stage of the project to avoid unnecessary Project Change Autorizations (PCAs) and additional training cost to the contract.

3.11.3 SCRs Submitted to Document Events

N-2015-18986

3.11.4 Action Requests to Implement Changes

None

3.12 EPC Contractor's Safety Issues (Owner's only Contract)

3.12.1 Background

Several Safety incidents (Eg. Contractor's worker slipped and fell on ice, Piece of pipe fell on employee's left foot, worker pinched finger, worker reported tingling sensation in arm, worker injured his hand, roofing Insulations blew off the OSB roof into Fore bay during high wind, Genie boom came in contact with old Security Fence south of OSB. etc) happened at site with EPC Contractor under Owner's only contract during the installation phase of the project within the EPC Contractor's construction island where they were the constructor. All safety incidents reporting and management in their construction island were addressed as per the contractor's health and safety policy and per OHSA.

3.12.2 Lessons Learned

SCRs were written to document the incidents and to share with others as lessons learned. Since it was a Owner's only contract and contractor was the constructor, their health and safety policy were applied to address all the safety incidents. No OPG's direct interferences were required.

3.12.3 SCRs Submitted to Document Events

D-2013-23401, N-2015-00513, N-2015-03507. N-2015-15914, N-2015-17006, N-2014-35142, N-2017-34068, N-2014-24828, N-2014-08991, N-2014-08796

3.12.4 Action Requests to Implement Changes

None

3.13 MOE Waste Manifest Handling Issue: Administrative error/processing of paperwork to support hazardous waste shipments for owner-only projects

3.13.1 Background

To support the off-site shipment of glycol wastes from the OSB Refurbishment Project (an Owner-Only Contract), an MOE waste manifest was prepared. The wastes were shipped off-site safely through a licensed carrier to a licensed receiver, but the two copies to be retained by the "generator" (which is OPG) were not forwarded as required through either Powerhouse Stores or the East Warehouse to ensure that a copy was sent to the MOE within the required 3-day period (Copy 1) and a copy is retained on file (Copy 2). This error was discovered by OPG staff in the East Warehouse when a copy of this manifest came back from the receiver (Copy 6, as required) and they noticed that Copies 1 and 2 had not been received by them for forwarding to the MOE and placement on file. Although an administrative error was made during the processing of this manifest, there was no waste that was unsafely handled or unaccounted for as a result of this error.

Following immediate actions were taken for this significant issue:

1) EW (East Warehouse) staff notified the DNGD Environment Section immediately upon this discovery.

2) DNGD Environment reviewed the manifest to determine the extent of condition and contacted the carrier as well as the OPG Contract Administrator and Project Manager for this Project to assist in retrieving the copies of the manifest from the Project that OPG requires. It was determined that this error was administrative in nature and that there were no missing or unaccounted wastes involved.

3) Upon receipt of the manifest copies from the Project, DNGD Environment prepared a letter of notification to the MOE with submittal to Cont Docs (NK38-CORR-00541-10439).

4) DNGD Environment provided the manifest copies and the original notification letter to EW staff who sent these documents to MOE by courier utilizing our current processes.

5) This OPEX was discussed with the OPG Project Manager.

6) DNGD Environment provided the project with the latest version of the communication tailboard for handling waste manifests for their roll-out to staff.

3.13.2 Lessons Learned

N-GUID-09701-10013 (Nuclear Projects – Environmental Requirements Guideline) stipulates that contractors and their sub-contractors are responsible to handle appropriately all chemical wastes in accordance with the requirements of D-INS-79000-10000 (Completion and Processing of MOE Waste Manifests at Darlington). This includes the requirement to ensure that the two copies to be retained by the "generator" are forwarded to either Powerhouse Stores or the East Warehouse within 3 working days.

Further to this event, the contractor initiated a BMR (their equivalent to an OPG's SCR) to ensure that corrective measures were taken so as to prevent reoccurrence. As per BMR-3036 "Submission of OSB Manifest to MOE, 2014-06-031", on July 16, the contractor's Portfolio Manager at Darlington rolled out the BMR in an Ops meeting, and the contractor's Project Manager rolled the BMR out to the Project Team the following day. As a result, the contractor's Portfolio Manager at Pickering became aware of the BMR and rolled it out at the Pickering site as well.

In addition, reference to this SCR has been included as OPEX in the tailboard communiqué which is prepared by the Environment Section for other work groups to roll-out as required, and a copy of this SCR and associated correspondence has been placed in the waste manifest file in EW for auditing purposes.

Following actions were resolved:

1) Confirm process by which expectations regarding the processing of paperwork to support hazardous waste shipments are to be communicated to owner-only projects.

2) DNGD Environment updated the tailboard communiqué for MOE waste manifests which they maintain so as to provide a version for owner-only projects for their roll-out through the process identified above, and

3) Communicate expectations to other projects and vendors as per the process determined above.

4) Manager Briefing Card and & Communication tailboard issued.

This issue had a common implication for all projects. Regardless of whether it is a station project, an Owner-Constructor project, or an Owner-Only contract, any chemical wastes generated through their activities must be disposed of as Darlington's waste. The project may coordinate and pay for such disposal, but the MOE Waste Manifests must show Darlington as the generator and Darlington is accountable for ensuring that the manifests are processed as per regulatory requirements. Note that solid conventional wastes, recyclables and radioactive wastes do not have similar manifesting requirements.

3.13.3 SCRs Submitted to Document Events

N-2014-21558

3.13.4 Action Requests to Implement Changes

AR 28170043-1 to 5.

1) Update the existing Darlington MOE Waste Manifest Tailboard so as to create a version appropriate for distribution to, and for the education of, contracted project employees. In addition, provide it to Projects for distribution.

2) Present briefing card prepared by Environment regarding MOE Waste Manifest Processing Issues and request sign-back from the Managers of having communicated same to their staff as appropriate.

3) Ensure that Managers provide confirmation that they have communicated the expectations contained in the briefing card to their staff, as appropriate.

4) Present briefing card prepared by Environment regarding MOE Waste Manifest Processing Issues to PCC attendees for information.

5) Perform oversight review to determine whether these actions taken in the previous assignments have been effective.

3.14 Improper Protocol for Communicating a Security Document: S-99 Reportable Event: Process not followed (Transfer or disclosure of prescribed information not permitted by NSC Act & Regulations.

3.14.1 Background

The design agency contractor (RCM Technologies) self-reported that Security classified document 8300-D0S-61400-0107R001 was communicated internally by one of the contractor's team members via email without using the proper protocol (email was not encrypted). The email was sent internally to members of the contractor's team, a number of which were not on the restricted document access list.

Management was immediately notified, with the email being recalled at time of discovery. In addition to the email recall, each individual on the distribution list were contacted and asked to delete the email as well. Contractor's IT was contacted and a request was submitted to quarantine all emails with the relevant subject title. Senior management took action and immediately provided coaching to the staff involved.

DN Site Security reported S99 to the CNSC under S99 6.3.1 Security Section (31) on behalf of Darlington Refurb & Projects; Refurbishment Project B - Refurb Projects 5 Management for transmission of prescribed information based on General Nuclear Safety and Control Regulation (SOR/2000-202): Transfer and Disclosure 23(1) & 23(2).

3.14.2 Lessons Learned

If the project involves site security system modification and Security Design Engineering Changes (ECs), the project team should flag during kick off meeting to OPG team and contractors to follow Site Security guidelines regarding handling of all security documentations.

3.14.3 SCRs Submitted to Document Events

N-2014-10945

3.14.4 Action Requests to Implement Changes

None

3.15 Lack of OPG design resource resulted delay in acceptance of design package beyond the EPC contractual review cycle (15 business days)

3.15.1 Background

Project schedule was delayed due to delay in acceptance of Design Agency's design package beyond the contractual review cycle (15 business days) to provide a Comment Disposition Sheet (CDS) for 60% Designs to contractors. The schedule was also delayed beyond the contractual review cycle (5 business days) for end user acceptance of the CDS for 60% Design. The delay impacted the design agency's ability to meet its deadlines.

Displayed below was the delay in business days of the end user submittal of 60% CDS beyond the contractual review cycle:

EC 122235 (47 days), EC 122230 (41 days), EC 122234 (17 days), EC 122228 (16 days), EC 122229 (16 days), EC 122239 (15 days), EC 122241 (14 days), EC 122240 (13 days), EC 122237 (13 days), EC 122276 (11 days), EC 122247 (10 days), EC 122246 (10 days), EC 122244 (9 days), EC 122224 (7 days), EC 122303 (7 days), EC 122220 (6 days), EC 122243 (6 days), EC 122245 (6 days), EC 122242 (5 days), EC 122225 (4 days).

Displayed below was the delay in business days of the end user acceptance of 60% CDS beyond the contractual review cycle:

EC 122244 (18 days), EC 122224 (18 days), EC 122225 (18 days), EC 122243 (18 days), EC 122218 (17 days), EC 122240 (5 days), EC 122237 (4 days), EC 122228 (3 days), EC 122229 (3 days), EC 122234 (3 days), EC 122239 (3 days), EC 122241 (3 days). READJ 2014/01/22 15:49 : Recommend C3 ACE, with EO by Refurb Design to determine apparent cause.

OPG did not have needed design engineering resources in place in order to simultaneously review several design packages at once.

Up-to 8 design packages with multiple deliverables were received together at once. Detail design schedule was not shared with OPG in order for OPG to anticipate the condition early.

3.15.2 Lessons Learned

1) Obtain schedule for detail design from the design agency ahead in order to help make design resources available for review according to the schedule.

2) Request design agency to send maximum of upto 3 design packages (DEC) for review at one time.

3) Line up adequate OPG design resources well ahead of time to review and accept the packages

3.15.3 SCRs Submitted to Document Events

N-2014-02076

3.15.4 Action Request to implement Changes

AR 28165913-1,2

1) Obtain OSB refurbishment schedule for detail design from the design agency in order to help make design resources available for review according to the schedule. OSB refurbishment schedule was requested and received from the design agency. This assignment is complete.

2) Request design agency to send maximum of upto 3 design packages (DEC) for review at one time.

3.16 Environment Procedural Non-Compliance to NK38-MAN-03480-10001 - Cable Duct Manhole Radiation Sampling Requirements

3.16.1 Background

OPG Environment advisor identified to the OSB Refurbishment (16-25619) project contract administrator that the project was in non-compliance with NK38-MAN-03480-10001, section 2.22. This manual stated that the sampling of radiation was required for ground water found in the cable duct manholes within the protected area boundaries before pump-out and discharge into the forebay.

Nuclear East Facilities (NEF) identified to the project team in October 2012 that groundwater accumulated in the manholes located east and west of the OSB lower ground. Since the project was being completed as owner-only, it was decided that the project EPC contractor would be best to take on this responsibility (from a health and safety perspective). During scoping of this contract, NEF indicated that per their past practice, the water could be pumped from the manhole directly into the forebay without radiation sampling since this work was taking place within zone 1. This past practice was then included in the EPC contractor's scope of work. The owner-only turnover to the EPC contractor took place on March 10, 2014. Any manhole dewatering prior to that date was performed by Nuclear East Facilities. This appears to be legacy issue caused by the relocation of the security protected boundary fence to include the OSB zone 1 area.

3.16.2 Lessons Learned

All contractors must send water samples for radiation sampling to the chemistry lab prior to manhole dewatering activities per NK38-MAN-03480-10001 section 2.22.

3.16.3 SCRs Submitted to Document Events

D-2014-26679, D-2014-25541

3.16.4 Action Requests to Implement Changes

None

3.17 Lack of proper formal turnover during movement of dedicated resources within Design Agency, EPC Contractor and OPG P&M organization resulted significant delay in project close-out

3.17.1 Background

Modification Team Leader from Design Agency RCM Technologies, Project Manager from EPC Contractor B&M and OPG Project Manager/MTL left this project after the Final AFS without completing formal turnover/ documentations turnover to complete the AFS open Item assignmnets & close the project as per the ECC process. This left a significant gap and resulted excessive delay in the design and project close-out activities due to the unavailability of the required close-out information/ documentations.

In addtion this project was on hold for almost six months after the AFS due to funding issue.

The new design and project close-out team spent significant time and effort to resolve multiple AFS open items and to collect design and project close-out information/ documentations.

3.17.2 Lessons Learned

It is very important that formal turnover of information / documentations must take place among all organizations including OPG before the key staffs were allowed to leave the project to avoid project schedule delay and additional cost to the project.

3.17.3 SCRs Submitted to Document Events

N-2017-20219

3.17.4 Action Requests to Implement Changes

None

4.0 COMMUNICATIONS PLAN FOR THE LESSONS LEARNEDS REPORT

Lessons learned report will be filed in OPG Control Documents. All events during the project lifecycle have been documented in the SCR database, and available for OPEX review for future project/station work.

5.0 CONCLUSIONS

Overall, the project's performance was not satisfactory, not meeting the required cost and schedule performance requirements with several safety events during three years execution period. A Project Overvariance had to be completed to increase project funding from $53M to $62.7M due to increase additional scope of work identified late in the project and field discovery issues. In addition, as instructed by the CNO, a C2 SCR needs to be initiated and the results of the SCR to be presented to the CNO. The project is completed under the Project Over Variance release at a final cost of $62.1M.

Appendix A: SCR Summary

SCR Number	Category	Status	Title
N-2015-26824	D4	COMPLETE	OSB Refurbishment Project (25619): Opportunity to provide project savings
N-2015-26201	D4	COMPLETE	Project 25619 - OSB Refurbishment -Sewage Pump Work Delayed due to safety concerns
N-2015-25218	D4	COMPLETE	OSB Refurbishment Project (16-25619); Ops/Maintenance Stakeholders Not Present at Operations Acceptance Walk Down for Demolition PMOD Design ECs
N-2015-24242	D4	COMPLETE	OPG Staff Entering Owner Only Jobsite Without Permission. OSB Refurbishment Owner Only Project (Project # 16-25619).
N-2015-23554	D4	COMPLETE	OSB Refurbishment Project # 16-25619 - Failed Strainer Caused Water Leaks in OSB Basement
N-2015-22909	D4	COMPLETE	OSB Refurbishment Project (16-25619): EPC Contractor Missed Contractual Milestone - AFS Declaration
N-2015-22894	D4	COMPLETE	OSB Refurbishment Project: EPC Contractor Procurement Issues - Domestic Waterline Replacement Installation per Design EC 122238
N-2015-22892	D4	COMPLETE	OSB Refurbishment Project: EPC Contractor Procurement Issues - Steam and Condensate System Installation per Design EC 122240
N-2015-22778	D3	COMPLETE	OSB Refurbishment Project (16-25619): Missed Design Requirement - Abandonment of Domestic Water Booster Pumps and Recirculation Line Disconnection
N-2015-22416	D3	COMPLETE	OSB Refurbishment Project (16-25619): Design Field Interferences - Steam and Condensate Field Changes Required

SCR Number	Category	Status	Title
N-2015-20789	D4	COMPLETE	25619- OSB Refurbishment Project Steam and Condensate Material Issues
N-2015-18986	D4	COMPLETE	OSB Refurbishment: EPC Contract Scope Change - NEF Video Training
N-2015-18984	D4	COMPLETE	OSB Refurbishment: EPC Contract Scope Change - Painting of Stairwells
N-2015-18628	D4	COMPLETE	OSB Refurbishment: EPC Contract Scope Change - Supply and Install New Front Entrance Floor Grill
N-2015-18362	D4	COMPLETE	OSB Refurbishment: EPC Contract Scope Change - Emergent Support to Resolve Uninterrupted Power Supplies (UPS) in LAN rooms A170 and A171 Issues
N-2015-18333	D4	COMPLETE	OSB Refurbishment: EPC Contract Scope Change - Replacement of Front Entrance Aluminum Doors
N-2015-18326	D4	COMPLETE	OSB Refurbishment Project: EPC Contract Scope Change - Ground Floor Architectural Changes
N-2015-17006	D4	COMPLETE	OSB Refurbishment Project - Worker Reported Tingling Sensation In Arm - Project # 16-25619 (Owner Only Project)
N-2015-15914	D4	COMPLETE	OSB Refurbishment Project #16-25619 - Pinched Finger
N-2015-15516	D4	COMPLETE	OSB Refurbishment Project (25619) - Leaking Junction Box in A26 requires repair

SCR Number	Category	Status	Title
N-2015-13409	D4	COMPLETE	Environmental Release To Manhole. OSB Refurbishment Project (Owner Only). Project # 16-25619
N-2015-10969	D4	COMPLETE	OSB Refurbishment Project (25619) - legacy Issue regarding Fire Hose Cabinet Fire Rating
N-2015-10834	D4	COMPLETE	OSB Refurbishment Project (25619) - Leaking Air Conditioning Units requiring immediate repair
N-2015-10831	D4	COMPLETE	OSB Refurbishment Project (25619) - Procurement delay of 1/8' ER70S tig wire affecting field work
N-2015-09416	D4	COMPLETE	OSB Refurbishment Project (25619): AFS date delayed / at risk
N-2015-09225	D4	COMPLETE	OSB Refurbishment Project (25619) – Numerous delays to Fire Detection EC 122228 Rev 001 acceptance causing schedule impacts
N-2015-09223	D4	COMPLETE	Operations Support Building Refurbishment Project (16-25619) –Design Quality issue for OSB roof design drawings
N-2015-07361	D4	COMPLETE	OSB Refurbishment Project – Damaged Blue Phase Conductor to MCC611 – cable 0-53340-355
N-2015-06583	D4	COMPLETE	Operations Support Building Refurbishment Project (16-25619) - Acceleration Plan
N-2015-06577	D4	COMPLETE	OSB Refurbishment Project (16-25619) – Contract Scope Change - IT cable jacks required for consolidation points installation

SCR Number	Category	Status	Title
N-2015-06145	D4	COMPLETE	Operations Support Building Refurbishment Project (16-25619) – Existing Caulking at Ground Level Precast Panel Joints
N-2015-05249	D4	COMPLETE	OSB Refurbishment 16-25619 - EC 122240 REV001 (Heating and Condensate) Submitted to OPG with Constructability/ Maintainability Concerns Not Resolved
N-2015-03815	D4	COMPLETE	OSB Refurbishment Project (25619) – Late Plumbing/Sewage EC 122239 rev 001 causing schedule impacts
N-2015-03814	D4	COMPLETE	OSB Refurbishment Project (25619) – Late Fire Detection EC 122228 rev 001 causing schedule impacts
N-2015-03812	D4	COMPLETE	OSB Refurbishment Project (25619) – Late Electrical Distribution EC 122234 rev 001 causing schedule impacts
N-2015-03507	D4	COMPLETE	OSB REFURBISHMENT OWNER ONLY PROJECT # 16-25619 - WORKER PINCHED PINKY FINGER
N-2015-02638	D4	COMPLETE	OSB Refurbishment Project (25619) – Late Plumbing Sewage EC 122239 rev 001
N-2015-02506	D4	COMPLETE	OSB Refurbishment Project (25619) – Late fire Detection EC 122228 rev 001
N-2015-02305	D4	COMPLETE	OSB Refurbishment Project (25619) – Late Domestic Water EC 122238 rev 001 causing schedule and financial impacts
N-2015-02303	D4	COMPLETE	OSB Refurbishment Project (25619) – Late Electrical Distribution EC 122234 rev 001 causing schedule and financial impacts

SCR Number	Category	Status	Title
N-2015-02091	D4	COMPLETE	FUEL TRUCK CONTACTS GATE EXITING FROM OSB BY RADIATION KIOSK (BUILDING # 512). PROJECT # 16-25619 OSB REFURBISHMENT OWNER ONLY PROJECT
N-2015-02058	D4	COMPLETE	OSB Refurbishment Project (25619): EPC Contract Additional IT/Telephone Additional Scope
N-2015-01962	D4	COMPLETE	OSB Refurbishment Project (25619): Replacement of insulation on lower ground floor soffit.
N-2015-00513	D4	COMPLETE	Piece Of Pipe Fell On Employee's Foot. Project # 16-25619 OSB Refurbishment Project (Owner's Only Project)
N-2015-00215	NE0	COMPLETE	OSB Refurbishment Project (25619): Opportunity to use cheaper ceiling tile
N-2014-35142	D4	COMPLETE	Roofing Insulation Blew Off The OSB Roof Into Fore bay - Project # 16-25619 - OSB Refurbishment Project (Owner Only)
N-2014-34068	D3	COMPLETE	Genie Boom came in contact with old Security Fence south of OSB. Project # 16-25619 - OSB Refurbishment Project
N-2014-32658	D4	COMPLETE	OSB Refurbishment project (16-25619) – Walkdown report signed late causing schedule impacts
N-2014-32656	D4	COMPLETE	OSB Refurbishment project (16-25619) –Schedule changes impacting AFS
N-2014-32161	D4	COMPLETE	Recurring Design Reviews on OSB Design Packages

SCR Number	Category	Status	Title
N-2014-30827	D4	COMPLETE	OSB Refurbishment Project (25619): Size change of frit pattern on curtain wall
N-2014-30128	D4	COMPLETE	OSB Refurbishment Project (25619): Removal of raised flooring in Lower Ground Floor A1
N-2014-27370	D4	COMPLETE	Project Scope Addition - OSB Refurbishment (16-25619) - Replacement of Electrical Panels
N-2014-27339	D4	COMPLETE	Domestic Water Main Supply Line Replacement Project (16-38946): Revised Mechanical Design Required
N-2014-24828	D4	COMPLETE	Contractor Injured On Owner's Only Project - Project # 16-25619 OSB Refurbishment
N-2014-21558	C3	COMPLETE	Project 16-25619 (OSB Refurbishment) - MOE Waste Manifest Handling Issue
N-2014-17560	B2	COMPLETE	Engineering Design deliverables for Nuclear Refurbishment Program are not meeting Program expectations for cost, schedule and quality
N-2014-17351	D4	COMPLETE	OSB Refurbishment Project #16-25619 - Workers Entered Owner Only Construction Island Without Approved Access by EPC Contractor
N-2014-16482	D4	COMPLETE	Darlington OSB Refurbishment Project 16-25619 - OBC Compliance
N-2014-15706	D4	COMPLETE	Darlington OSB Refurbishment Project 16-25619 - P6 Schedule Updates

SCR Number	Category	Status	Title
N-2014-14314	D4	COMPLETE	Darlington OSB Refurbishment Project 16-25619 – Lack of Representation at Meeting
N-2014-12558	CO3	COMPLETE	OSB refurbishment EC 112245 Rejected
N-2014-12523	C3	COMPLETE	OSB Refurbishment - Design EC 122243 Rejection
N-2014-11619	D4	COMPLETE	Darlington OSB Refurbishment Project 16-25619 – EC 122230: Delays obtaining Audio/Video Specifications
N-2014-11196	D4	COMPLETE	16-25619: OSB Delay in EC submittals for Acceptance
N-2014-10945	D3	COMPLETE	Darlington OSB Refurbishment Project 16-25619 - Improper Protocol for Communicating a Security Document
N-2014-10017	D4	COMPLETE	OSB Refurbishment 16-25619 - EPC Contract Cost/Schedule Impact due to Owner-Only Turnover Delays
N-2014-09624	D4	COMPLETE	16-25619 - OSB Refurbishment Project - Rejected Vouchers in Oncore due to disallowed costs per ES-MSA
N-2014-09245	D4	COMPLETE	Darlington OSB Refurbishment Project 16-25619 - DNGS Station ETAP Model Delays
N-2014-09079	D4	COMPLETE	Darlington OSB Refurbishment Project 16-25619 - EC 122241 Fire Protection (Sprinkler System Water Supply Flow and Pressures)

SCR Number	Category	Status	Title
N-2014-08991	NE0	COMPLETE	Owner's Only Worker Required Use of Eye Wash.
N-2014-08796	D4	COMPLETE	Darlington OSB Refurbishment Project 16-25619 - Additional asbestos identified within the OSB
N-2014-07948	D4	COMPLETE	OSB Refurbishment 16-25619 - Cost Reporting - Negative Earned Value Being Reported in MSBI
N-2014-02076	C3	COMPLETE	Darlington OSB Refurbishment Project 16-25619 - Document review cycle delays by end user is causing Design Agency's ability to meet deadlines
N-2013-03113	D4	COMPLETE	OSB Refurbishment Project: Potential Schedule Delay - Contractor Unable to Access OSB Room A6 During Walkdowns
N-2013-02101	D4	COMPLETE	OSB Refurbishment Project 16-25619 - Delay in Vendor Acceptance of PO 225657
N-2012-06425	C4	COMPLETE	Remove or bypassing the 3 booster pumps located in the OSB basement currently not working
N-2011-00146	D4	COMPLETE	OSB Refurbishment Project 16-25619 - Delay to 3rd Party Alternatives Analysis Request for Proposal
N-2010-06030	D4	COMPLETE	OSB Refurbishment Project 16-25619 - Unable to Report Future OM&A in P5 and Proliance
N-2009-02621	D4	COMPLETE	NEF: Old OSB Fire Alarm System still installed

SCR Number	Category	Status	Title
D-2015-20292	D3	COMPLETE	OSB Refurbishment (16-25619): BU55/BU56 outages for VBO
D-2015-19374	D4	COMPLETE	OSB Refurbishment Commissioning Activities Tripped Unit 0 Circuit Breaker (Project # 16-25619)
D-2015-19373	D4	COMPLETE	Human Performance - False Fire Alarm Annunciation During OSB Refurbishment Project Fire Detection Upgrades (Project # 16-25619)
D-2015-18508	D4	COMPLETE	225657 - OSB Refurbishment - Scheduled activities delays
D-2015-15911	NE0	COMPLETE	OSB Refurbishment Project #16-25619 - Pinched Finger (SCR to be Closed Out NOSS SCR)
D-2015-15506	D4	COMPLETE	225657- OSB Refurbishment Project - TSSA package for Steam and Condensate Delays
D-2015-04638	D4	COMPLETE	OPS support tasks to be rescheduled. Project # 16-25619 OSB Refurbishment Project (Owner Only)
D-2015-01464	NE0	COMPLETE	Configuration Management – CAT ID 123833 Description Not Consistent With Installation in Field
D-2014-26679	D4	COMPLETE	Environment - Procedural Non-Compliance to NK38-MAN-03480-10001 - Cable Duct Manhole Radiation Sampling Requirements
D-2014-25541	D4	COMPLETE	Value for Money Challenge - Radiation Sampling of Ground Water in Manholes within OSB Zone 1 Area - NK38-MAN-03480-10001

SCR Number	Category	Status	Title
D-2014-23733	D4	COMPLETE	Unable to participate in station meeting
D-2014-15042	D4	COMPLETE	Challenge to Maintenance, Planned work requires new Access needs
D-2014-11858	D4	COMPLETE	OSB Refurbishment Project # 16-25619: Workers Walked In Un zoned Area From MSB TO ASB Without TLD Badges
D-2014-11258	D4	COMPLETE	Unclear Ownership/Accountability for Main Security Building Fire Panel 0-67870-FP2-416
D-2014-10438	D4	COMPLETE	D1411 - Challenge to Maintenance, Execution Coordinators Required to Leave the Plant for Outage Meetings
D-2014-09629	D4	COMPLETE	OSB Refurbishment Project (Project # 16-25619). Unable To Silence Fire Alarm QA Vault In OSB.
D-2014-04908	D4	COMPLETE	Former Nurses Station Duress Button in the OSB Requires Disconnection
D-2014-01491	D4	COMPLETE	Owner Only Construction Contract Worker Did Not Park Inside Construction Island. Project # 16-25619 OSB Refurbishment Project.
D-2014-01453	D4	COMPLETE	Contractor for the OSB Refurbishment Job Slipped and Fell on Ice in the Parking Lot. Project # 16-25619
D-2013-23401	D4	COMPLETE	OSB Refurbishment Project 16-25619 - Discrepancy in Drawing NK38-D0A-56281-0008

SCR Number	Category	Status	Title
D-2013-23399	D4	COMPLETE	OSB Refurbishment Project 16-25619 - Discrepancy in Drawing NK38-DRAW-56181-10009
D-2013-23387	D4	COMPLETE	OSB Refurbishment Project 16-25619 - Discrepancies in Flowsheet NK38-FXX-56281-0502-07
D-2013-22776	D4	COMPLETE	Project 16-25619 - Supply amperage to OSB MCC not as stated in Technical Specification NK38-TS-28110-10001, R000.

ONTARIO POWER GENERATION

Lessons Learned Report

Internal Use Only	
Document Number: NK38-LLD-76801-1000	
Project Number: 16-31508	Project Execution Plan Number: N/A
Revision: R000	

Title: **BDBE PROJECT 16-31508 / 16-32202 - LESSONS LEARNED**

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BDBE PROJECT 16-31508 / 16-32202 - LESSONS LEARNED REPORT

NK38-LLD-76801-10001-R000

Project Number: 16-31508/16-32202

2020-07-27

Internal Use Only

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Revision Summary

Revision Number	Date	Comments
R000	2020-09-17	Initial issue

1.0 BACKGROUND

As a result of the nuclear accident at the Fukushima Daiichi Nuclear Power Plant on March 11, 2011, the Canadian Nuclear Safety Commission (CNSC) and World Association of Nuclear Operators (WANO) requested that all of the Canadian Operated Nuclear Stations reassess and confirm the safety of their plants. The studies requested were to review the power plant's potential vulnerabilities to Beyond Design Basis Events (BDBE). As a result, numerous modifications have been made to protect the station in the event of a BDBE, under project numbers 16-31508, 16-32202 and 16-31512.

This lessons learned document captures the lessons from all of the modifications implemented at the station along with the procurement of the portable Emergency Mitigation Equipment (EME) which was procured as Minor Fixed Assets (MFA) under associated projects 16-31510, 16-32204.

A breakdown of all modifications captured within this document are listed in Table 1.

Table 1. List of Modifications for BDBE Projects

Modification	Project	Master EC	Vendor	Description
BDBE Telecom	31512	121400	ES FOX	Telecommunications system for use following a BDBE - new phones, electrical tie-in points around the station: MSB/Radio Room/phone locations
PHT Water Make-up	31508	124564	ES FOX	Water make-up quick connect location - installation in room R-210 on 107.5m elevation (P9000 Pump location)
ESC Water Make-up	31508	124564	ES FOX	Water make-up to the end shield cooling system - location is ESC line north of Airlock 1, 100m elevation
ESC Level Monitoring	31508	124564	ES FOX	Water level monitoring pressure gauge on the ESC - location is ESC lines north of Airlock 1, 100m elevation
Phase II – 4.16kV EPS Restoration	33202	122207	ES FOX	Repowering of Subset of 1 EPS division - portable generators with a new switchgear on south side of Unit 0, disconnect switch inside of ODD EPS room
Phase I - 600V Quick Connects	31508	120970	ES FOX	Receptacles on the south side of Unit 0 - ODD Division installed; EVEN division requires electrical tie-in and commissioning **Note:** NK38-LLD-50390-10000 addresses this modification.

120V PUPS	31508	120970	ES FOX	Portable UPS quick connection points include a new handswitch and plug **Note:** NK38-LLD-50390-10000 addresses this modification.
Airlock Seal Integrity	32202	N/A	ES FOX	Portable equipment including hose and compressors to maintain seismic integrity post BDBE
IFB Ventilation	32202	N/A	ES FOX	Portable equipment to vent the IFB of steam following boiling of the IFB
Portable Monitoring Equipment	32202	N/A	ES FOX	Portable equipment as a backup to installed systems to measure containment pressure, moderator level, steam generator level
ISRV Latching	31508	121688	B&M	Install means of latching the ISRVs in the open position if power is lost to the EPS batteries
EME Building II	32202	122207	B&M	New EME storage building- at the top parking in the former domestic water bladder location
ESW Tie-ins	31508	120954	B&M	ESW Tie-ins for BDBE Response to the Steam Generators and Moderator
Forebay Standpipes	31508	120454	AECON	Forebay standpipes for EME pump deployment - installation complete and only commissioning remains
EME Procurement	31510/ 32204	N/A	OPG	Original procurement of EME for Phase I / Phase II
New Pumps	31510/ 32204	N/A	OPG	New Pumps - no modification but EME guidelines will be affected by this
Deployment Plan Revisions	31508	N/A	OPG	Deployment Plan updates - no modification but EME guidelines will be affected by this

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The projects under the “Fukushima projects” title, or BDBE kept growing and because of that it spanned from 2013 to 2019. During that time there were several changes in organizational structure and persons working on these projects. Furthermore, Projects and Modifications evolved with respect to organization as well as departmental procedures. Therefore some of the lessons learned have been realized and implemented along the way.

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3.0 LESSONS LEARNED

3.1 Lesson 1: Design Requirements were Initially Poorly Defined based on Incomplete Stakeholder Needs and Lack of Definition in the BDBE Project

Project: All projects

Key Focus Area: stakeholder needs, stakeholder engagement, project deliverables, ESMSA contractor understanding of needs

Project Phase: Modification Planning, Detailed Design

Background: Determining the scope of work for BDBE response at Darlington was a complex process involving various stakeholders from across the nuclear organization. Both Pickering and Darlington evaluated conditions at their respective sites in Q2/Q3 of 2011 and identified scope within the Project Charters (D-PCH-09013-10001) issued in August of 2011 for Phase I and April of 2012 to incorporate Phase II considerations. A separate Emergency Telecommunications project under charter (D-PCH-03490-10001) was also developed as part of BDBE response.

Because the exact cause of a BDBE cannot be identified, the approach centred at mitigating the conditions associated with a BDBE as described in Section 1.1.1 “Approach to managing BDBE conditions” of N-GUID-01130-10000 “ Modifications for Beyond Design Basis Accidents”. The type of scenario identified was an Extended Loss of AC Power (ELAP) at one of the two sites. Because an ELAP can be the result of any entry condition outside of the design basis, selecting bounding conditions was a complex process, documented in various memos within the first several years of the project and later referenced in the revised modification guideline. In an effort to progress the procurement of EME for each site, the organization planned to have all Phase I emergency response equipment available by April 2012 alongside newly developed EME Guidelines prepared by Operations/Engineering specialists working under the same set of boundary conditions of an ELAP. To enable flexibility of response, commercial-grade pumps and generators were procured based on preliminary evaluations of the conditions which would be anticipated post-BDBE.

For the Telecom part of the project, there was a Collaborative Front End Planning contract conducted with the ES MSA vendor which resulted in further unknowns and no solutions. Subsequently OPG Projects had to regroup and consult internally to come up with a workable solution. The scope of work was modified and once the solution was identified and a realistic schedule was created the project moved ahead.

It was only after the equipment was purchased and EME guidelines were issued that the guideline for BDBE modifications was developed, in parallel with a refined set of scope based on ongoing analysis performed by nuclear safety. The combination of procuring equipment prior to finalizing the modification scope resulted in additional design efforts to attempt to back-fit the optimal design with the equipment already available. Further, because the scope of work evolved extensively within the first

several years of the project, the associated designs required extensive schedules to be completed.

Immediate action: revised scope of work, revised schedule, revised or issued new contracts

Root Cause: lack of understanding of requirements, lack of definition of scope of work, inadequate stakeholder engagement

SCRs: N-2013-03353, N-2013-16654

Recommendation: major scope needs to be locked in before project can proceed; all stakeholders need to be engaged

3.2 Lesson 2: OEM Vendor not providing required details on their documentation

Project: BDBE Telecom, 31512

Key Focus Area: Planning, Procurement, Scope of Work

Project Phase: Procurement, Execution

Background: the OEM vendor for the telecom equipment was selected based on technical requirements, cost and easiest to work with. However, the vendor was not providing appropriate documentation, drawings, level of detail in their communication related to the telecom trailer. The vendor was not prepared to provide the level of detail that projects and engineering expected. This caused significant delays and missing milestones.

Similarly, the OEM vendor's model of training on the telecom trailer was significantly inadequate to our expectation. This created a delay in the training and turnover as well as projects providing the expectation to what the training should entail.

Immediate action: Requested correction and recovery plan from the vendor.

Root Cause: OEM vendors who do not supply to the nuclear industry are often not aware of the scrutiny and level of detail is expected of them. In addition, OEM vendors are not prepared to discuss things in great detail before a purchase order is issued. Therefore detailed, clear expectations are not discussed and not locked in.

SCRs: N-2015-18871, N-2016-06709

Recommendation: if at all possible select a vendor with experience in supplying to the nuclear industry.

3.3 Lesson 3: BDBE Telecom Project Stakeholder engagement with Security

Project: BDBE Telecom, 31512

Key Focus Area: Stakeholder engagement, conventional safety

Project Phase: Planning, Execution

Background: The electrical tie-in point to the station for the telecom trailer was through an electrical panel that powers other security systems. Because of the nature of the loads on this panel it could not be isolated and therefore modification had to be done on a live panel. This is an important safety risk that was not planned for.

Immediate action: Requested walkdowns with Security to assess and evaluate best path forward.

Root Cause: lack of stakeholder engagement

SCRs: N-2017-25963, N-2017-26930

Recommendation: better tracking of stakeholder engagement

3.4 Lesson 4: Telecom trailer (Communication equipment) ownership turned over to Emergency Preparedness, with inadequate technical knowledge

Project: BDBE Telecom, 31512

Key Focus Area: Available for Service, Turnover Declaration

Project Phase: Closeout

Background: during Available for Service turnover an agreement was made at high level that Emergency Preparedness will be the owner of the telecom trailers, even though the CIO would have been better prepared and more knowledgeable. This created a gap in operational knowledge among the EP staff and lack of understanding of the required maintenance, what to look for during a surveillance.

Immediate action: Had discussions with EP to understand their concern. Had discussion with CIO to understand their perspective. CIO agreed to accept ownership.

Root Cause: lack of understanding of the role

SCRs: None

Recommendation: Transfer ownership of the Telecom Trailers from EP to CIO

3.5 Lesson 5: Valve Analysis for Over-pressure Protection Was Inadequate – Assumptions Incorrect; Valve installed incorrect due to error in documentation

Project: PHT Water make-up, 31508

Key Focus Area: Quality

Project Phase: Detailed design, execution

Background: HSL had provided an incorrect over pressure protection report (OPPR) at the outset. This report was not reviewed and was discovered that it had errors at the tail end of the installation. In the course of the project there was a changeover of Design Service Provider to Es.Fox from HSL to Tetratech. Tetratech was not aware of the incorrect OPPR and did not know that it needs to be revised. This caused some issues at the tail end of the project where it seems Tetratech had not budgeted for discovery issues such as this and they had to then fix the report.
Tetratech did not know the following with respect to the OPPR for the Water to PHT modification:

a. Calculation of the over pressure value in the isolatable volumes. OPG Projects Design had to provide guidance.
b. Address the pressure boundary concerns with respect to the associated valves for the OPPR. OPG Projects Design stepped in and had to perform the analysis for one such critical Velan valve and also to get Throburn to address their Quick Connect. Other two valves were IMI and addressed through IMI at the instance of OPG Projects Design.
c. How to orient the valves in the affected isolatable volumes so as to seek credit for the bellows compression. OPG Projects Design had to provide guidance.

Immediate action: OPG Projects Design stepped in and provided guidance

Root Cause: lack of knowledge; unclear drawings and lack of adherence to design and construction package

SCRs: N-2017-09927

Recommendation: since this knowledge and skill is gained through experience, have more experienced staff review the work

3.6 Lesson 6: ESMSA Vendor did not create CATIDs per expectation

Key Focus Area: Procurement

Project Phase: Procurement, Execution

Background: ES MSA vendor did not follow the process of CATID creation and provided inadequate information in the request to create a CATID. In turn deliverables were not met in a timely manner, milestones were missed.

Immediate action: Asked vendor to correct the missing information and re-submit.

Root Cause: procedural non-compliance, lack of ownership of the task

SCRs: N-2016-25443, N-2016-24276, N-2016-24253, N-2016-21747

Recommendation: Although the CATID creation process is now changed, the procedure still need to be followed and complete the task with accuracy.

3.7 Lesson 7: Schedule Delays for Valve Procurement Delayed Modification into Unit 2 for Refurb – Importance of Using Available Valve CAT IDs Where Possible

Project: PHT Water make-up, 31508

Key Focus Area: Long lead material, integration with station schedule

Project Phase: Execution

Background: Within the BDBE project, several modifications were performed on the reactor units between the 2014 – 2017 timeframe. Modifications on Unit 2 were specifically identified as having an elevated schedule risk for execution due to the Refurbishment outage starting in October 2016. In particular, the modification for the Primary Heat Transport (PHT) system was at risk due to the lead time of nuclear class 3 valves. Although attempts were made to limit the schedule risk by seeking alternate suppliers for the valves, ultimately the original lead time was accepted but experienced further delays, resulting in the Unit 2 execution pushing into the U2 outage window.

Execution on subsequent units was also delayed as a result of procurement challenges, however, the U2 execution required additional planning and scheduling as Refurbishment was managed under a separate work control structure than the rest of the AISC portfolio.

Apart from the PHT modification, other modifications within the BDBE portfolio were forced to enter into the U2 refurbishment execution window because of equipment availability challenges, including the Seismic Upgrades to the Deaerator and HP Feedwater Heat Exchangers as well as the End Shield Cooling Level Monitoring modifications. In all of the cases, the execution in the field was well after the start of the U2 outage which suggested that the individual schedules were unrealistic to meet execution timelines ahead of the start of the outage. The recovery plans which were developed did not reflect the actual time required to plan and execute the work in the station.

Immediate action: requested an installation window in U2 refurbishment

Root Cause: inadequate planning for procurement and execution

SCRs: N-2016-10418

Recommendation: develop a more realistic schedule, better risk assessment, collaborate with other projects

3.8 Lesson 8: Challenges Experienced in Completing Final AFS for DNRU2 Water to PHT and Seismic Reinforcements

Project: PHT Water make-up, 31508

Key Focus Area: Stakeholder Alignment

Project Phase: Commissioning, AFS, and Closeout

Background: The installation of U2 Water to PHT and U2 Seismic Reinforcements was completed in 2018. A leak check of the piping installed under the mods was required to complete commissioning, however this could not be completed at the time due to the systems being depressurized in Refurb. An AFS Strategy meeting was held June 18, 2018. It was decided in the meeting and documenting in the minutes that a Partial AFS be completed for the two modifications, and then after the leak checks are completed, the Final AFS declarations will be routed for final signatures. No meeting was required. The remaining work order tasks were scheduled to be completed in 2019 for seismic reinforcements and 2020 for Water to PHT.

When it came time to complete the Seismic Reinforcements Chemical Addition Feedline Leak Check, it was discovered that the work order tasks were not properly scheduled. The chemical addition feedline was required to assist in getting the required chemistry in the Deareator, but could not be used until the Chemical addition feedline leak check was completed. A strategy needed to be developed by Operations to pressurize the chemical addition feedline, complete the leak check, then send the chemicals up to the Deareator to get the required chemistry. Once the leak check was completed, Operations requested to use the line to complete their Hotwell Dosing. Per the ECC process, the system could be pressurized for up to 28 days. The final AFS required to be completed by then. The next challenge was getting the declaration signed in this time. The stakeholders that signed the Partial AFS Declaration were Station Resources, however the Final AFS was completed by Refurbishment Organization stakeholders. There was confusion regarding which stakeholders needed to declaration. Station resources believed Refurbishment needed to sign and vice versa.

For the U2 Water to PHT Leak Check, there was also similar issues in regards to scheduling and stakeholder alignment. The PHT system required to be at LPH in order to complete the leak check. The ECs required to be at Modified to complete the PHT SAFS. However, there was only a few days between when the leak check would be completed after the SAFS was done. After further review of the PHT commissioning schedule, an earlier opportunity to complete the leak check was identified. This added a few more days to complete the AFS and set the ECs to MODIFIED. In order to get the Final AFS Declaration signed on time, ESFOX needed to complete the documentation ahead of time, and the stakeholders needed to be lined up. There was a similar issue in confusion of which stakeholders were required. Also, there was misalignment between the avenues to complete the AFS. The minutes just requested the form be routed for signatures, however the DA did not agree and requested a Final AFS meeting. The minutes were never issued or signed by the DA at the time. A

formal revision to AFS strategy Memo should have been completed. Also, the Modification Outline called for an enhanced AFS. A contrarian had to be assigned and meeting held in very short period of time.

Root Cause: Incomplete Planning

SCRs: N/A

Recommendation: Ensure plan agreed and fully developed for work that will be completed in the future and with a different project team.

3.9 Lesson 9: Interference between Modification and IRI Modification Was Missed – Abandoned Port to Containment was selected by IRI After ESC Piping Location was finalized by BDBE Project

Project: ESC Water Make-up 31508

Key Focus Area: Stakeholder engagement, Execution planning

Project Phase: Execution

Background: An interference was identified in June 2017 between the BDBE End Shield Cooling Make-up project and the IRI Rapid Delivery project (MEC136923) at RB-R103 modification location. The obstruction was discovered after an IRI walk down identified floor marks being used by the BDBE project for future anchoring.

The location of the supply connections interfered with previously existing IRI equipment pathway. The said IRI equipment was to connect to EPs on the external wall of the Containment.

The obstruction was in relation to a containment penetration located immediately west of the floor area where the ESC piping was to be installed. This penetration was identified during the COMS phase of the ESC modification and identified to be no longer in use by IRI. The Project team proceeded to use this area in the design. As the modification progressed, an independent modification within the IRI organization for the Rapid Delivery tooling machine underwent scope assessment which recommended the use of the penetration. This occurred after the ESC modification was finalized and without awareness across the groups.

Both organizations reviewed the obstruction and because the BDBE modification was a regulatory commitment there would be no re-design performed for the modification. The IRI team conceded that they would need to re-visit their design strategy as a result.

In this case, no group was at fault, however, a mechanism could have been implemented to define that the location around the penetration would be used as part of the BDBE project, either via temporary tape on the ground or other designation in

the area. This may have generated additional communication between the project teams.

Immediate action: upon discovery held meetings to determine path forward

Root Cause: inadequate stakeholder identification or engagement

SCRs: D-2017-15342, N-2017-15348,

Recommendation: better planning and stakeholder engagement

3.10 Lesson 10: Importance of Communication between Control Room, Station Field Staff and Vendor during Commissioning – Damaged Gauge

Project: ESC Level Monitoring, 31508

Key Focus Area: Validate assumptions

Project Phase: Execution

Background: During final leak checks for the End Shield Cooling Level Monitoring modifications both OPG Operations and ES FOX QC were following workplan / ITP steps to complete leak checks on both Line L4 / L5 for two newly installed valves on each line protecting new pressure gauges. On Line 5, the leak check required only the first of the valves (2-34110-V163) to be opened to demonstrate a leak tight seal. A request was made to obtain ESC System pressure which the Operator assumed could be obtained without issue by partially opening of the second valve (2-34110-V165). This action exposed the gauge (2-63411-PI102) to water pressure exceeding its operational pressure but within its design pressure - this caution was identified in the work-plan steps. As a result, the gauge incurred damaged and had to be replaced.

Immediate action: Field closed valves, backed out of leak test leaving the field in the safe state. Pressure gauge was subsequently replaced as part of field closeout activities.

Root Cause: Assumption was not validated.

SCRs: N-2017-25085

Recommendation: This is a learned skill and OPEX should be shared with Operations and Maintenance

3.11 Lesson 11: Design Requirements for Hi-Pot Testing Were Not Clearly Defined During Modification Planning

Project: Phase II – 4.16Kv EPS Restoration, 33202

Key Focus Area: Design Requirements

Project Phase: Execution

Background: The Phase II Electrical modifications for BDBE required a brand new switchgear to be installed on the 4.16kv EPS bus to support connection of large 1.4MW generators to re-power a division of EPS. During installation activities, the construction team demonstrated a questioning attitude and asked for Design input for an execution step related to high potential (Hi-Pot) tests of the new permanent cabling which allowed for the step to be by-passed if deemed appropriate by the team.

Following review by the Design team, it was identified that Hi-Pot testing was required, in alignment with OPG standards. The design teams from OPG and Tetratech engaged in an engineering review of whether the Hi-Pot testing was required for a BDBE style piece of equipment and determined that the test would be required. There was disagreement amongst the design teams, however, a decision was made to set the Hi-Pot testing as a formal requirement. As the permit had already been removed for connection of cables, a significant amount of re-work was required to enable the cables to be accessed for the testing. This caused a delay in the installation schedule of approximately four months and a cascading delay into the commissioning phase of the modification.

Immediate action: Project team assembled design challenge meetings to review the need for Hi-Pot testing. Notifications were made to the management team.

Root Cause: Design requirements not adequately specified; the team did not properly address the concern during the work planning phase by allowing the testing to be optional; allowing field work to progress at risk even after identifying the issue which led to the re-doing the test itself.

SCRs: N-2017-24924, N-2017-23956

Recommendation: Design requirements need to be clearly defined during the preliminary engineering phase, including testing requirements to demonstrate quality of the installation. As part of preliminary COMS process, construction discussion should include discussion surrounding commissioning requirements. Workplan steps which are optional should be flagged to design during the work planning process for concurrence, especially for quality hold points, to ensure that there is alignment prior to entering into the field.

3.12 Lesson 12: Off-Site Commissioning Activities Significantly Reduced Commissioning Duration at DNGS Site

Project: Phase II – 4.16kV EPS Restoration, 33202

Key Focus Area: FAT tests, Commissioning sub assemblies

Project Phase: Commissioning

Background: The Phase II EPS restoration modification involved providing backup power generators to be used during a BDBE to restore one division of the EPS system. The scope included procurement of several portable, 4.16Kv, 1.4 MW generators and a portable switchgear from Wajax which would all be deployed following a BDBE. Normal commissioning could not be performed with the generators as repowering an EPS bus would not be permitted during normal station operation. A modified set of commissioning was identified, however, given the schedule pressure and complexity associated with the commissioning scope, the project identified a major risk in being able to complete work by the end of 2017. To mitigate this schedule risk, OPG and its contract partner, ES FOX, developed an innovative solution which involved performing extended commissioning as part of the Factory Acceptance Testing performed on the generators and switchgear at the Wajax facility in Drummondville, Quebec. Activities included load bank testing, load sharing tests and other inspections on the equipment which otherwise would have prolonged field execution in Q4 of 2017.

The strategy was developed by the project team and received approval through the Darlington Design Authority. Further, the project secured support from station Operations, Control Maintenance and Engineering personnel along with ES FOX representatives, to attend the testing and bring back OPEX to support planning for the final commissioning activities. This evolution demonstrated the great team work between the three organizations with a common vision to complete work with quality, and within schedule and cost allocation.

Immediate action: perform extended commissioning during FAT test at vendor's site

Root Cause: N/A

SCRs: N/A

Recommendation: implement this concept where applicable. It provides less burden on station work plan and allows the project to proceed off site.

3.13 Lesson 13: Procedural Revisions Were Initiated With No Float Remaining In Schedule – Importance of Filing TPARs

Project: Phase II – 4.16kV EPS Restoration

Key Focus Area: updating or creating new procedures

Project Phase: Execution, Closeout

Background: The requirement to have procedures issued to support ongoing station operability is a key deliverable for many projects. However, within the bounds of the BDBE project, the revisions to or issuance of new EME guidelines was key in the declaration of emergency response readiness. Since EME guidelines were in place prior to the implementation of modifications at the station, a basis was available for the project team to start from. Even with an available framework, a significant amount of

effort was put in to developing how new equipment would integrate with the existing deployment strategies and how the overall guideline hierarchy would evolve. A common issue related to each modification was that the TPARs for the guideline revisions/development were late or required re-work which placed strain on the procedure departments to re-align their organizations to facilitate BDBE project support. In the case of the Phase II EPS restoration modification, a contract partner under the Operations Support Services (OSS) contract, Worley Parsons, was engaged to develop the required procedure in time to support AFS.

It is often the case that procedure impacts are not well known until a modification's design is completed. Further, the design or project support groups may not have the technical expertise to supply TPARs of adequate quality which can be processed by the procedure departments without significant involvement by internal staff. A combination of these issues led to reaching out to the external agency. A contract was issued within the Phase II project leading to the development of an over 220 page guideline for integrating an EPS bus restoration strategy within a four month period. This was followed by extensive guideline reviews within the Operations organization allowing the document to be used as an interim tool for emergency response.

Future projects should place significant emphasis on ensuring a plan is available for procedure updates. Alignment with procedure departments should also be outlined early in the project so that forecasts can be made in regards to document processing quantities, personnel requirements and expertise levels.

Immediate action: Project did not identify the procedural gap until approx. 6 months prior to AFS. Once the issue was identified, the schedule risk was flagged to Darlington senior management with the team contracting out the procedural development to a company specializing in nuclear operations procedural development.

Root Cause: Project team did not understand the complexity associated with the procedure development / issuance process and failed to build in adequate scheduling to complete this deliverable.

SCRs: N/A

Recommendation: The Procedure development process should be discussed during the Scoping COMS to establish general expectations quantity and content of the documentation. A COMS process requirement should be to review final TPARs during the final detailed design COMS process.

3.14 Lesson 14: Category IV Requirements not Well Defined – Challenges with Development of Packages

Project: Airlock Compressors/IFB Ventilation/Portable Monitoring IFB Monitoring Equipment – Category IV Package, 32202

Key Focus Area: FOAK tasks with no procedures or OPEX

Project Phase: Execution

Background: the BDBE project introduced a new category of modification specific to Beyond Design Basis Accidents (BDBA/BDBE), termed the Category IV modification. This was introduced after the development of the Guideline for BDBA Modifications and applied to many pieces of equipment procured in later years of the projects. The Category IV ("Cat IV") package was to be the equivalent of a design engineering change package for portable equipment, for example, the airlock compressors, IFB ventilation fans, portable monitoring tools and IFB monitoring equipment.

Because the development of a Cat IV package was defined in general terms, it provided for flexibility in what was included in the report. Consequently, this led to some confusion with regards to what had to be included and what was optional, further, what station stakeholders expected to see. The education of BDBE at the station evolved through the execution of the project and stakeholders often requested conservative actions which placed nearly the same rigour which would be applied to a standard modification at the station. This issue was replicated at both Pickering and Darlington in parallel. While the expectation was that the Cat IV packages would be easier to manage than the standard modifications, the outcome was that the incomplete expectations resulted in the growth in scope and delays to issue the packages. Both contract partners and internal stakeholders quoted these packages as major deliverable challenges within the BDBE project.

It is recommended that if future Cat IV modifications are pursued, clear expectations are set forth at the start of the modification, using the OPEX from the previous modifications as lessons learned inputs.

Immediate action: created a turnover document for each set of portable equipment (see document list in Appendix A)

Root Cause: scope creep, stakeholder expectation,

SCRs: N/A

Recommendation: Develop a template or a guideline where the modification process does not apply

3.15 Lesson 15: Portable Equipment Not Properly Defined in MEL – BDBE Tags Not Entered

Project: Airlock Compressors/IFB Ventilation/Portable Monitoring IFB Monitoring Equipment – Category IV Package, 32202

Key Focus Area: Turnover

Project Phase: Execution, Closeout

Background: Portable equipment is not connected to station systems and it is not operated during normal operation. Therefore it can be thought of that no MEL tag is necessary. On the other hand for consistency and in line with the tagging of rest of the equipment one may think that a MEL tag is necessary to refer to the BDBE components.

Subsequently Darlington Performance Engineering reviewed the condition and concluded that it is not necessary to create MEL tags for the entire BDBE equipment inventory since it is not related to station systems and operation.

Immediate action: reviewed condition with Performance Engineering

Root Cause: D-INS-03491-10000 and N-BDB-03600-00001 EME Inventory list which carries incorrect equipment tag number for EME equipment, which needs to be corrected with appropriate tool number. EME equipment is considered tools, not permanent station equipment.

SCRs: N-2016-01874, D-2020-06415

Recommendation: Per Station Design Document D-ED-01520 -10001 Darlington Equipment Identification, it is considered a tool, thus no equipment tag number is assigned

3.16 Lesson 16: Unclear COMS recommendation resulting in no COMS meeting

Project: Phase I – ISRV Latching, 31508

Key Focus Area: planning

Project Phase: planning

Background: The Modification Outline form template (N-FORM-10958) was at R13 when it was approved and the question in Part 5.0 APPROVALS was worded in a confusing manner with a double negative statement. It was interpreted as formal COMS not required, even though the intention of the approving authority was it should be held. The current form template is at R16 and this possible source of error has been eliminated by using more direct words. It was discovered when one of the members of the project team indicated that holding a formal COMS was required. Contributing to the opinion that no formal COMS is required was the fact that the modification is a Reduced Risk A Modification (RRAM)

Immediate action: Held meetings with Design Projects team, Design Authority and sought approval to waive the requirement of a formal COMS. The DA approved the waiver subject to a few actions being completed. Due to the maturity of the project it was determined that backtracking to complete a formal COMS was not required for this RRAM. Based on this the request from the DA was to summarize all related actions in a memo to file to document what was completed in lieu of the formal COMS. The responsible DE/DTL for this project was also coached in terms of the

requirements related to COMS and how these requirements are outlined and documented in the Mod Outline.

Root Cause: unclear communication, assumption not validated

SCRs: N-2017-10377

Recommendation: N-FORM-10958 has been revised and implemented to ensure clarity around COMS requirement.

3.17 Lesson 17: Interferences discovered between the intended installations and existing structures

Project: Phase I – ISRV Latching, 31508

Key Focus Area: planning, design verification

Project Phase: Execution planning

Background: the instrument panel that was to hold the components in this installation was too big for the space intended to be installed. When questioned the DTL the reply was that the design was based on an existing installation. No field verification was done. Projects along with field engineering was trying to verify what is going to be installed and it was discovered that the panel as is was too big. Furthermore, there is a difference in space available from unit to unit.

Immediate action: Requested the civil DTL to walk it down with projects to understand what installation was intended. Examined other possible areas to install and examined the possibility of reducing the panel size and support (legs). The latter was selected and successfully installed.

Root Cause: lack of field verification by design team

SCRs: N-2017-22621, N-2017-05776

Recommendation: field walk down with verification of proposed design to be done by the DTL

3.18 Lesson 18: Confirmation for Design Specific Qualifications for EME Building II

Project: EME Building II, 32202

Key Focus Area: Vendor quality, Engineering Design Quality, Engineering Change Control Process

Project Phase: Detailed Design

Background: Design engineering agency hired in this project was not qualified per OPG's ES-MSA agreement; instead they were the vendor's sub-sub contractor. The subcontractor was supposed to oversee the work however there were numerous misses, both technical and schedule, incomplete deliverables, not following the modification process (N-PROC-MP-0090). There was a breakdown in communication, lack of ownership and lack of collaboration. Action Tracking items were not completed on time, not incorporating FICREQs, documents submitted with missing details, documents submitted last minute for AFS without giving time for OPG staff to review. This resulted in significant delays, re-work, additional meetings and oversight.

Immediate action: documented findings, implemented additional reviews, held more meetings

Root Cause: sub-vendor's lack of qualifications, vendor not managing their sub-vendor

SCRs: N-2018-18697, N-2018-18964, N-2018-12265, N-2018-04973, N-2018-04473, N-2018-03971, N-2018-03255, N-2018-02981, N-2018-02980, D-2019-18692

Recommendation: ensure sub-vendor is qualified to OPG procedures like N-PROC-MP-0090.

3.19 Lesson 19: EME Building II is Not a Heated Building – Importance of Ensuring Equipment is not exposed to Harsh Conditions

Project: EME Building II, 32202

Key Focus Area: Scope definition

Project Phase: project planning

Background: Based on a common project strategy between Pickering and Darlington EME storage buildings, the scope of work for the EME buildings did not include permanent heating solutions. The project team implemented both buildings at Darlington without such heating. Once EME equipment was placed into the building and exposed to the elements, i.e. cold, the batteries drained very quickly and generators or other equipment was failing to start.

Immediate action: ERT would plug EME into chargers or operate periodically. Equipment failures on the EME were repaired on-demand.

Root Cause: At the start of the project, it was envisioned that heating the EME buildings would not be a requirement based on plugging in battery chargers and coolant heaters. Insufficient stakeholder engagement allowed this strategy to proceed at both Pickering and Darlington facilities. Maintenance complication were not properly evaluated by the project at the early stages of the project.

Recommendation: Emergency Preparedness (owner of the facility) have implemented walk-downs and equipment checks. For future projects, a thorough review of ongoing

operational / maintenance considerations should be performed as early in the project as possible to identify potential pitfalls such as this one. Stakeholders should be engaged as early as possible in the project to provide valuable feedback in these project areas.

SCRs: D-2020-02381, D-2020-19617, D-2018-25558, D-2018-24026, D-2018-16790, D-2017-00585, D-2018-01876,

Recommendation: Emergency Preparedness (owner of the facility) have implemented walk-downs and equipment checks.

3.20 Lesson 20: Contracting strategy changed during detailed design

Project: Forebay Standpipes, 31508

Key Focus Area: Contract strategy, scope definition, design oversight

Project Phase: Detailed design

Background: this detailed design was initially contracted out to Black and MacDonald and RCMT as the design agency. To gain efficiency, the contract was issued before the scope definition was finalized. When the detailed design was completed, the contract was stopped because the Design Agency did not complete the work properly.

Seismic design scope definition was not clear at the time of issuing the contract and it was not finalized until close to the completion of detailed design. To be on the safe side the design agency over designed the standpipes to have conservative seismic margin, in line with Beyond Design Basis Review Level Conditions. The change in scope added further complexity and delays. Furthermore there was a design flaw identified by OPG design team that the RCMT placed the header in a vertical position (designed from the side) that would create cavitation.

The design was not accepted and the vendor was requested to re-design using the new set of pumps and correct the header. At this point the contract with B&M was stopped.

The procurement and execution contract was issued to Aecon and SNC following a competitive bid. This was their first major project with OPG and appeared to have a steep learning curve. The complexity of the work was underestimated, including level of effort required by MTL, field activities and this created a significant time pressure. Although they had a high level of understanding of the project once they got into the detailed design work and execution they claimed too many discovery issues which resulted in numerous change notices. There were a total of twelve PCAs and three CTPs in this PO.

Examples of the variety of issues that created delays and / or added cost are documented in SCR N-2016-29310 and include

1- Delay due to getting soil sample results
2- Delay to the issuance of CWP due to delay of the Work plan
3- Delay of material delivery, several occasions
4- Wrong rebar material delivered onsite
5- Discovery of groundwater well in the way of the west concrete pad (COMS??)
6- Delay to issue a FICR to address groundwater well issue
7- Missing ground information for concrete pad rebar and pipe support (Design issue)
8- Delay of issuing a FICR to resolve grounding issue
9- Delay to form rebar material due to issue of shop drawing
10- Delay to form rebar due to change material thickness for rebar
11- Delay of the delivery of the fabricated material onsite to start the installation of pipe support
12- Interference of the a ground cable on the forebay wall with the pipe support bracket
13- Delay to Re route the ground cable as per the path forward provided
14- Delay to start the installation of the pipe support due to delay to fabricated material and re routing the ground cable on the forebay wall
15- Wrong scaffold erected on the west side
Immediate action:

Root Cause: Scope definition not final; vendor not understanding of the work involved

SCRs: N-2016-18623, N-2016-29310, N-2017-00226, N-2016-26797, N-2017-13901, N-2017-08694; N-2017-00226; N-2016-08533

Recommendation: Based on OPEX, the project should have reconsidered pursuing a competitive bid for this second procurement / construction phase. Maintaining B&M as the contractor would have cost more upfront but likely would have been less costly in the long run since the estimate more accurately described the work compared to that of AECON's. They understood the complexity and level of effort more than the subsequent vendor.

3.21 Lesson 21: Non compliances to EC process by Black and Mcdonald / RCMT

Project: Forebay Standpipes, 31508

Key Focus Area: technical understanding of deliverable

Project Phase: detailed design

Background: Poor quality was observed in RCMT submitted pipe support calculation under EC 123927 and EC 123928 (NK38-CALC-76500-10005 and NK38-CALC-76500-10006). Due to the poor quality these reports were not accepted.

During the second review of the same reports it was found that the corrections that were not incorporated, there were technical errors, inaccurate information, missing

explanatory figures and explanations of results. Therefore the report was not accepted again.

NPSHR should be calculated considering Phase-2 flow rates. Design Agency submitted the Final Package (100% complete) for the final design "Installation of Suction stand pipes into the Fore bay for BDBE" yet there was no separate calculation submitted, instead Design Agency referred to the CALC (NK38-CALC-72800-10037) which was submitted along with ESW tie-in package where the NPSHR calculation was done incorrectly and inadequately (pressure drop at bends, strainer were not considered). The flow considered was incorrect; it neither met the phase-1 nor phase-2 requirement.

Root Cause: procedural non-compliance

SCRs: N-2014-14342, N-2014-12954, N-2014-08214

Recommendation:

Non-compliances to the EC process by AECON / SNC Lavalin:

Background: There were issues with the installed forebay standpipe air supply hose carts which lead to the incorrect final installed assembly:

- Procurement issue with the pressure gauges and pressure regulating valves that were ordered as they were not as per the EC.
- There were no ITP's generated to execute and control the installation of the carts.
- During execution, questioning attitude was not present to stop work without an ITP.
- EC drawings which were in the CWP's were not used to install the carts and thus the installed carts are different than what is shown on the drawings and we are not able to identify what drawing was used in the field.

Change papers affected under EC 129299 and 129300 were not uploaded to Asset Suite. It had to be brought to the Vendor's attention that it has to be completed.

SCRs: N-2018-16090, N-2017-10150

3.22 Lesson 22: Pump Specifications Changed During Design of Standpipes Requiring Full Re-design of Standpipes

Project: Forebay Standpipes, 31508

Key Focus Area: Validate design inputs

Project Phase: Detailed design

Background: During the late stages of detailed design the design agency reached out to the pump manufacturer for better quality pump curves to confirm calculations. When

the pump curves were provided they were different from those originally supplied with the pumps. Specifically the minimum flow required by the pump had been increased from 40L/s to approximately 120L/s. This had occurred during the time between when the pumps were purchased and prior to the start of the modification.

The design prepared by the design agency was inadequate to handle the new minimum flow without possibly damaging the pump due to cavitation. The size of the piping would have resulted in too great a head loss to the pump inlet at the required flow. The piping size is integral to all aspects of the design, and materials had been purchased and fabrication begun under a Work at Risk Release (WARR), therefore recovering the design via revision at such late stages was not feasible.

Immediate action: The project was put on hold with the design agency responsible for upgrading the design to address the new pump curves and correct orientation of the standpipe headers which was a separate design issue. The pump supplier was notified of the unacceptable practice of changing pump curves without properly notifying customers and negotiations were held for future supply of pumps at a reduced price.

Root Cause: The apparent cause was failure of the design agency to validate design inputs during the initial stages of the detailed design. Delaying the validation of pump flow characteristics after the design was completed confirmed that the design was inadequate.

SCRs: N-2014-13060, N-2014-26738, N-2015-07670, N-2015-07670

Recommendation: Quality and Supplier Performance group to review the incident to determine if the vendor was within their Quality Assurance program and Design procedures.

3.23 Lesson 23: Safety Procedure not followed – grounding of crane without following procedure; Scaffold Tube Dropped in Forebay

Project: Forebay Standpipes, 31508

Key Focus Area: Conventional Safety

Project Phase: Execution

Background: During initial set up to Critical Lift (under 500KV lines) of stand pipe in North West Forebay, contractor was witnessed that their electricians were grounding the crane with out OPG Standards references OPG-PROC-0123 Workplace Electrical Safety and N-MAN-08965-10001 Rev 011 Electrical Safe Work Practices and PPE Task Matrix-Darlington. As well as not using appropriate PPE and not grounding to the station ground first for the bonding cable.

This modification required a scaffold to be built above water and while handling scaffold tubing during a minor scaffold modification a worker inadvertently lost control of a 4-5’ long piece of tube into the waters of the Forebay.

As an additional example of proper safety planning when working in the forebay, in the original effort to install the standpipes, the construction contractor did not take proper precautions for inclement weather. This resulted in the partial submersion of a safety boat in a flash rain storm leading to delays to the restart of work and hazards resulting from retrieving the boat from the forebay.

Immediate action: Coached staff on expectations. Work Group given a roll out on OPG Procedures for proper grounding technics and PPE required to properly ground equipment at OPG. Best practices for a safer environment for everyone especially when working under high voltage lines.

Additional oversight/CMO presence was put in place.

Root Cause: Procedural non-compliance; FME plan was not being adhered to at the time of the incident.

SCRs: N-2017-14160, N-2017-14193

Recommendation: Ensure that Contract partners enforce their safety plans with workers as part of pre-job briefings on site to be aware of their expectations. Increase oversight by CMO should be applied for high risk projects or for less frequent type activities which have unique hazards and risks.

3.24 Lesson 24: Initial Procurement of EME Completed Without Modification Design Available – Backfitting Required Later in the Project

Phase I/Phase II – EME Procurement and Deployment Revisions

Key Focus Area: Scope definition, realistic achievable schedule

Project Phase: Planning, execution, and closeout

Background: At the start of the Beyond Design Basis Event response project, there was a fleet wide initiative to procure EME as quickly as possible to site for rapid response to BDBE mitigation. As a result, the initial set of EME was procured prior to the modifications / designs finalized for the Darlington and Pickering stations. As the modifications progressed, the scope of the project kept changing while some of the equipment was procured. This created a challenge for the design team since the equipment had to be back fitted into the design of the modifications. In other cases, the EME had to be modified to suit the requirements of the modification. The most significant impact identified here is the change in the portable pump scheme from 4 to 2 pumps given that the original pumps did not meet the requirements of the design conditions as scope was settled.

Immediate action: Ongoing activities took place to upgrade the EME as needed or modify the design as necessary. The increase in project costs was not estimate directly, however, such changes led to significant project re-work activities, increased design support, supply chain engagement and stakeholder alignment.

Root Cause: Due to the fleet wide strategy, the procurement of EME was initiated prior to confirming all design requirements for the BDBE response project. The scope definition had not been completed prior to proceeding with the procurement phase of the project.

SCRs: N/A

Recommendation: Based on acceptable risk, a project may choose to perform certain project phases out of order, however, once purchasing equipment / components the impacts are much larger an overall project. It is recommended that project follow the standard project cycle and perform activities within the bounds of ECC process.

3.25 Lesson 25: Ownership of Portable EME Was Not Well Established at the Time of Procurement Leading to Confusion amongst Station / Project Stakeholders

Key Focus Area: Stakeholder relations, Turnover

Project Phase: Closeout

Background: the numerous EME portable equipment was not clearly defined from the beginning and it changed during the course of the project. Since the scope was not clearly defined and kept increasing, similarly the number and type of EME equipment was increasing. In some cases due to schedule restraints the equipment was turned over to the respective organization

Immediate action:

Root Cause:

SCRs:

Recommendation:

3.26 Lesson Learned Summary

Areas for improvement identified from this review: better scope definition; better stakeholder engagement and alignment, closer oversight of EPC contractors, including quality, contract management and field engineering oversight.

This number of projects increased along the way as scope of the project and work was further analyzed and defined. This caused a significant amount of increase in work load for project managers, project leads, modification team leaders and related staff, including staff (section) management. As projects were getting more complex and more defined, more issues were discovered and additional people were hired in project management, project coordinating and modification team leader role. Eventually these projects were grouped under one program and a Program Manager was assigned to it.

As the scope of work increased, the Project team and Operations had to be able to respond to the changes expediently which created assumptions both technical and project management deliverables that were later discovered to be not possible. For example – modification not commissionable de to interfacing system can't be available for testing, station resources not available for commissioning and delivering within the committed due date. Other challenges were identifying appropriate window to execute the work and having station support available. Assumptions in scope also created incorrect cost estimates and because of that the budget included significant contingency amount to ensure funding is available for the project to be completed with minimal delay.

EME equipment can be physically big – i.e. various generators, pumps and compressors and storing these equipment proved to be challenging. They need to be procured according to a modification schedule or the availability form the vendor sometimes does not align with project's due date. Therefore the project team reached out to different groups to find temporary space. For some smaller items an additional seacan was rented on a temporary basis until the temporary storage space was required.

This project started in the early days of Projects and Modifications section within the Nuclear organization when project management processes and procedures were evolving and changing. Elements like Project Management Plan, gated process, risk identification and mitigation, schedule management and cost management was not defined and not managed consistently. Costs of these projects were difficult to estimate as well and therefore significant amount of contingency was allocated to cover potential increase in scope.

There were numerous unique, non-standard, retrofitting installations required for BDBE projects which led to misunderstanding in deliverables in both technical (design) and execution (construction). This created challenge in guiding and managing the team, at times there were multiple meetings in a course of a day to ensure right progress in any of the technical, procurement, station support, execution, commissioning areas is maintained. The project team at this stage grew and included a project coordinator, modification team leader in addition to project manager and a program manager.

3.27 Recommendations

With respect to project management techniques and processes, significant improvement has been made since the completion of this project. A new organization has been created – Enterprise Project Management where the lifecycle of the project has been defined by governance, procedures and templates. Roles have been identified in a clearer manner.

When a group of similar projects are bundled into one big project, a program management structure should be incorporated to ensure a systematic management, accountability and project stability.

4.0 COMMUNICATIONS PLAN FOR THE LESSONS LEARNED REPORT

Add to Lessons Learned database in the RMO tool program.

Distribute to P&M staff at DNGS.

5.0 CONCLUSIONS

Enterprise Project Management procedures and templates including the gating process improved the flow and scrutiny of project management. This helps in assessing scope and readiness of progressing a project which in turn improves the cost, schedule and risk assessment.

In a scenario of many similar projects or related projects that are bundled together a program management structure should be incorporated.

Appendix A: List of Approval for Service (AFS) reports for BDBE Modifications

Further information on document numbers such as work plans, history docket numbers, design and installation related document are included in the AFS reports below.

Design EC	AFS Report
121400, BDBE Telecom	No AFS report, only MOD turnover and Commissioning Report
124564, PHT Water Make-up	NK38-REP-33310-10022 NK38-REP-33310-10021
124564, End Shield Cooling Water make-up	NK38-REP-34110-10061 NK38-REP-34110-10057
124564, End Shield Cooling, Level Monitoring	NK38-REP-63411-10012
Airlock compressors, Containment Airlock Inflatable Seal Air Supply Study	NK38-REP-21022-10001
Airlock compressors, Category 4 Package Airlock Seal Integrity Following A Beyond Design Basis Event	NK38-REP-21022-10002
Turnover Report For Dngs Portable Instrument Monitoring Equipment	NK38-REP-76801-10005
Turnover Report For Category 4 West And East Ifb Portable Ventilation Equipment	NK38-REP-76801-10006
Turnover Report For Airlock Seal Integrity	NK38-REP-76801-10003
Darlington Bdbe Ifb-e And Ifb-w Portable Ventilation Category 4 Technical Basis Document	NK38-REP-34400-10003
122207, Emergency Power Supply System Connection	NK38-REP-50390-10063

Points For 4.16kv Portable Gensets	
121668, Local Opening of ISRVs	NK38-REP-36140-10050,
122207, EME Building II	NK38-REP-53700-10012
120954, ESW Tie-ins for providing make-up water for steam generators and moderator	NK38-REP-72800-10066 NK38-REP-72800-10067
120454, Forebay Standpipes	NK38-REP-76500-10002, NK38-REP-76500-10003
EME Walkthrough	NK38-REP-03490-0632628
Beyond Design Basis Emergency Mitigating Equipment (eme) Turnover 2 - Darlington	NK38-REP-76801-10009
Darlington Ngs - Emergency Mitigating Equipment (EME) Deployment Strategy	NK38-REP-03490-10134
Beyond Design Basis Emergency Mitigating Equipment (EME) Turnover - Darlington	NK38-REP-76500-10001

ONTARIO POWER GENERATION

Lessons Learned Report

Internal Use Only	
Document Number: NK38-LLD-71110-10000	
Project Number: 16-31552	Project Execution Plan Number:
Revision: R000	

Title: Lessons Learned for the CCW & LPSW Travelling Screen Replacement Project

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16-31552 Lessons Learned for LPSW and CCW Travelling Screen Replacement Project

NK38-LLD-71110-10000-R000

Project Number:16- 31552
Date: 2021-04-15

Internal Use Only

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Revision Summary

Revision Number	Date	Comments
R000	2021-04-15	Initial Issue

1.0 BACKGROUND

The travelling water screens are a primary means of removing the debris from the intake supply water to the Condenser Cooling Water (CCW) and Low Pressure Service Water (LPSW) system. During inspections, significant degradation was discovered on the underwater stationary components of CCW Travelling Screens. Much of the degradation was due to corrosion and excess pressure on the chain guides from the carriage chain rollers resulting in significant erosion of material. In addition, the frame and bolt connections were badly corroded causing loosening of the screen frame. Although, periodic maintenance was being completed on all the moving components (e.g. chain, foot shaft, baskets) the stationary components, like the frame and the guides, had never been replaced and were approaching the end of life.

The travelling screens are a major component in the CCW system as its function is to remove the debris from the lake water that is then used as the process fluid for the system. Failure of the screens to perform its function can have an adverse impact on the operation of the system and the unit, as there would be insufficient flow. For the CCW system, loss of one travelling screen would require shutdown of the corresponding CCW pump which would result in loss of generation (up to 40 MWe during the summer months). In the event two travelling screens failure on the same unit, 2 CCW pumps would be shutdown leading to a subsequent shutdown of the unit.

1.1 Purpose

The purpose of this project was to address the issue of degraded CCW and LPSW Travelling Screens that were reaching their end of life. In order to address the issues of degraded CCW and LPSW Travelling Screens, the existing screens were replaced with a modern day equivalent provided by the OEM. The screens were the same fit and function. This ensured the travelling screens maintain their design function, improve equipment reliability and mitigate potential failures of the equipment causing unit de-ratings and forced outages. The proposed scope of this project was to replace the Condenser Cooling Water (CCW) and Low Pressure Service Water (LPSW) travelling screens (32 screens in total) with the existing design which were still supplied by the OEM.

1.2 Definitions, Abbreviations and Acronyms

CCW: Condenser Cooling Water

COIR: Contractor/Owner Interface Requirements

DN: Darlington

ES MSA: Extended Services Master Service Agreement

LPSW: Low Pressure Service Water

MWe: Megawatts electric

OAR: Organizational Authority Register

OEM: Original Equipment Manufacturer

OPG: Ontario Power Generation

1.3 Project Funding History

Approval	Cost	Date
Original Approval Estimate	27,496k	2013
Additional Scope Released	10,124k	2016
Final Approval Estimate	37,620k	2017
Final Actual Project Cost	37,620k	2018

1.4 Project Cost Performance

Project performance for the final actual project cost was in-line with the OAR Approval Amount of $37,620k.

In 2013, scope for the replacement of eighteen (18) travelling screens was released to the vendor (OAR Approval of $27,496k). In 2016, additional funding of $10,124k was released to install the remaining fourteen (14) Travelling Screens.

2.0 CONTRACT STRATEGY

The contracting strategy for the project involved Engineering and Procurement scope which was completed in-house at OPG, with Construction portion completed by the vendor per ES MSA [1] & COIR [2].

2.1 SCOPE OF WORK

The scope of work for the project is NK38-SOW-71110-10003: DN- U3/U4 CCW and U1/U2 LPSW Travelling Screens Replacement. The scope of work involved the replacement of 24 CCW travelling screens & 8 LPSW travelling screens in the Darlington Pump House.

2.2 EXECUTION PHASE

The execution scope released to the vendor for replacing each screen across all units is as follows:

1. Removal of the existing screen. All components for the screen will be replaced except for the anchors and guideways (the vertical, metal channel imbedded into the concrete walls of the CCW pit.) that will be reused.

2. Clean the screen pit and the guideways of any debris.

3. Inspect the concrete walls and the floor in and around the CCW pit. Repair concrete if required.

4. Inspect the existing anchor bolts. Repair/replace anchor bolts if required.

5. Install the new travelling screen in screen pit.

6. Support post installation inspections and function testing with the vendor's field representative.

3.0 RESULTS

The results of the assessment was a reduction of the maintenance costs, reduction in the number of failures due to a travelling screen malfunction, removal of Margin Management #35 on U1 and U2 of the CCW System, & restoration of the travelling screen operation back to the original design basis.

3.1.1 Reduction of the Maintenance Costs

The operation and maintenance costs were significantly reduced by the new travelling screen which is equipped with self tensioning system requiring adjustment/inspection once per year, no hydraulic jacking pumps are required. Also, the head shaft bearing is a new non lube type Thordon bearing which eliminates lubrication requirements every 8 weeks.

3.1.2 Reduction in the number of functional failures due to travelling screen malfunction

There was no functional failures due to travelling screen operation since the first installation in 2014.

3.1.3 Remove Margin Management Issue #35 on U1 and U2 of the CCW system

Margin Management issue has been removed.

3.1.4 Restore travelling screen operation back to the Design basis

New screens and their operation align with all of the station design basis.

4.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Site Management and Project Team Organization Map			
Exec Sponsor (Minimum Stratum V)	Name: Brian Duncan Title: SVP, Darlington		
Exec Representatives (Minimum Stratum IV Department Manager)	**Project Sponsor**	Name: Jeff Lehman Title: Director, Station Engineering Darlington	
	Project Executing Organization	Name: Dragan Popovic Title: Project Director	
	Site Accepting Organization	Name: Steve Gregoris Title: : Director, Operations and Maintenance Darlington	
	Site Design Authority	Name: Jason Wight Title: Senior Manager, Plant Design Darlington	
Site or Division Representatives (as applicable, minimum Stratum III)	**DNGS**	Name: Brett Weir Title: Senior Technical Engineer/Officer	
Oversight/ Approval Committees		**Title (s):**	
		Jeff Lehman	Engineering Director
		Brian Duncan	SVP, Darlington Station
		Glenn Jager	CNO
Project Team	**Project Manager:** Brian Graham	**Project Leader Name:** Sam Salama	
	Modification Team Leader: Sam Salama	**Design Team Leader:** Steve Sylvestre	
	Contract Administrator: Chuck Glover	**Field Engineering Representative:** Al Cleland	
	Cost and Schedule Analyst: Rob Conacher	**Other (Specify):**	
Contractor Contacts	**Role:**	**Name:**	
	Project Manager , B&M	Rick Crough	
	General Foreman	Jorge Capucho	
Other Stakeholders	**Organization:**	**Name:**	
	Maintenance-	Frank Batty	
	Operations	Jasvinder Segu	
	Work Control	Dave Guernsey	

5.0 LESSONS LEARNED

Key lessons learned for the project include ensuring the gantry cranes are operable prior to the start of installation, FME procedure to be followed while executing work on the travelling screen, & ensuring the work on the LPSW travelling screen replacement is not limited to the LPSW pumps outage

5.1 Lessons Learned# 1: Ensure the gantry crane are operable before start of installation.

5.1.1 Background

The CCW and LPSW travelling screen are large and heavy equipment. They are located in the pump house at Darlington station. Overhauling or replacing the travelling screens depends heavily on the hoisting/lifting equipment (gantry crane). There are two gantry cranes in DNGS, west-side crane for servicing Units 1/2 pump house, while the eastside crane is for servicing Units 3/4 pump house. Projects execution was mainly relying on the gantry crane availability for assembling screen subassemblies outside of the pump house as well as removing old screen and installing the new one. However, the gantry crane was unreliable for carrying heavy load & for working longer hours to meet the demands of the project. In the beginning of the screen installation on Unit 1 - CCW Screens 5&6, the gantry crane was out of service multiples times and for a longer window until it was put back in service.

Due to gantry crane being inoperable, the project was unable to proceed with the CCW screen replacement as scheduled. This resulted in a significant impact to the project schedule and cost. Furthermore, other work groups (IMS/ MM) needed the gantry crane to preform other related maintenance activities, but due to the unavailability of the crane, it was difficult to prioritize the work.

5.1.2 Recommendation

Review the capability and reliability of the existing gantry cranes prior to future use. Look for an alternative crane to be used for the work in the pump house during the unavailability of the gantry crane. Arrange work in the pump house to avoid any interference between other working groups.

5.2 Lessons Learned# 2: Ensure FME procedure is followed while executing work on the traveling screen

5.2.1 Background

FME breach occurred while performing final testing on LPSW Travelling Screen SC2. Using past practice, workers installed anti rotation device (tooling/pipe) to each side of screen, tooling was inserted through the chain and chocked against the sprocket gears to prevent its movement. Worker installed tooling to one side of screen, ensuring device was tethered and tied-off to handrail. While attempting to install second piece of tooling

on the opposite side, the first tool broke free from its tether/tape and fell into the travelling screen pit. Although, an acceptable method of tethering (use of tape) was employed to secure the tooling, this incident resulted due to insufficient inspection (integrity check).

5.2.2 Recommendation

Conduct the field walk-down to review FME, & add steps in the ITP for FME verification. Utilize the two minute job site drills to identify hazards and mitigate them.

5.3 Lessons Learned# 3: Ensure work on LPSW travelling screen replacement is not limited to the LPSW pumps outage

5.3.1 Background

The installation of the fist two LPSW traveling screen were originally scheduled to be replaced in parallel in D1531 and during the LPSW pumps outage. Due to the re-scheduling of LPSW pump house, it caused significant impact to the project schedule and cost. In addition, due to the limited window of the LPSW outage, project had to increase resources to complete the project with-in the execution window.

5.3.2 Recommendation

Ensure adequate review of the execution schedule by the relevant stakeholders (i.e. work control, operations, maintenance, etc.). During execution, it was identified that the replacement of LPSW travelling screen can be done in series while the LPSW pump is in service.

5.4 SCRs Submitted to Document Events

All of the SCRs are documented in Appendix A

5.5 Action Requests to Implement Changes

To implement changes, the following Action Requests (AR) have been inputted. AR # 28173718 was created to track and implement the changes.

6.0 COMMUNICATIONS PLAN FOR THE LESSONS LEARNED REPORT

Lessons Learned report will be issued and made available to the project team through Asset Suite.

7.0 CONCLUSION

Overall, the project was executed safely, timely, and under budget, meeting all of the scope from the project charter [3]. Project faced challenges around the gantry cranes, execution schedule & following appropriate FME procedures. The team correctly

documented these challenges via SCRs and these have been captured as part of the Lessons Learned report. Project was able to improve the system health condition to align it with the existing design basis, and meet the PIR requirements.

8.0 REFERENCES

Reference #	Document Name	Document #
[1]	Engineering, Procure and Construct Master Services Agreement	ES MSA
[2]	Contractor/Owner Interface Requirements For Nuclear	N-COI-00120-00001
[3]	Project Charter	NK38-PCH-71110-10001-R000

Appendix A: List of SCRs with their dispositions

No.	SCR #	Event Date	Title	Disposition
1	N-2018-23311	2018/11/05	16-31552 4-71110-SC5/SC6 Vendor post installation pre-op tasks carried into WW#45-Delay	D4
2	N-2018-22400	2018/10/24	Contractor Failed to Employ the Required Chemical Hazard Controls for Protection of Staff (Project# 31552)	D3
3	N-2018-21454	2018/10/10	Project-16-31552 CCW screen 5&6 replacement	D4
4	N-2018-18981	2018/09/06	PJ#16-31552 - Item previously available for purchase removed with no alternative means of purchasing	CO3
5	N-2018-06115	2018/03/14	16-31552 - Worker slipped on river rock covering unit 4 pumphouse supporting 4-71110-SC4	D3
6	N-2018-05797	2018/03/09	Project 16-31552 - Unit 4 CCW Travelling Screen SC5/SC6 replacement IPG planned work moved from 18WW08 to 19WW08 at T-1	D4
7	N-2018-03061	2018/02/06	U4 CCW Screen Replacement Project 16-31552: 034-76131-CR2 Failed during a lift leaving the load suspended.	NE0
8	N-2018-02491	2018/01/30	16-31552 Crane failed on CCW screen replacement project - Operator stuck in Crane	D4
9	N-2018-02147	2018/01/26	Project # 16-31552 U4 CCW; Lost/Missing Tool	D4
10	N-2018-01698	2018/01/22	Project #16-31552 U4 CCW Travelling Screeens Replacement Screens 3 & 4 - Gantry crane unavailable	D4
11	N-2018-01122	2018/01/16	Project #16-31552 U4 CCW Travelling Screeens Replacement Screens 3 & 4 - Gantry crane unavailable	D4
12	N-2017-28633	2017/12/10	PO# 261011-004 === 4-71110-SC1 Schedule delay Project # 16-31552	D4
13	N-2017-28304	2017/12/06	Trapped Comerant in north pit 4-71110-SC2; Replacement CCW Travelling Screen 16-31552	D4
14	N-2017-28076	2017/12/04	Project #16-31552 WO#2912633, 4-71110-SC1 damage to screen cover	D4
15	N-2017-27760	2017/11/30	16-31552: Unit 4 CCW Travelling Screens 1 and 2- Materials unavailable	D4
16	N-2017-27700	2017/11/30	16-31552: Broken hand switch on 4-67150-PL2081	D4
17	N-2017-27131	2017/11/23	Worker pinched finger supporting 4-71110-SC-1 WO# 2912633-18 CCW Screens Project#31552	D3
18	N-2017-22908	2017/10/05	16-31552: WO 2924463: Unit 2 - LPSW Traveling Screens project 2-72110-SC2	D4
19	N-2017-18826	2017/08/17	16-31552: Unit 2 LPSW Travelling Screen 2 _ Delay - DNRU2	D4
20	N-2017-18703	2017/08/16	16-31552: Unit 2 LPSW Travelling Screen 2 _ Delay - DNRU2	D4
21	N-2017-18609	2017/08/15	16-31552: Unit 2 LPSW Travelling Screen 2 _ Delay-DNRU2	D4
22	N-2017-18543	2017/08/14	16-31552: Unit 2 LPSW Travelling Screen 1 _ Delay-DNRU2	D4
23	N-2017-17774	2017/08/02	16-31552 Unit 2 LPSW Travelling Screen - WW30 Delays	D4

24	N-2017-16897	2017/07/20	American eel in trash bin in pump house 2 (Project 31552)	D4
25	N-2017-16896	2017/07/20	Project 16-31552 comissioning of new 2-72110-SC1 delayed	D4
26	N-2017-16794	2017/07/19	Project 16-31552 Comissioning of the new 2-72110-SC1 delayed	D4
27	N-2017-16714	2017/07/19	16-31552: Unit 2 LPSW Travelling Screen 1 _ Delay-DNRU2	D3
28	N-2017-16690	2017/07/18	Project 16-31552 Comissioning of the new 2-72110-SC1 delayed, electrical issues	D4
29	N-2017-16002	2017/07/10	Project # 16-31552 LPSW unit 2 travelling screen replacement missing material	D4
30	N-2017-15737	2017/07/05	Project 16-31552 LPSW SC1-Hard Hat fell into Fore Bay as a result of a Seagull Attack	D4
31	N-2017-14935	2017/06/23	Project 16-31552 LPSW SC1 Delay	D4
32	N-2017-09154	2017/04/17	Project # 31552, WO# 2917243, Work plan steps completed out of sequence.	D4
33	N-2017-09071	2017/04/15	LPSW SC1 WO#2917243 predecssor delay (Project 31552)	D4
34	N-2017-08172	2017/04/05	Electrical Procedural Non Compliance - Temporary Extension Cords without Approved Labeling or Markings from the ESA or CSA (Project 31552)	D3
35	N-2017-07624	2017/03/30	B&M Delay to LPSW Screen Replacement Project 31552	D4
36	N-2017-05981	2017/03/10	Project#31552 Repeat Event: Scaffold rescue beam placed out of service by others	D4
37	N-2017-05881	2017/03/09	OPG Project # 31552 ---- W.O.# 2912630-----FME incident on 3-71110-SC6	D3
38	N-2017-03721	2017/02/13	Project # 16-31552 U3 CCW 3-71110-SC5/6	D4
39	N-2017-03356	2017/02/09	Project # 16-31552 U3 CCW 3-71110-SC5/6 Permitry delay	D4
40	N-2017-03236	2017/02/08	Project # 16-31552 U3 CCW 3-71110-SC5/6 Permitry delay	D4
41	N-2017-03124	2017/02/07	Project # 16-31552 U3 CCW 3-71110-SC5/6 Permitry delay	D4
42	N-2017-02002	2017/01/25	Project 16-31552. Missing tools.	D4
43	N-2017-01995	2017/01/25	Project 16-31552. Missing tools.	D4
44	N-2017-01272	2017/01/17	16-31552 Delay of the Workplans Review for LPSW Travelling Screens on Unit 2- DNRU2	D4
45	N-2017-00290	2017/01/06	B&M Project 16-31552. Weather delay to CCW Travelling Screen replacement	D4
46	N-2017-00202	2017/01/05	B&M Project 16-31552. Weather delay to CCW Travelling Screen replacement	D4
47	N-2016-31461	2016/12/20	Project # 16-31552 U3 CCW 3-71110-SC3/4 Unable to perform hoisting activities.	D4
48	N-2016-31002	2016/12/15	Project # 16-31552 U1 CCW 3-71110-SC3/4. Broken overhead door.	D4
49	N-2016-29134	2016/11/23	16-31552 Incorrect Travelling Screen Logic showed U3 CCW P2 and P3 being shut down at same time	D4

50	N-2016-28097	2016/11/11	16-31552, Travelling Screens Replacement - Expired material issued by stores	D4
51	N-2016-26120	2016/10/21	16-31552 delay of issuance the Workplans for LPSW travelling screens on unit 2- DNRU2	D4
52	N-2016-25862	2016/10/18	16-31552 delay of issuance the Workplans for CCW travelling screens on unit 3	D4
53	N-2016-19544	2016/08/03	16-31552 Cid 999079 has not been set up for Darlington station , caused delay to demand	D4
54	N-2016-16024	2016/06/16	Delay to travelling Screen replacement 4-72110-SC1, project 16-31552	D4
55	N-2016-14941	2016/06/03	Project 16-31552. Delay to U4 LPSW Travelling Screen Replacement.	D4
56	N-2016-14869	2016/06/02	LPSW Travelling screen replacement Project#31552 WO#2917206	D4
57	N-2016-14648	2016/06/01	Project 16-31552. Delay to U4 LPSW Travelling Screen Replacement.	D4
58	N-2016-14242	2016/05/27	Project 16-31552. Delay to U4 LPSW Travelling Screen Replacement.	D4
59	N-2016-13488	2016/05/19	U4 LPSW Screen Replacement Project#31552 Delay	D4
60	N-2016-12637	2016/05/11	Project 16-31552 LPSW SC2-discovered concrete damage in screen pit	D4
61	N-2016-12544	2016/05/11	LPSW project#16-31552 unit 4 travelling screen delay	D4
62	N-2016-12510	2016/05/10	Project 16-31552 LPSW SC2-discovered concrete damage in screen pit	D4
63	N-2016-12378	2016/05/09	Project 16-31552 LPSW SC2-crane broke down	D4
64	N-2016-12279	2016/05/09	Project 16-31552 LPSW SC2-crane delay	D4
65	N-2016-12220	2016/05/08	Project 16-31552 LPSW SC2-crane delay	D4
66	N-2016-12152	2016/05/07	LPSW project#16-31552 Unit 4 SC2 WO# 2917214	D4
67	N-2016-11976	2016/05/05	Project #16-31552 U4 LPSW SC 2 Travelling Screeens Replacement-Permit delay	D4
68	N-2016-11862	2016/05/04	Project 16-31552. Delay to U4 LPSW Travelling Screen Replacement.	D4
69	N-2016-11020	2016/04/27	Summary of Schedule Delays to Date - D-1641 LPSW Screens Project#31552	D4
70	N-2016-09650	2016/04/15	Project 16-31552. Delay to U4 LPSW Travelling Screen Replacement	D4
71	N-2016-08753	2016/04/06	LPSW Screens Replacement project#16-31552 Hurt finger	D3
72	N-2016-07363	2016/03/22	16-31552 Delay of AFS of CCW travelling screens, 2-71110-SC3/SC4 due to MV2 failure	D4
73	N-2016-06715	2016/03/15	Project # 16-31552 U2 CCW Sc 5 & 6 Traveling Screens- Schedule Delay	D4
74	N-2016-06454	2016/03/11	Delay to U2 CCW Travelling Screen replacement Project#16-31552	D4
75	N-2016-05470	2016/03/01	Project # 16-31552 U4 CCW,delay due to crane incident	D4

76	N-2016-04302	2016/02/17	Project # 16-31552 U2 CCW-Schedule delay	D4
77	N-2016-03700	2016/02/10	Project # 16-31552 U2 CCW-Schedule delay	D4
78	N-2016-03562	2016/02/09	Project # 16-31552 U2 CCW-Schedule delay	D4
79	N-2016-03058	2016/02/03	Project #16-31552 U2 CCW SC 5 & 6 Travelling Screeens Replacement-Schedule delay	D4
80	N-2016-02884	2016/02/02	Project # 16-31552 U2 CCW-Schedule delay	D4
81	N-2016-02819	2016/02/01	PO 250639-0001 Delay to U2 CCW Travel Screen Project. Project #31552	D4
82	N-2016-02276	2016/01/27	Project #16-31552 U2 CCW SC 5 & 6 Travelling Screeens Replacement-Material issues	D4
83	N-2016-01747	2016/01/21	Project # 16-31552 U2 CCW Sc 5 & 6 Traveling Screens- Schedule Delay for Diving Crew	D4
84	N-2016-01477	2016/01/19	Project # 16-31552 U2 CCW-incorrect material	D4
85	N-2016-01203	2016/01/16	Project # 16-31552 U2 CCW , worker inadvertently passed TLD through x-ray machine at the ASB security building. (Close Out SCR to D-2016-02806)	NE0
86	N-2016-01109	2016/01/15	PO# 250639-0001, WO# 2912624/2912615 Stack permit delay for Travel Screen replacement Project#31552	D4
87	N-2016-00362	2016/01/06	Project # 16-31552 U2 CCW Sc 5 & 6 Traveling Screens- Schedule Delay	D4
88	N-2016-00161	2016/01/05	Project # 16-31552 U2 CCW-Schedule delay	D4
89	N-2015-29892	2015/12/22	Project# 16-31552 U2 CCW Travelling Screens-Schedule Completion Delay	D4
90	N-2015-29886	2015/12/22	Project # 16-31552 U2 CCW-Schedule completion delay	D4
91	N-2015-29462	2015/12/16	Project# 16-31552 U2 CCW Travelling Screens - Delay due to chain pins not sent by vendor resulting instand by charge.	D4
92	N-2015-29313	2015/12/15	Project # 16-31552 U2 CCW Travelling Screen 2-72110-SC1 Seals plates Rubbing	D4
93	N-2015-29294	2015/12/15	Project # 16-31552 U2 CCW-Schedule - Delay - " Material Issues"	D4
94	N-2015-28399	2015/12/03	16-31552 Synopsis of LPSW Travelling Screen replacement 3-72110-SC1 Alignment Issue.	D4
95	N-2015-28384	2015/12/03	16-31552: Unit 3 LPSW Travelling Screen 1 - Standby Charges	D4
96	N-2015-28280	2015/12/02	16-31552: Unit 3 LPSW Travelling Screen 1-Delay	D4
97	N-2015-27961	2015/11/28	Project 16-31552 LPSW SC#1	D4
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99	N-2015-27765	2015/11/26	16-31552: Unit 3 LPSW Travelling Screen 1_delay	D4
100	N-2015-27742	2015/11/26	16-31552: Unit 3 LPSW Travelling Screen 1_delay	D4
101	N-2015-27701	2015/11/26	Project 16-31552 LPSW SC#1	D4

102	N-2015-25291	2015/10/30	Travelling Screens Replacement: 3-72110-SC2 FME failure (Project#16-31552)	D4
103	N-2015-24527	2015/10/23	Project # 16-31552 Delay of issuance MMPs as per AR 28173718-01	D4
104	N-2015-24375	2015/10/22	16-31552: Unit 3 LPSW Travelling Screens - Delay	D4
105	N-2015-16514	2015/07/20	D2O Project #31552 - Lack of Communication for Outgoing Shipment	D4
106	N-2015-15345	2015/07/03	Project # 16-31552 - CTP Submittal Delay by Vendor for CCW Travelling Screen Replacement Project	D4
107	N-2015-14922	2015/06/26	Weather conditions cause delay in installation Project # 16-31552	D4
108	N-2015-14919	2015/06/26	Weather conditions cause delay in installation 16-31552	D4
109	N-2015-14775	2015/06/25	Project # 16-31552 U1 CCW , Worker hurts leg	D4
110	N-2015-11252	2015/05/16	Project # 16-31552 U1 CCW-unable to open man door	D4
111	N-2015-10939	2015/05/13	Project # 16-31552 U1 CCW 1-71110-SC#1 and 2 Added scope (Cutting shim and bolts)	D4
112	N-2015-10936	2015/05/12	Project # 16-31552 U1 CCW 1-71110-SC#1 Missaligned bolt holes	D4
113	N-2015-10809	2015/05/11	Project # 16-31552 U1 CCW 1-71110-SC#1 and 2 Added scope (wrong bolts)	D4
114	N-2015-10578	2015/05/08	Minor coolant spill from forklift - CCW Screen Replacement Project#16-31552	D4
115	N-2015-09978	2015/05/01	Project # 16-31552 U1 CCW 1-71110-SC3,SC4 Damaged equipment	D4
116	N-2015-09434	2015/04/24	Project # 16-31552 U1 CCW 1-71110-SC3, Challenge to project	D4
117	N-2015-09412	2015/04/24	Project # 16-31552 U1 1-71110-SC3&4- Equipment gone missing.	D4
118	N-2015-09133	2015/04/21	Project # 16-31552 U1 1-71110-SC3&4 Delay due to gantry crane break down - CCW Screen Replacement.	D4
119	N-2015-08643	2015/04/15	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due unit 2 shut down	D4
120	N-2015-08557	2015/04/14	Work stopped due to unit 2 transiant (Project # 16-31552)	D4
121	N-2015-08537	2015/04/14	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to Gantry crane break down	D4
122	N-2015-08452	2015/04/13	U1 CCW 1-71110-SC3/4 Crane Unavailablity Due to Crane Repairs Required (Project # 16-31552)	D4
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126	N-2015-08209	2015/04/09	U1 CCW 1-71110-SC3/4 Crane Unavailablity Due to Crane Repairs Required (Project # 16-31552)	D4
127	N-2015-08093	2015/04/08	U1 CCW 1-71110-SC3/4 Crane Unavailablity Due to Crane Repairs Required (Project # 16-31552)	D4

128	N-2015-07988	2015/04/07	U1 CCW 1-71110-SC3/4 Crane Unavailablity Due to Crane Repairs Required (Project # 16-31552)	D4
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131	N-2015-07720	2015/04/01	U1 CCW 1-71110-SC3/4 Crane Unavailablity Due to Crane Repairs Required (Project # 16-31552)	D4
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136	N-2015-07290	2015/03/26	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
137	N-2015-07177	2015/03/25	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
138	N-2015-07084	2015/03/24	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
139	N-2015-06980	2015/03/23	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
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143	N-2015-06524	2015/03/17	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
144	N-2015-06404	2015/03/16	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
145	N-2015-06337	2015/03/16	Project # 16-31552 U1 1-71110-SC3&4 Delay due to gantry crane break down.	D4
146	N-2015-06262	2015/03/13	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
147	N-2015-06176	2015/03/12	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
148	N-2015-06033	2015/03/11	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
149	N-2015-05917	2015/03/10	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
150	N-2015-05808	2015/03/09	Project # 16-31552 U1 CCW 1-71110-SC3/4 Wrong bolts supplied from vender	D4
151	N-2015-05807	2015/03/09	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
152	N-2015-05736	2015/03/09	Project # 16-31552 U1 CCW 1-71110-SC3&4 Delay due to gantry crane break down	D4
153	N-2015-05670	2015/03/06	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4

154	N-2015-05538	2015/03/05	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
155	N-2015-05425	2015/03/04	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
156	N-2015-05307	2015/03/03	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
157	N-2015-05151	2015/03/02	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
158	N-2015-05101	2015/03/02	Project # 16-31552 U1 CCW 1-71110-SC3&4 Delay due to Gantry Crane break down	D4
159	N-2015-04975	2015/02/27	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
160	N-2015-04878	2015/02/26	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
161	N-2015-04877	2015/02/26	Project # 16-31552 U1 CCW 1-71110-SC3/4 gearbox seal	D4
162	N-2015-04744	2015/02/25	Project # 16-31552 U1 CCW 1-71110-SC3/4 No crane	D4
163	N-2015-04585	2015/02/24	Project # 16-31552 U1 CCW 1-71110-SC3/4 Bolt hole issue	D4
164	N-2015-04463	2015/02/23	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to RA-95(cold weather)	D4
165	N-2015-04287	2015/02/20	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to RA-95(cold weather)	D4
166	N-2015-04247	2015/02/20	Project #16-31552 U1 CCW 1-71110, Delay due to RE-95 (cold weather)	D4
167	N-2015-04239	2015/02/20	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to RA-95(cold weather)	D4
168	N-2015-04170	2015/02/20	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to Gantry crane break down	D4
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170	N-2015-04038	2015/02/18	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to Gantry crane break down	D4
171	N-2015-03909	2015/02/17	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to Gantry crane break down	D4
172	N-2015-03672	2015/02/13	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to Gantry crane break down	D4
173	N-2015-03576	2015/02/13	Project # 16-31552 U1 CCW 1-71110-SC3/4-new screens/alignment issues	D4
174	N-2015-03574	2015/02/13	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to Gantry crane break down	D4
175	N-2015-03557	2015/02/12	Grantry Crane Acting up again Project # 16-31552 CCW Traveling Screen Replacement	D4
176	N-2015-03446	2015/02/12	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to Gantry crane break down	D4
177	N-2015-03196	2015/02/09	Gantry Crane Making Strange Noises Project Number 16-31552 CCW Traveling Screens Replacement	D4
178	N-2015-03161	2015/02/09	Permitry delay to U1 screen motor #3 & 4 Mcc tie in. WO# 2912598-04 & 2912599-04/ CCW Screens Proj.#16-31552	D4
179	N-2015-03032	2015/02/07	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to Gantry crane break down	D4

180	N-2015-02997	2015/02/06	Project # 16-31552 U1 CCW 1-71110-SC3/4	D4
181	N-2015-02939	2015/02/06	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to Gantry crane break down	D4
182	N-2015-02794	2015/02/05	Project # 16-31552 U1 CCW 1-71110-SC3/4	D4
183	N-2015-02793	2015/02/05	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to Gantry crane break down	D4
184	N-2015-02693	2015/02/04	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to Gantry crane break down	D4
185	N-2015-02576	2015/02/03	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to Gantry crane break down	D4
186	N-2015-02466	2015/02/02	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to Gantry crane break down/weather	D4
187	N-2015-02330	2015/01/30	Project # 16-31552 U1 CCW 1-71110-SC3/4 Delay due to Gantry crane break down	D4
188	N-2015-01995	2015/01/27	Project # 16-31552 U1 CCW-P3 Delay due to vibration readings which prevented roof hatch removal.	D4
189	N-2015-01903	2015/01/26	Project # 16-31552 U1 CCW 1-71110-SC3/4 Cold weather preventing roof hatch to be removed	D4
190	N-2015-01901	2015/01/26	Project # 16-31552 U1 CCW 1-71110-SC4 : Ladder contacted and broke electrical switch at local control panel.	D4
191	N-2015-01708	2015/01/23	Project # 16-31552 U1 CCW 1-71110-SC3/4 VENDOR SUPPLIED INCORRECT PARTS	D4
192	N-2015-01606	2015/01/22	Project 14-5114 OPG 16-31552 U3 Travelling Screen Replacement - Electrical power cables to short to meet new motor location	D4
193	N-2015-01602	2015/01/22	Project 14-5114 OPG 16-31552 U3 Travelling Screen Replacement - EPSCA/Chestnut Park Conflict	D4
194	N-2015-01373	2015/01/20	Project 16-31552 Pumphouse 1 delay due to Gantry crane accident(N-2015-01254)	D4
195	N-2015-01254	2015/01/19	Project 16-31552 Pumphouse 1 gantry crane made contact with an ERT vehicle.	CO3
196	N-2015-00949	2015/01/15	Project # 16-31552 U1 CCW 1-71110-SC3/4 new screen material couldn't get through the exploranium	D4
197	N-2015-00489	2015/01/09	Hard hat blown off workers head and lands in Forebay. CCW Screen Replacement Project#16-31552	D3
198	N-2015-00437	2015/01/08	CCW Pump House 1-PO#232721-0001- New gearbox supplied by vendor for SC5 has bearing seal damage. Project#16-31552	D4
199	N-2015-00430	2015/01/08	New Travelling Screen Motor #6 has abnormally high current readings - CCW Screen Replacement Project#16-31552	D4
200	N-2015-00141	2015/01/05	CCW Screen Replacement Pump House 1-PO#232721-0001-Gantry Crane unavailable because of ice build up on main drum Project#16-31552	D4
201	N-2014-35103	2014/12/24	Proj # 16-31552 U1 CCW 1-71110-SC5/6 Traveling Screen Replacement issues causing a delay in installation	D4
202	N-2014-34901	2014/12/19	CCW Pump House 1-PO#232721-0001-Contractor No Scheduled Scope Project # 16-31552	D4
203	N-2014-33841	2014/12/08	Project # 16-31552 U1 CCW 1-71110-SC5/6 traveling screen replacement issues causing a delay in installation	D4
204	N-2014-33727	2014/12/06	Original 600 volt power cables will not reach the new traveling screen motors. CCW Travelling Screens Project#16-31552	D4
205	N-2014-32960	2014/11/27	Project 16-31552 CCW travel screens concrete cracked while removing existing anchors	D4

206	N-2014-32447	2014/11/22	Ministry Of Labour - Inspection of Diving Operations CCW Screen Replacement Project#16-31552	D4
207	N-2014-32420	2014/11/22	Lack of Lighting Conditions Not Addressed Poses Unsafe Working Conditions (Project #16-31552)	D4
208	N-2014-29639	2014/10/23	Project # 16-31552 -CCW Traveling Screen material receiving delay	D4
209	N-2014-25430	2014/09/09	Project # 16-31552 - EC 123416 Proposed Motor for the Travelling Screen does not meet NEMA desgn B. and might cause schedual delay	D4
210	N-2014-24286	2014/08/25	Project 16-31552 Changes to Scope Of Work	D4
211	N-2014-03541	2014/01/31	BCS Milestone Missed for Long Lead Material Contract Award- Project 16-31552	D4
212	N-2013-22235	2013/11/26	Labour Contract cannot be awarded due to lack of CPAA decision- Project 16-31552	D4
213	D-2018-04064	2018/02/16	U4 CCW Screen Replacement Project 16-31552: 034-76131-CR2 Failed during a lift leaving the load suspended.	D4
214	D-2017-05634	2017/03/07	Proj #16-31552 U3-CCW Screen Replacement Electrical Reconnect Delays	NE0
215	D-2017-02492	2017/01/30	Unit 3 CCW 16-31552 Contractor's TLD removed from rack	NE0
216	D-2016-11871	2016/05/04	D1641 Delay to WO#2915878 due to no vault access S.T.O.P. Project#31552	D4
217	D-2016-10719	2016/04/25	D1641 Delay to Project #16-31552 Unit 4 LPSW screen replacement	D4
218	D-2016-02806	2016/02/01	Project # 16-31552 U2 CCW , worker inadvertently passed TLD through x-ray machine at the ASB security building.	D4
219	D-2015-27921	2015/11/27	D1531 U3 LPSW Travelling screen alignment issues Project#31552	D4
220	D-2015-27810	2015/11/27	D1531 LPSW Travelling Screen Alignment issues Project#31552	NE0
221	D-2015-27144	2015/11/19	16-31552: Unit 3 LPSW Traveling Screen 1- Delay	D4
222	D-2015-26521	2015/11/12	D-1531 W/O# 2917267-30 LPSW Travelling screen, Concrete Curb Broke at SC1 Project#31552	D4
223	D-2015-25475	2015/11/02	Travelling Screens - LPSW Unit 3 SC2: FME Event - Project 16-31552 (W/O 2917261)	D4
224	D-2015-25457	2015/11/02	Load Not Adequately Secured - LPSW/CCW Screens Replacement Project#31552	D3
225	D-2015-08524	2015/04/14	GANTRY CRANE NOT AVAILABLE DUE TO REQUIRED REPAIRS. CCW Sreens Replacement PROJECT # 16-31552	D4
226	D-2015-06675	2015/03/19	Unit 3 LPSW Travelling screen replacement Gantry crane maint. Project#16-31552	D4
227	D-2015-04523	2015/02/24	VBO Outage schedule changed to Sept. 2015, PCA required to manage project requirements till new start dat\.Proj.#16-31552	D4
228	D-2015-01927	2015/01/27	Project # 16-31552 U1 CCW 1-71110-SC4 : Ladder contacted and broke electrical switch at local control panel.	D4
229	D-2015-00882	2015/01/14	Project #16-31552 U1 CCW 1-71110-SC 5/6 Added scope	D4
230	D-2015-00372	2015/01/08	Material Issues Causing Risk to Schedule - Project# 16-31552 - CCW Travelling Screens	D4
231	D-2014-34209	2014/12/11	Project 16-31552: Existing Checker Plate Trench Covers Were Found to be Corroded	D4

232	D-2014-32094	2014/11/19	PO-232721-001, U1 CCW TRAVELLING SCREENS-SAFETY ISSUE:NO HOISTING DUE TO HIGH WINDS Project#16-31552	D4
233	D-2014-31573	2014/11/13	PO-232721-001 Pump house 1 CCW Travelling Screen replacement-As-FoundProject#16-31552	D4

ONTARIO POWER GENERATION

Lessons Learned Report

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Revision: R000	

Title:
DARLINGTON NEW MAINTENANCE AND COMPUTER DEVELOPMENT FACILITY PROJECT 16-31717

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DARLINGTON NEW MAINTENANCE AND COMPUTER DEVELOPMENT FACILITY PROJECT 16-31717

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Revision Summary

Revision Number	Date	Comments
R000	04-Dec-2014	Initial Issue.

1.0 BACKGROUND

The project was a Design-Build EPC contract to provide a new Maintenance and Computer Development Facility (Facility hereafter) at Darlington Nuclear Generating Station. The Facility consists of maintenance workshops, mock up and training areas, computer development and test laboratories, offices, conference rooms, a lunch room and supporting amenities.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The Contractor's (Aecon) scope of work included the engineering, procurement, and construction of the Facility, including detailed design, site preparation, procurement of materials, construction, commissioning and close-out.

The project was released in two phases as follows:

Phase 1: Site preparation, detail engineering, specification and ordering of long lead material and equipment.

Phase 2: Procurement, construction, commissioning and turnover to OPG.

3.0 LESSONS LEARNED

3.1 Bidding and Subcontracts

Ensure that all subcontractors are prequalified, and subcontracts are in place prior to commencement of work on site.

Ensure that Prime Contractor requirements are thoroughly understood before putting together a project schedule, bid, staffing and subcontractors.

Ensure that an exhaustive survey of site conditions is conducted.

Ensure that all quotations received are thoroughly reviewed.

Ensure that the base line schedule is signed off by the client prior to commencement of work.

Ensure that notification is provided to consultants regarding any deviations of site conditions prior to commencement of work.

Ensure that all additional costs pertaining to OPG scope changes are approved by OPG prior to ordering materials and the commencement of work.

Shop drawing review comments from consultants and Prime Contractor must be incorporated into one set of shop drawings to avoid any confusion to sub-trades.

Ensure that parameters and expectations for what documents require OPG control document numbers are established.

Create an OPG building requirements or Design Manual including all requirements and specifics if inside or outside the Protected Area. This will improve all future building projects.

Include for a cellular distributed antenna system.

Establish OPG IT requirements up front and include them in the RFP.

Ensure that subcontractors are held accountable for committed dates with contract schedule, etc.

Ensure that the Contractor follows work plan step sequences.

Ensure that proper clarification is provided to the contractor regarding equipment tagging requirements. Equipment tagging should be established on construction drawings prior to the start of field work.

Ensure that at the RFP stage, specialized software's required by the design team for submittal of documents are identified (e.g. electrical software).

3.1.1 Related SCRs (Refer to Appendix A: SCR Summary)

- D-2008-08863
- D-2009-00309
- D-2013-16492
- N-2013-18405

3.2 3.0.2 Quality Control

Anchor bolt and wall plate installation must be checked against the survey reports daily. Rework is costly and may cause schedule delays.

Ensure that non-destructive testing of structural steel is done at the fabrication shop and not in the field. Magnetic particle and ultrasonic testing takes longer to complete in the field. Additionally, if a repair is required, it is more difficult to complete the repair in the field.

Designer of record oversight reports should be reviewed and addressed as a team weekly. This will result in having issues identified and addressed in a timely manner.

Ensure that quality personnel coordinate all third party inspections (geotechnical, concrete, structural). This will ensure all contractual, code, and specification requirements are met.

Increase surveillance and oversight of sub-contractors providing critical components, material or services. This will ensure the sub-contractors obligations are being met and will allow for intervention if it becomes clear that the sub-contractors do not understand the scope of work.

Improved upfront quality training for Prime Contractor personnel to ensure all personnel involved are familiar with OPG nuclear requirements including OPG permit and work protection procedures.

Pay special attention to winter concrete and establish upfront parameters for dealing with concrete quality issues including surface appearance.

Communication tie-ins (e.g. fiber optics), should be conducted only by vendor and not share with OPG resources to eliminate liability on OPG if any issues arise.

3.2.1 Related SCRs (Refer to Appendix A: SCR Summary)

- D-2008-13200

3.3 Staffing

In addition to the project manager, coordinator, superintendent, the following project staff is recommended, depending on contract amount:

- QA/QC to administer quality control right from the start.
- Safety Manager.
- M/E coordinator starting at building enclosure, at design development stage and commissioning.
- Additional coordinator towards project turnover to assist with documentation and close out.
- Shop drawing clerk to administer the shop drawing phase.
- Administrator to handle security clearances.

Set expectations of design field support as port of the contract.

3.3.1 Related SCRs (Refer to Appendix A: SCR Summary)

- N/A

3.4 Site Specifics

Allocate costs for full "identification scanning" of all existing buried services. OPG was not able to provide accurate "as-builts".

Establish required temporary site by-passes; pedestrian traffic, services and site access.

Establish with OPG, the supply of all the required services during construction; temporary electrical, water and sewers.

Allow for Hydro-Vac excavation of full building perimeter, and drilling of caissons.

Allow for full layout service to establish, maintain, and document all building layout points and grids including complete "as built "site surveys.

Establish Client parameters for security clearance for long term and short term workers.

Better prepare for "Mark up Meetings" based on the EPSCA requirements and ensure attendance by representatives of all trades.

Ensure all trades are unionized and that they fully understand the EPSCA agreements pertaining to their work.

Improve on project pre-planning activities with Prime Contractor personnel on project quality requirements and expectations.

Improve on communications with sub-contractors on project quality requirements and expectations.

Regarding resilient flooring and epoxy flooring on slab on grade, review concrete mixes and allowable humidity levels of concrete. Ask sub-trade to carry separate price for moisture barrier.

Improve on timely communications and resolutions with Client on project quality issues. Track issue age on all issues list.

3.4.1 Related SCRs (Refer to Appendix A: SCR Summary)

- D-2008-09773

3.5 Building Code Issues

For design/build project, ensure that the Consultant has a code consultant on their team to ensure compliance.

Ensure familiarity with building code requirements for washroom vanity heights, stairwell dimensions and site specific equipment such as dust collectors, paint booth, transformers, etc.

Establish early relationships with "Authorities Having Jurisdiction"; such as building inspection, fire department, ESA, TSSA, etc.

Establish NEF OPEX-based requirements (e.g. entrance floor grating).

Minimize landscaping.

Office space size/layout should be designed with OPG furniture standards in mind from the very beginning of design.

All LAN cables should be from ceiling drops and not in the walls wherever possible, allowing for flexibility.

Ensure that as-built submittals are better coordinated between the sub-contractors and the design agency. Clear understanding and review by OPG is required. Too many parties were involved with no clear direction in the end.

OPG to outline preference for transformer type (dry versus oil filled) based on the size as part of RFP including containment requirements for oil type transformers, site specific.

Meetings with stakeholders after project award resulted in multiple changes and in particular to electrical including the size of the transformer.

OPG Environmental group should be engaged in the project from the beginning and throughout the design for approval of environmental related issues (e.g. bird screening, bird strike prevention, transformer containment etc.). Although they were involved initially, they weren't engaged until later when design was complete which resulted in late changes.

3.5.1 Related SCRs (Refer to Appendix A: SCR Summary)

- D-2014-13436
- D-2014-23975

3.6 Warranty Work post-AFS (Available for Service)

Establish procedures and guidelines with OPG to allow sub-contractors to access building after AFS to carry out warranty work. Work Protection and training requirements made this process very difficult and time consuming.

The initial scope of work for the project identified an option price for maintenance of the Facility for a minimum duration of five years. This option was not taken by OPG but it would have possibly resolved many ongoing access problems for warranty work.

3.6.1 Related SCRs (Refer to Appendix A: SCR Summary)

- D-2009-05764

3.7 Internal Communication

Establish a team working environment within OPG and ensure that communication is kept constant between OPG departments and stakeholders.

3.7.1 Related SCRs

- D-2008-08866
- D-2008-08872
- D-2009-07904

4.0 LESSON LEARNED SUMMARY

- Tighten up procedures for pre-qualifying and awarding subcontracts
- Understand Prime Contract requirements.
- Conduct an exhaustive survey of site conditions. This includes foundation and geological conditions.
- Ensure that the base line schedule is signed off by the client.
- Establish parameters for what documents require OPG control document numbers.
- Establish tagging requirements of equipment devices.
- Identify at the RFP stage design team requirements for submittal of documents.
- Quality control personnel should coordinate all third party inspections (geotechnical, foundations, etc.).
- Project must be staffed properly with personnel that are experienced with OPG nuclear procedures.
- Allow for Hydro-Vac excavation/daylighting.
- Establish parameters for security clearance for long term and short term workers.
- For design/build project, ensure design consultant has code consultant to ensure compliance.
- Become familiar with building code requirements for washroom vanity heights, stairwell dimensions, dust collectors and paint booth.
- Establish early relationships with "Authorities Having Jurisdiction"; such as building inspection, fire department, ESA, TSSA, etc.
- Improve as-built submittals between the sub-contractors and design agency.
- Implement early meetings with stakeholders after project award to limit late scope changes.
- Establish procedures and guidelines to allow access after AFS to carry out deficiencies and warranty work.
- Ensure that stakeholder and design requirements are identified prior to the award of the contract. This includes larger cranes, specialized rooms and services, etc. Freeze scope.
- Ensure environmental requirements are identified early. This includes endangered species, bird film on windows and doors, etc.
- Ensure power supply requirements are appropriate and an applicable transformer is chosen.
- Ensure there is an extensive review process of design, field changes, installation, and as-built documents, and their associated findings.
- Establish effective communication and team work between OPG departments.

5.0 SCRS SUBMITTED TO DOCUMENT EVENTS

For SCRs submitted to document events summary, refer to Appendix A: SCR Summary.

6.0 OPEX REVIEW FINDINGS

N/A

7.0 ACTION REQUESTS TO IMPLEMENT CHANGES

There were no Action Requests to implement changes.

8.0 COMMUNICATIONS PLAN FOR THE LESSONS LEARNED REPORT

The Lessons Learned Report will be scanned into PassPort for future project OPEX.

9.0 CONCLUSIONS

This Lessons Learned Report highlights valuable OPEX gained from experiences over the course of the EPC contract between OPG and the Prime Contractor (Aecon). By documenting this Lessons Learned Report, future projects can utilize the information within this document in order to avoid and/or mitigate similar issues.

ONTARIOPOWER GENERATION

Lessons Learned Report

Internal Use Only	
Document Number: N-LLD-28270-10001	
Project Number: 16-31717	Project Execution Plan Number: NK38-PEP-28270-0438233
Revision: R000	

Title:
DARLINGTON NEW MAINTENANCE AND COMPUTER DEVELOPMENT FACILITY PROJECT 16-31717

Appendix A: SCR Summary

SCR #	Status	Title	Condition Description	Action Taken
D-2008-02589	CLOSED	Schedule Issue - Project 16-31717 DNGS PHA Demolition - Missed Project Milestone	Project 16-31717 DNGS Maintenance Facility missed the Preliminary Engineering Milestone (DES) of December 4, 2007. A recovery plan was agreed upon, and put in place for DNGS Project Design and the Design Agency with a DES completion date of December 21, 2007. Design Agency deliverables for this milestone were submitted to OPG on Dec 4th, 2007 (Design Plan) and the Dec 12th, 2007 (Modification Design Requirements) for initial review, however due to three separate review cycles for these documents, they were not approved until Feb 1st, 2008. The OPG deliverable for this milestone (Modification Outline) was submitted to the Design Authority on Dec 20th, 2007 for final approval; however this document remained with the DA over the holiday period, and was signed off on January 11th, 2008. The DES Milestone was completed on February 1st, 2008, 7 weeks late. The late submission of Design Agency deliverables combined with three separate reviews performed by OPG caused the delay for the approval of the MDR and DP. The MDR was reviewed multiple times due to a change in personnel in OPG Design. The Modification Outline was submitted late due to a resource issue in Projects Design which led to an excessive workload for the DTL. Approval for the MO was delayed due to late submission prior to the December holiday period. Project tracking of Project # 16-31717, DNGS Maintenance Facility Project - PHA demolition design contract	Issue was communicated to Project Manager.

D-2008-02591	CLOSED	Scope Issue - Project 16-31717 DNGS PHA Demolition - Addition to Project Scope	Project Sponsor has requested that the Site Security Change Room (Building 6) be included in the scope of the PHA Demolition portion of project 16-31717. The design agency has quoted an added cost of $9100 to the firm fixed price contract for this additional scope. The cost of decommissioning and demolition of Building 6 will be estimated based on OPEX and the conceptual estimate for the PHA demolition provided by ASandL during the conceptual study for this project (NK38-REP-28200-10001). At the time of the original PHA Design contract it was unknown that the electrical feed to building 6 was fed from the PHA. As building 6 was not in the footprint of the proposed new Maintenance Facility it was not included in the original project scope. During preliminary design the electrical feed to building 6 was found to be fed from the PHA. As the building is unoccupied and slated for future demolition it was approved by the sponsor to add it to the scope of this project instead of providing a new electrical feed to the building.	Informed the Project Manager and consulted with the sponsor to decide the most cost effective path forward.
D-2008-08863	CLOSED	Design Agency committed to providing a P3 schedule for May 29, and did not meet this date. Project #16-31717 Maintenance Facility Relocation of Burie	The Design Agency committed to providing a P3 schedule for the project kickoff meeting for the Maintenance Facility dated May 29. Upon arrival to this meeting, the Design Agency did not have their P3 schedule and committed to OPG personnel that they would provide a schedule during a walkdown scheduled for June 9th. A P3 schedule was then provided on June 9th to OPG projects however, OPG Design was not aware of the schedule until June 13th. Lack of attention to detail as well as a lack of organization and commitment. During the May 29th kickoff meeting.	OPG informed the Design Agency that they would stop work on this project until a P3 schedule has been provided to OPG.

D-2008-08866	CLOSED	Projects agreed to a revised SOW and then changed their minds after the PO was issued. Project # 16-31717 Maintenance Facility RSTI	The existing SOW prepared by OPG Design Projects for the Maintenance Facility Relocation of Existing Buried Services and Tie-Ins was significantly missing information and did not have the necessary detail required for the project execution. During the bid process OPG Design requested to issue a new SOW that would be clear, concise and without conflicting or confusing information. Owing to time pressures and Milestone commitments from Projects, Projects agreed that a SOW could be issued after the PO to summarize the Scope into one complete document. However to avoid delays and missed Milestones Projects requested that a clarification of Scope is prepared and agreed upon by all parties and will become part of the contract documentation. The clarification document was prepared and accepted, and a new SOW was prepared as agreed upon. One month after the PO was issued OPG Projects decided that the new SOW is no longer required and gave specific direction that it is not to be issued without consulting OPG Design. Lack of team work from Projects. Great efforts from OPG Design proved to be wasted. During the Bid process	Informed OPG Design Section Manager and initiated SCR

D-2008-08867	CLOSED	OPG Projects did not send P3 schedule provided by the Design Agency to OPG Design. Project 16-31717 Maintenance Facility RSTI	The Design Agency provided a P3 schedule on June 9th to OPG projects however, OPG Design was not aware of the schedule until June 13th. OPG Design continually requested the P3 schedule and never received it. OPG Design was forced to provide direction to the Design Agency that work should not continue until a P3 schedule has been provided. OPG Projects then mentioned that the P3 schedule was provided to them on June 9th. OPG Projects claimed that the P3 schedule was sent to OPG Design on June 13th. The P3 schedule was not provided to OPG Design on June 13th. The P3 schedule was only provided to OPG Design on June 16th. Lack of a communication plan. At the kickoff meeting OPG Design specified that all design related issues/ deliverables should be provided by the Design Agency DTL to the OPG DTLs. The Design Agency Project Manager provided the P3 design schedule to OPG MTL. OPG MTL did not forward the P3 schedule to OPG DTL and did not inform OPG DTL that they received the P3 schedule. Sending direction to Design Agency to stop work	OPG Design informed OPG Projects that the P3 schedule was still not provided on the date specified (June 13th). OPG Design met with OPG Projects to discuss the P3 schedule that was provided on June 16th. The P3 schedule was still lacking significant information and a face-to-face design meeting with the Design Agency will take place on June 18th to discuss the P3 schedule.
D-2008-08872	CLOSED	OPG Projects cancelled Value Engineering Workshop Proposal Presentation meeting on short notice due to the team being unprepared. Project 16-31717 Mai	OPG DTLs were working on the value engineering proposals for the Maintenance Facility Project. OPG DTLs requested additional time from OPG Projects in order to prepare a sound proposal and to be properly prepared for the presentations. OPG Projects would not agree to provide additional time and decided to carry out the meeting regardless. The day of the meeting was to take place, OPG DTLs met with OPG Projects and it was evident that no one was prepared for this proposal presentation. OPG Projects had no choice but to cancel the meeting. Insufficient amount of time provided to prepare a good quality proposal Lack of organization from OPG Projects. Preparing for Value Engineering Workshop Proposal Presentation.	OPG DTLs informed OPG Projects that additional time is required to meet with the proper stakeholders and to obtain the required input. OPG DTLs met with OPG Projects to discuss the proposals and path forward.

D-2008-08876	CLOSED	Level P3 Schedule provided by Design Agency is significantly missing information and is still listed as a P2 schedule. Project 16-31717 Maintenance Fa	The Design Agency committed to providing a P3 schedule for the project kickoff meeting for the Maintenance Facility dated May 29. A P3 schedule was then provided on June 9th to OPG projects however, OPG Design was not aware of the schedule until June 13th. Upon OPG Design reviewing the "Level P3 schedule", the title was still listed as Level P2. Furthermore, there were significant details missing, and the schedule provided did not meet the criteria of what is required for a P3 schedule as per the "Clarification" document that formed part of the contract. In addition it should be noted that the Design Agency incorrectly stated that the P3 schedule is not a deliverable as per SLN contract for the Maintenance Facility Relocation of Buried Services and Tie-Ins Project. Lack of attention to detail as well as a lack of organization and commitment. Lack of Knowledge from the Design Agency with respect to preparing a Level P3 engineering design schedule. Design Agency did not request assistance from OPG Design to help prepare a proper Level P3 schedule. Review of the "Level P3 schedule".	OPG DTL's set up a face-to-face Design meeting with the Design Agency to discuss the Level P3 schedule that was submitted.

D-2008-09773	CLOSED	Scope Changes as a result of Configuration Discrepancies - Project 16-31717	Scope changes totaling less than $k10 will be issued by the Demolition Contractor as a result of Design drawing differences to the as found field installed service components as follows: 1) Domestic Water supply 4" ductile iron line c/w 4" flanged valve aprox. 4' under the ANNEX above grade. This line branches off into three other lines. Two lines supplying the ANNEX,, one 2" copper and one 2" CS. The third line is also 2" copper running aprox. 20' to the South and then aprox. 20" to the West, then continues below grade which supplies the existing CCR. and an Air conditioner in U-4 on the 107.500el East end in the valve shop. All three lines have individual isolation, via a 2" copper valve, just down stream of 4" cast flanged valve. The supply to the PHA wil be removed during the demolition phase however, the remaining supply points are required to remain in service. 2) Discovered a 1" Instrument Air line (no drawings) which provides service from the 7512-L101-A3ATB header at valve 0-75120-v2121 located in U4 to the PHA. 3) 4" PVC ground sewer line connected to the ERT trailer discovered above ground. Initial configuration walkdown and underground scanning exercise was performed during the winter season, in addition existing drawings were not updated prior to proceding with design changes. During Field verification of Final Design drawings, discrepancies between the EC Documentation and the actual installed service components became evident. These occurances will create a number of CCA's duing the execution phase of the project.	Informed the Project DTL and Design agency. Requested Field Engineering to provide dimensioned sketches and performed a walkdown with the DA representative which confirmed the findings. EC 98252 and 98258 to be revised and re-issued.

D-2008-09820	CLOSED	Schedule Delays in the Issue of Revised Design EC's - Project 16-31717 PHA Demolition	Promised dates for revising of Approved and Accepted Design EC's completed under Master EC 94443 by the Design Agency has not been met. Issue date for revised DEC's 98252, 98255, 98258 was 22 August 2008. Pending issue of revised EC98509 of 29 August 2008 is presently at risk. In summary DEC revisions were to correct discrepencies to drawings and DBOM's as follows: 1) Service piping on drawings do not match the Field configuration. 2) CatID's selected from Pickering. (not engineered for Darlington) 3) Incorrect Material specifications. 4) Unclear and missing details for construction of panels 5) Missing technical information. Inadequate performance of contract. During Project Management status update of revised Engineering Change packages	Informed OPG DTL , Design FLM, Design Agency representative and Projects FLM. Provided information and issue descriptions and sketches where applicable to the Design team for correction.
D-2008-11176	CLOSED	Deviation from Design EC (N-GUID-00700-10000) - Field Initiated Change Process - PHA Demolition Project 16-31717	Currently the process for Field Initiated Changes to a Design EC in N-GUID-00700-10000 Section 1.6.2 (c) and (d) specify that for non-intent changes the Design EC is to be revised within 2 days of a request. The process of revising an EC in Passport could be quite time consuming when taking into consideration all steps that are required. Some examples are drawings and/or BOMS marked-up; Cat IDs must be set to ready in order to approve the EC in Passport; all drawings and/or BOMs must be scanned in Passport prior to approval. Assessment and review of Design EC's in preparation for Execution in the field.	Informed all affected FLM's. A memorandum (NK38-CORR-28200-0265635) was writen to request approval and direction to use an alternative method to perform Field Initiated Changes (FIC) for Design Non-Intent changes pertaining to master EC94443.

D-2008-11277	CLOSED	Delays and missed preliminary engineering milestones for the DNGS Maintenance Facility RSTI Project # 16-31717	In relation to the delays and missed milestones encountered in the preparation and acceptance of the Preliminary Engineering package completion of the DNGS Maintenance Facility RSTI Project 16-31717, the following was found to be the extent of the Design Agency contribution to the issues: There were small Technical errors with respect to Mechanical and Electrical, however, numerous Editorial errors. Comments were first discussed in face-to-face design meeting where they were agreed upon however the majority were not incorporated. In some instances, there were more than anticipated and long drawn out face-to-face reviews than expected prior to the official CandD reviews (DP was reviewed 3 times and the MDR reviewed 2 times prior to the official CandD review). This process still did not aid in the official CandD review since the majority of the same comments found during the face-to face reviews were found in the officially submitted deliverables (the DP and MDR have extensive CandD commentary). Furthermore, when the CandDs were dispositioned the revised deliverables still had some outstanding issues concerning the incorporation of the dispositioned comments. This was dealt with via e-mail and attached to the official CandDs for record. Face-to-face reviews were also used for non-deliverables with respect to Project Design group acceptance but deliverables for the overall Design acceptance such as the Design Scoping Checklist and its associated forms. These also went through several iterations and face-to-face meetings before they were ready for acceptance. Unfamiliar with OPG governance Not incorporating CandD dispositions when required When they did not know, they did not inform OPG for assistance. Review of Preliminary Engineering deliverables	Coached Design Agency, overextended oversight and aided in completion of the package. These were all done with notification to the Section Manager, PDEES

D-2008-11905	CLOSED	Project 16-31717 PHA Demolition - Request to deviate from N-PROC-MA-0022	Current rejection of tasks for the Power House Annex and associated buildings demolition in the integrated on-line work schedule due to holds created when materials are requested because of discovery work is contributing to delays in the project meeting stakeholder milestone requirement of November 15, 2008 The project has experienced delays due to design discrepancies discovered during assessments and preparation for installation. That resulted in EC revisions and additional assessments. (Reference: SCR D-2008-09820) Due to the nature of the work, the project is requesting a deviation from governance in N-PROC-MA-0022 specifically Section 1.3.12 (Objectives by end of T-4) - All parts holds removed, primarily to provide some flexibility to deal with resolution of discovery issues in a timely and efficient method while maintaining IPG stability. The project work scope does not pose operability or reactor safety concerns neither is there a threat to station schedule and resource availability for other planned work. TZAMBAZV 2008/10/15 Project modification work is dynamic and often changes are required to maintain continuity. However, the IPG focus is on typical maintenance work which is often more defined and fixed. Monitoring progress of tasks associated with work orders # 1709007 and # 1712181 in addition to weekly schedule status review in relation to holds based on discovery work.	Informed FLM and Section Manager. Meeting was held with Work Control coordinator and project team to find a solution and path forward.
D-2008-13200	CLOSED	Inspection/receipt/acceptance of incorrect materials for Project 16-31717 PHA Demolition	Vendor shipped incorrect material (Catid 279672) instead of MR#1957694 for Catid 279331 (60 feet EMT 2" conduit - in 10 ft. lengths) for new the LAN line installation at the project office. The material was accepted in the East warehouse. It was discovered at the time of picking and staging to site that the material was incorrect. This created an unacceptable project delay. No visual inspection was performed upon receipt by OPG. Catid description attached to package was incorrect. While attempting to obtain materials delivery from the warehouse.	Informed FLM, FEE and contractor. Buyer was requested to facilitate the receipt of replacement materials from vendor. Scheduled work for the weekend was cancelled.

D-2008-13202	CLOSED	Contractor lack of resources - Delays in field execution for Project 16-31717 PHA Demolition	Previously committed resources by the contractor for completion of work during the weekend of November 08 and 09 were withdrawn on a short notice without the approval of the project leader. The situation has lead to major delays in completion of work for the PHA Demolition project. The project was previously billed for the training of four electrical trade personnel to complete work assigned, however resources were reassigned to other projects which were deemed to be high priority by the CMO. Unavailability and over extension of resources. Pre-planning for assigned work incomplete. Confirmation of additional resources to support weeked work which became necessary due to the fact that work could not be done in the building (project office) in normal working hours (Building in use)	Informed FLM and Contract Administrator. Also cancelled scheduled work of that weekend.
D-2008-14690	CLOSED	Required stakeholders missing at AFS meeting for EC98509 - Project 16-31717	Several required stakeholders were missing at the AFS meeting for the ESSB/Project Office LAN connection FMOD scheduled for 10:00am 16-DEC-2008. Required attendees were sent a meeting notice invitation one week prior to the meeting to give the required advance notice as per governance. Acceptances were received from the required stakeholders and no conflicts were identified. At the start of the AFS meeting several required stakeholders were not present. This forced the project team to cancel the AFS meeting at 10:20am. This could potentially increase the risk to discontinue in-service testing leaving the LAN service to the project office in-operable. Meeting attendees accepting meeting notices that conflict with their schedule, not communicating conflict with meeting organizer, or not sending delegates. Meeting started on time at 10:00am with several accepted attendees missing	Meeting organizer made several attempts to contact missing attendees but was not able to get their feedback. Present stakeholders were asked to wait 20 minutes for missing stakeholders until they were dismissed and the AFS meeting was cancelled. Contacted customer following meeting and recommended walking the AFS forms for signatures.

D-2009-00309	CLOSED	Human Performance-Procedural Adherence - Authorized Work plan step sequence not followed - Project 16-31717	Contractor did not follow work plan step sequence. Work plan steps to perform the demolishing activities of the PHA and associated buildings were misinterpreted following a team decision to use an alternate method to refurbish an adjoining wall of the main structure of the U4 power house, but the step to separate the PHA hallway from the Power house wall was to be done prior to demolition. If demolition tasks were allowed to continue the result would have placed undue stress on the main building wall. Contractor received feedback on a potential change during a project meeting. Formal documentation change (w/pl) was not made to authorize change in sequence. During daily project work task progress review and field walk down	CMO Administrator and the Contractor were contacted and the project initiated a corrective solution as per the authorized work plan. Also informed FLM and project leader
D-2009-00391	CLOSED	Project 16-31717 - Missed stakeholder requirement	Discovery issues during excavation in addition to severe weather conditions and the unavailability of key resources due to higher priority work caused delays to the PHA Demolition work. These delays have caused the project to miss one of the Maintenance Department objectives to have the PHA vacated space as a VBO lay down area available by November 15, 2008. Discovery issues and performing outdoor work during winter conditions and commitment of resources were not maintained, due to changing priorities on other high profile jobs. Project coordination and monitoring	Informed Section Manager and provided Stakeholders with new dates of December 18, 2008 and subsequently January 31, 2009. In addition weekly project status meetings included rigorous monitoring of scheduled tasks.

D-2009-01994	CLOSED	Project 16-31717 - AFS Delay due to Discovery work	Available for Service meeting for the PHA demolition phase scheduled for February 09, 2009 has been delayed due to late discovery issues of missing components on the existing structures needed to install the wall. This caused a hold to the contractor tasks to remove the temporary opening for the PHA annex corridor into the EFFA at the north-eastern wall and replace with original pre-cast concrete panel. Initially installed connection clips were removed when the temporary opening was installed, however no record of the change was found. Pre-installation planning and assessment of the work was inadequate. A revised date for the AFS meeting will be decided upon following completion of the pre-cast wall installation. Less than adequate pre-planning assessment and review of installation techniques. Project coordination and monitoring	Informed Section Manager and stakeholders. Design has been requested to review a field change to facilitate proper connection of the panel to the building supporting structure
D-2009-05764	CLOSED	Project 16-31717 Settlement / void around newly installed Lan Manhole	A sink hole was identified near a manhole and SCR # D-2009-04872 was initiated to document condition. Installation of new LAN conduit runs were completed (F-Mod) under project 16-31717 as a precursor to the demolition of the Powerhouse Annex. The F-Mod was AFS'd in Q4 2008. Because the project had completed the work recently, the warranty aspect came into question. The manhole cover was removed to attempt to understand the root cause of the settlement. Pictures were taken and it is evident that a ground wire was installed through one of the premanufactured openings. The seal was not sufficient around the ground wire and gravel was washed into the manhole creating the void under the pavement. The ground wire inside the manhole was not installed as per the drawing. The ground wire was suppose to be fastened to the walls by means of cable clips (DWG NK38-D4S-57600-0003-036). An investigation of documents referenced in the AFS package included the ITP for the installation. The landC ITP was signed off stating that the grounding was installed as per drawing. To be determined. Investigation of settlement/void causal factors.	Notified Field Engineering SM, requested an extent of condition evauluation. A total of two new manholes were installed and a third was modified during construction.

D-2009-07904	CLOSED	Mtce. Facility - Proj # 31717 - Original TCD missed for Conceptual Design Report	Initially the draft Conceptual Design Report was submitted for comments as per the Design Projects TCD. During the ongoing team review it was requested by Design Projects to elabreate on options and add comprehensive table to identify gaps and selection of options to further determine advantages and disadvantages. This entailed changing the format of the report to accommodate Design Projects requirements. The initial intent of the draft Conceptual design Report did not align with the Project Charter. Additional time was needed to incorporate Design Projects and stakeholders comments for it to be effective for establishing scope of work and to support BCS requirements. TZAMBAZV 2009/07/07 TZAMBAZV 2009/07/07 Date was missed due to inadequate communication between team members. Modification Team Leader did not comminicate to the Section Manager that the milestones would be at risk and action was required to obtain firm committments from the Project Design Section Manager. During the initial review of the draft report.	Discussed details of the report with the Project Design team in several meetings, conducted additional field walk downs, reviewed technical documents to determine the path forward.
D-2009-09111	CLOSED	Trend - Mtce. Facility - Proj # 31717 - Current TCD missed for issuing the Conceptual Design Report NK38-REP-28200-10007 R00	Design Projects informed Projects Design about the possible Scope changes due to the feed back they have received from Maintenance Group. The draft conceptual Design Report NK38-REP-28200-10007 was completed and ready for approvals. Report could not be processed for approvals due to the scope change. Scope change will requires a new assessment to the maintenance work shops for the Valve shop, RV shop and breakers shop in addition to 4 more work shops to be considered. Review options and add comprehensive table to identify gaps and selection of options to further determine advantages and disadvantages. The possible scope change will impact on not meeting the approved charter.	Informed supervisors, documented in SCR Requested the confirmation to Scope change from Design Project's MTL to determine the path forward.

D-2012-11625	CLOSED	Procedure Use and Adherence: Work Orders Taks for the Domestic water Tie-in for MandCDF Project 16-31717 scope injection into IPG at T-01	A new pipe tee and valve 0-72710-V461 is required to be installed for tie-in of the new Darlington Maintenance and Computer Development Facility to the Site Domestic Water system. The tie-in connectiion is outside of the Protected Area. The valve will be in 'Normally Open' state during normal operational mode. However, after installation and completion of tie-in, the valve will stay in 'Closed' position until completion of domestic water/ firewater piping installation in the builiding, subsequent to which the valve will be opened by Station Operations to complete commissioning and AFS activities. The tie-in of Domestic Water system is expected to be a one day-shift operation on Saturday, December 1, 2012. The work needs to be completed now before setting in of hard frost and onset of inclement weather. Any delay in tie-ins will push the tie-in to the next Spring, resulting in impact on AFS and costs associated with re-mobilzation of sub-contractors, which could be up to two months costing more $100K to the Project. The delay in AFS will push back relocation of building tenents, and its cascading effect on Campus Plan schedule. The tie-in activities will require minimum station resources for permits and water sampling. Any overtime by Station resources will be covered by the Project. Affected W.O Tasks 02819101 - 01,02,03,04,06,07,08,09,10,11,12,13,14,15,16,17 and 02819101-18 . The delay in planning the tasks in IPG according to procedures is due to the delays in reviewing and approving deisgn and delays in reviewing approving the work plan. Add to that the requirement to have the water supply to the new facility available for testing early Feb 2013.	Developed a detailed actions list for the domestic water tie-in swork, developed Levl 1 plan with the help of PCC, prepared draft Scopr change form to inject the work order tasks into WW49 at T-01. Initiated this SCR. Preparing Human Performance lessons learned presentation. SMAILIA 2012/12/04 SMAILIA 2012/12/04 SMAILIA 2012/12/04 Subsequent to initiating this SCR, the project team is developing a plan with the OPG stakeholders to perform the tie-ins early in 2013. Alternate water supply (rented tanker trucks) will be used in order to eliminate impact to the AFS/schedule.

D-2013-16492	COMPLETE	OPG equipment tags lost Darlington MandCDF Project#16-31717	Equipment and TCR tags for Domestic Water valves 0-72710-V461, 0-72710-V466, 0-72710-V467 and 0-72710-HYD73 where lost after valve tubes were raised during final site grading. Discovered by OPG during routine project oversight.	Reported issue to supervisor and filed SCR.
D-2014-11540	COMPLETE	925g Coffee can ,2lb sugar and cups gone missing again in new Maintenance Facility Building 141	employee came in start of day with new coffee can , sugar and cups put in supplies in lunch area went into power house with employee and when return went to make coffee new supplies were gone.	Informed Section Manager , contacted Security for report and file SCR.
D-2014-13436	COMPLETE	Environment - New Maintenance Facility Outdoor Transformer	The Project Manager requested Environment to walk down the new Maintenance Facility prior to AFS. During design and installation, it was communicated to Environment that the Outdoor Transformer had internal spill containment. This was verbally confirmed from Project to Environment on the walkdown. The transformer is in a high risk area for migration of oil if a spill were to occur (runoff slopes to the roadway and drains) and therefore, Environment requested further follow up on the details. The response was not timely, but we did receive further correspondence that the internal spill containment was in place. When challenged with producing the drawings to support this, it was found that in fact the transformer did not have internal spill containment.	Assessed the spill risk as low in probability but high in consequence which requires additional spill prevention measures. Discussed options with the Project to put additional spill prevention measures in place

D-2014-16474	COMPLETE	jhsc inspection area 46- New maintenance facility	JHSC inspection of the new maintenance facility 1) eye wash station in the mechanical room on the 2nd floor out of date (02apr2014) 2) welding shop bottle storage area (outside) has no roof on it, contravening N-INS-08965-10048 sect 1.6.1.1 3) loading dock room there is a square section of flooring right inside the door that is raised and has a different floor coating the location and coating creates a tripping hazard. 4 the top stair on the main stair case has still not been ground down to the bring it inside the building code(repeat finding)	initiated scr as required by the employer to document inspection findings SCOTT1R 2014/05/28 12:53 : 1) Eyewash station requires monthly inspection in the mechanical room on the 2nd floor (repeat finding). a. Work Order #3152441 2) Welding Shop bottle storage area (outside) has no roof, contravening N-INS-08965-10048 sect 1.6.1.1 a. Work Request # 00941801 3) Loading Bay (dock area) Rm. # 145 there is a square section just inside the door that is raised and different cement finish which has the potential to create a tripping hazard. a. Project to review 4) Top star on main stair case still needs to be addressed for the tripping hazard (repeat finding.) a. Project Work TCD – July 2014
D-2014-19810	COMPLETE	JHSC inspection area 46-new maintenance facility	JHSC inspection of the new maintenance facility 1) floor area just inside loading bay 145 has a raised section and is coated in a different floor material due to the location you cannot see it until you step on it, this is a potential tripping hazard and a repeat finding see scr# d-2014-16474 2) the permanently installed emergency eye wash stations have not been inspected since April (all shops). 3) reactor mtce shop Flammable storage cabinet has no inspection sheet filled out and it is not grounded and there are 2 5 gallon pails of oil inside.	initiated scr to document the inspection findings as required by the employer.

D-2014-23940	COMPLETE	JHSC Inspection of New Maintenance facility	During Inspection noted the following findings: 1) repeat findings from SCR D-2014-20546, loading bay 145 – entrance to room floor is a tripping hazard, unidentified door (offered to address for discussion and confirm via JHSC),corrective measures for First Aid room, hallway floor outside of 2nd floor cafeteria near stair well is uneven and potential tripping hazard. Pleased JHSC member to discover that remedy has been made for predictive MTCE Bldg 133 which is now on call up for cleaning. Thank you NEW FINDINGS 1) Oxygen bottle laying sideways under pillow on stretcher, recommended in upright position and secured – bottle immediately placed in upright position by area owner 2) Expired water cool call up, last "recorded" cleaning is May 2014-08-2014 3) North double cafeteria doors do not open from the north side when closed – doors are heavy to open creating accessibility issue's 4) South west man door of outer patio catches and is difficult to open 5) The Proximity card access is not working on west man (from the inside) door off of outdoor deck/patio area (same door as described above) 6) Patio/outdoor deck area needs a shelter from the sun/elements that is permanent in nature and secured safely, the area is not being utilized by workers due to heat/sun exposure, in addition it seems a waste not to utilize area	Spoke and toured with area owner delegate Submitted SCR
D-2014-23975	COMPLETE	JHSC Inspection New Maintenance Facility	During inspection noted the following additional findings: 1)Ceiling tiles need to be placed correctly in hallway north of lunch room, several not placed properly 2)Questionable Identification of stairwells, thoughts are that the stairwells should be reflective of one number and consistent throughout floors (of the same stair case) i.e. stair well 136, is 210 on a different level, stairwell 216 is indicating 115 on the second level	Submitted SCR

N-2008-01276	CLOSED	Project 31717 - DP Not Issued in Passport	As of 26-Feb-2008 Design Plan NK38-DP-28200-10003 (authorized 01-Feb-2008) for EC 94443 had not been submitted to CD for issue into passport as requried by N-GUID-00700-10000 Section 1.3.9. There was no indication that the issuing was in progress until the enquiry was made. This is a vendor provided EC. LAWRENCS 2008/03/02 HP-PROC NON COM ECC-PROCS ECC-Vendor. Review of Master EC	Contacted MTL for resolution
N-2008-04629	CLOSED	Missed Director's Milestone - DNGS Maintenance Facility Tie-ins: Preliminary Design Complete	The DNGS Maintenance Facility Tie-ins Director Milestone for Preliminary Design Complete was not achieved by the May 15, 2008 milestone date (Ref: UN108813). This resulted in a recorded "Missed" Director's Milestone. The following issues contributed to a significant re-vamp of the project schedule: (1) Project Manager and Project team members were changed. (2) Design team members were changed. (3) Design responsibility was transferred from PDD to PDEES. (4) Negative impact from related CCR Project. In addition, EMD had little influence over the acceptance of schedule delays and impacts as the design responsibility was controlled by PDD, and eventually by PDEES. Preliminary Design execution and Milestone review.	OPG DTL informed SM that the Milestone was in jeopardy and would likely be missed. SM advised manager that Director's Milestone would not be met. Manager discussed with Director. Milestone change request was submitted and rejected.
N-2008-04928	CLOSED	Project 16-31717: Contract Award Milestone missed	The New Maintenance Facility (RSTI Phase) project #16-31717 missed a key milestone to award the Design Contract. The original target milestone date was April 16, 2008 and the contract was awarded May 12, 2008. TZAMBAZV 2008/09/05 RSTI means Relocation of Services and Tie In. - Additional scope discovery after completion of Bid Evaluations - Extensive clarifications and lengthy evaluation and review of clarifications - Lengthy processing of PO and procurement activities by Supply Chain. During bid evaluations and clarifications as part of the Contract Award Process.	Notified Management. Phased the Contract with Rev 0 for original scope.

N-2010-00696	CLOSED	Schedule and Scope Issues. AISC review of Darlington Maintenance Facility Project 31717 Partial BCS resulting actions impact Project Schedule and Scope	Project team prepared a partial BCS for building a new maintenance facility for nonradioactive shops and supporting offices and to house a computer development facility as per the latest Project Charter D-PCH-28200-1001 R003 approved in April 2009 and according to the partial Release BCS D-BCS-28200-10003-R00 aproved in May 2008. The objective of the new Partial BCS is to present the recommended alternative to build a new maintenance facility that meet the needs of the station maintenance organization within the executive control limit of $50.0 set in May 2008. The partial BCS was presented to the SC and PAC and got their endorsement on January 13, 2010 to proceed to the AISC on January 20, 2010. The project team seeked the help of the Station Strategic planning to develop a complex NPV model requiring input from the stakeholders. The NPV was completed and the results were summarized in the BCS. The project team circulated the BCS and the AISC Part "B" for three alternatives (build insiode protected area, outside protected area, and delay by two years) for review prior to the AISC meeting and obtained comments and questions that were either addressed or answered. At the AISC meeting on January 2010 the NPV caluculations results were challenged and the Project was actioned to validate the results. Several discussions and meetings took place between the AISC meeting and the special AISC meeting on February 03, 2010 to validate, refine the PV base, and the NPV for the three alternatives. During the same period more questions were raised by Coroporate Finance to help the Project team clarify and refine the BCS further. The Project Team answered the questions, and refined the BCS and Part "B" to address the clarification requests. The partial BCS and part "B" was presented to the special AISC meeting on February 03, 2010, the project was actioned to evalaute other alternatives to possibly integrate higher business and strategic ideas i nto the scope of the project.	SALIBAA 2010/02/10 SALIBAA 2010/02/10 Reviewed the impact of the actions and the decision by AISC for delaying the submission of the BCS to the Board Of Directors in May 2010 versus March 2010 Identified the areas in the BCS that could be updated or refined to address the actions Prepared a plan for evalauating alternatives and discussed with line management Followed up along with Line Management with Corporate Finance to obtain a checklist of expectations for the revised BCS Obtained Checklist from Finance on February 10, 2010. Some of actions in the list are outside the scope of the Project. Discussed the Checklist with line management and idenntified the actions that are outside the scope of the project and would have a major impact on the schedule Preparing a new plan to address or disposition the actions listed in the ckhecklist and will be discussing with Line managment before presenting to AISC on February 18, 2010 Initiated this SCR to develop a corrective action plan

N-2011-00636	CLOSED	Resource Management: Preliminary Engineering Milestone Completion at Risk: DNGS New Maintenance and Computer Development Facility Project 16-31717	DNGS New Maintenance and Computer Development Facility Project 16-31717 Preliminary Engineering Milestone completion date of March 28, 2011 is at risk due to the lack of OPG engineering support and late deliverables by the external Engineering Company. Prel Eng Contract awarded Sep 25, 2010 and up to date there is no OPG engineering support to review the design documents and deliverables as per the F-MOD process. This was discovered as part of the weekly schedule updates and after various discussions with line management. Line Management has been actively trying to obtain adequate design resources to address to the adverse condition	Informed Line Management, Design Con, other Project Team members including CSA and MTL. Initiated this SCR
N-2011-00638	CLOSED	Resource Management:Preliminary Engineering Milestone Completion at Risk for Darlington Maintenance and Computer Development Facility Project 16-31717	Darlington Maintenance and Computer Development Facility Project 16-31717 Preliminary Eng Milestone of March 28, 2011 is at risk due to the lack of OPG engineering support to review design documents and deliverables, and late deliverables by external design company. The contract was awarded on Sep 25, 2010. The project has not been getting engineering support to assist the project as per the FMOD process. These issues were identified to my line Management. Line Management has been actively trying to obtain necessary resources without success so far. These issues were discovered as part of the weekly project schedule updates.	Informed Project Manager, the design company PM, and other Project Team members including MTL, and CSA.
N-2011-00638	CLOSED	Schedule: High Risk for missing Preliminary Eng Milestone for New Maintenance and Computer Development Facility Project 16-31717	The preliminary engineering deliverables continue to be delayed due to the lack of OPG engineering support resources and unfamiliarity with OPG F-MOD process by the Architect Engineering company (Adamson Associates). Previous SCR N-2011-00636 was initiated to raise the same adverse condition but efforts to develop a corrective plan was not successful. Therefore, the risk for not meeting the preliminary engineering Milestone on March 28, 2011 is higher and needs immediate resolution. As part of review of preliminary engineering documents and monitoring the progress of the work.	SALIBAA 2011/02/23 Informed Line Management. spending more time helping the project team to prepare and review eng. documents. Discussed possible resources options with management without any resolution yet. Initiated this SCR

N-2011-01055	CLOSED	Scope and Cost: New Maintenance and Computer Development Facility (NMandCDF)Layout larger than identified in Partial BCS	The architect engineering company Adamson Associates finalized the (NMandCDF) layouts and summarized the space requirenets in a draft Design Requirements (DR). The DR was submitted to OPG for review. During review of the DR, OPG Project team discovered that the total space requirements for the facility is 59,200 sq ft to meet the functional requirements of the new facility. The new space requirements is about 10,200 sqft larger than the space used to prepare the basis of estimate in the partial BCS approved in May 2010. The additional space could cost the project an extra $4M assuming $400/sq.ft. Therefore, Project team requested communicating this issue to the Project Sponsor for resloution.	Informed Line managment about the variance and potential cost impact. Requested a meeting with the Project sponsor to discuss the variance and develop options and path forward Initiated this SCR
N-2011-03836	CLOSED	Darlington Maintenance and Computer Development Facility - Budget Cash Flow Adjustments	The Year End expenditures for 2010 are lower than the allocated funds per approved BCS. The unspent amounts need to be transferred to Years 2012 and 2013 to align the Control Budget with the project actual costs in 2010 and the forecasts for future years. The 2010 year-end actual cost was $703 K which is $723 K less than the control budget of $1,426. The main reasons for $723 K variance were due to the lower than expected value of fixed price preliminary engineering contract, project management and OPG support costs.and delays to engineering work. However, except for a minor shift in the Design Agency's work ($75k), all the remaining 2010 planned work was completed. This SCR is being initiated for trending purpose and to document the event.	Initiate this SCR and submit PCRAF.
N-2012-00998	CLOSED	COST-Found Discrepancies between Approved Release Doc's (BCS) and P6 Schedule Project 31717	Discrepancies between Approved Release Documents BCS and P6 Schedules. on or about 2012/02/10. During the preparation of a recent Business Case Summary (BCS), it became apparent that there were mistakes made in the past regarding entry of DEV BCS funds not listed in Proliance or in P6. This was discovered when attempting to create new FRF BCS P6 schedule and attempting integration into the Proliance program.	Section Manager and team members notified.

N-2012-04329	CLOSED	BCS Design Completion Milestone missed for the Maintenance Facility Project 16-31717	The New Maintenance and Computer Development Facility Project 16-31717 BCS milestone of August 8, 2012 for all design documents approved was missed due to the directed design changes resulted from detailed definition of the stakeholders requirements. The additional design activities planned to take about six weeks to complete.The milestone for design completion is now forecasted for September 15, 2012.	Informed Managment and obtained approval on the directed design changes by the Project Sponsor prior to the start of the additional design work. SMAILIA 2012/09/07 A recovery plan has been put in place and is being executed to meet the Sep 15th date. trend SCR as D4.
N-2012-04622	CLOSED	BCS Design Completion Completion Forecast for previously missed Milestone was delayed for MandCDF Project 16-31717	The New Maintentance and Computer Development Facility Project 16-31717 design completion milestone of August 08, 2012 was missed due to additional work on recent Directed Changes. SCR N-2012-04329 was initiated with a forecast completion date for the milestone of September 15, 2012. The Forecast date was also missed due to the additional reviews by Nuclear East facilities related to the power connections and feed impact on the existing power distribution system, and by NR for Fire Protection. New Forecast Completion date is October 19, 2012. The additional time for the review is beneficial since it will help define the scope of any modifications required to upgrade the distribution system now to allow timely implementation of the potential upgrades wihout impact the AFS date. Construction work is on continuing on all accepted DCNS and building permit is obtained.	Informed Management. Developed a new Plan for: Nuclear East Facilities to complete the design review of 8 DCNs by Sep 27, 2012. Fire water DCNs to be resubmitted by EPC Contractor by Sep 21 and review by NR engineering to be completed by Sep 28, 2012. Path forward for the scope of modification of Power distribution to be completed by October 05, 2012. Remaining DCNs final re-submission by Oct 12 and final review and acceptance by October 19, 2012. SMAILIA 2012/09/20 Cause is clearly documented and path forward has been developed and being executed per the above. Trend SCR as D4

N-2013-01172	CLOSED	MOL inspector issued Order to comply to "Owner Only" Contractor on Project 31717	Wednesday 06 March 2013 afternoon the MOL inspector showed up to the Maintenance Building Site unexpected, to walk down the premises for safety compliance as per OHSA. Upon completion of the site walkdown the MOL inspector issued 1 Order to Comply. Notifications were completed as required under OPG-SFTY-STD-005. Narrative of order: "The Constructor, Aecon Construction shall ensure that signs meeting the requirements of subsection (2) shall be posted in prominent locations and in sufficient numbers to warn workers of a hazard on a project. At time of visit it was observed on the second level that parts of the pre-cast wall and around a floor opening did not have signs posted to warn workers of the fall hazards in these areas. Constructor to post signs to warn of the hazards." Contractor has completed the OHSA requirements as per Order to Comply.	Contacted Projects and Modifications Managers involved with the project. Filed SCR documenting this event
N-2013-01180	CLOSED	DNGS Maintenance and Computer Development Facility Project 31717 Directed Changes and Cashflow changes in 2013 and 2014	The project is taking longer to implement due to geological conditions which required deep foundations ($1,200 k), and the discovery need for a Municipal developmental permit ($600 K), add to that directed changes by the Sponsor and user groups, and the requirement for an interim measure for dual power supply due to shortage in the existing power supply at site($2,400 K). Furniture scope and costs were included in the Capital portion of the Full Release BCS and now need to be transferred to the OMandA project 16-38945 (-2600 K) to comply with finance procedure. The net impact is an additional $5,250 K in 2013, and a reduction of $1,324 K in 2014 for the capital Project 16-31717, and transferring of $ 2,600 for furniture from 16-31717 to the OMandA Project 16-38945. The changes in the cashflow will not have an impact on the Full Release of Funds. Contingency remains the same.	Informed management, Obtained sponsors approval on the directed changes, reviewed the available release of funds and the BCS and associated Risk management plan, Adjusted the cashflows in P6, initiated PCRAF 16-31717-005 and 16-38945-001 to request approval of the cashflow changes SMAILIA 2013/03/08 . Trend SCR

N-2013-01199	CLOSED	DNGS Maintenace and computer Development facility Project 16-31717 Underspent in 2012	The project was few weeks behind schedule due to Deep foundations, delays in building permit, and extreme weather conditions and the work was pushed to 2013. The project was underspent by $6,526 K in 2012 due to the delays and less OPG costs.	Documented the underexpenditures in Q4 and Q5 2012 Year end Forecasts. Initiated PCRAF 16-31717-005 to request additional cashflow in 2014 to recover the time lost and Maintain the AFS date of Oct 30, 2013. SMAILIA 2013/03/08 For trending.
N-2013-01676	CLOSED	Potential Emerging Trend for EPC Vendor for PO 211664 (16-31717)	Based on the data from the Project Oversight Reports (PORs) initiated during routine oversight and the responses received from the Vendor (EPC Contractor), there is a potential emerging trend identified for the following: - Lack of supporting documentation prior to sign off on ITP steps; - Lack of ownership of the overall quality of the work by the Vendor, with reliance on their subcontractors. - The Vendor could be more proactive to ensure that the issues identified, observations, gaps, NCRs and corrective actions are managed in a timely manner. Identified during Weekly Project Oversight Team Meetings.	- Required Vendor to report the status of their own NCRs and OPGs PORs in the Weekly Progress Meetings; - Vendor requested to provide the annual Internal project site audit report to identify the actions being taken for problem identification and resolution and to report on the implementation of their management system for the project; - Continuing routine oversight conducted by OPG Project Team based on the Vendor's ITPs and Project Schedule; - Conduct routine oversight includes walkdowns conducted jointly by OPG Project Team and the Vendor to identify issues related to: extent of work completed, review of completion of milestones against the TCD, Identification and completion of Safety issues identified, quality and workmanship of work completed; - OPG Project Team to continue monitoring and pro-actively engage the Vendor and emphasize the need for the Vendor to take the lead in conducting their own oversight as the EPC Contractor and comply with the PO requirements; and - OPG Project Team have identified and discussed the issues with the Vendor, it will continue to monitor consistency in the implementation of improvements made by the Vendor to prevent recurrence.

N-2013-18405	COMPLETE	Project 16-31717 Oversite Equipment Tagging	Late oversite requested for equipment verification / tagging. F-Eng. Mechanical oversite asked to verify equipment tagging on mechanical systems in D141 project. Drawings are not as built, tagging has many deficiencies, design asbects need to be reviewed (RV settings, pressure ratings etc.)	deficiencies, inquiries being made along side with CNT and documented in quality surveilance report (mechanical - QS report #01)
N-2013-19049	COMPLETE	Roof leakage on new Maintenance Building "Owner Only" PO# 211664 Project 16-31717	As a result of the torrentian rain which occured on Saturday 26th October there were a substantial number of area effected with puddling of water inside the New Maintenance Building. There were a number of area's which appeared to be coming from the roof area and a number passing the seals on the shop doors. All of the areas appear to be new leaks and not reoccurance of the previous leak repairs.	Contractor consulting the supplier for assessment of the roof. Filed this SCR to document issues. SMAILIA 2013/10/29 10:35 : recommend C3
D-2014-00958	COMPLETE	Lack of attention to detail regarding ingress and egress of Power House on I00.0 Elevation by increased volume of personnel due to opening of MandCDF	Since our arrival in this new building 141-Maintenance and Computer Development Facility on Dec 3,2013. We have experienced a difficult passage to ingress the Power House at PD 48 Door of powerhouse from the Aux Security building. The ingress door was not maintained or pre-prepared with boot boy or ear plugs or trash bin to collect spent ear plugs. The pathway from the Aux Security building added to problems with ice slipping hazards and depositing of vast quantities of sand and ice melting deposits inside the station and the Aux.Security Building. In the meantime a boot boy was placed at the PD47 door exiting the powerhouse boot boy for egress to outside? We would ask for a post pro-active action to designate a proper path and aid civil in their clean up as it seems no one anticipated this new building appearing or the increase of people into the station at this portal point!	Reported this to my FLM and wrote SCR. See images attached.

ONTARIO POWER GENERATION

Lessons Learned Report

Internal Use Only	
Document Number: D-LLD-68000-10002	
Project Number: 16-33955	Project Execution Plan Number: NK38-PEP-68000-10004
Revision: R001	

Title:
DNGS SDS MONITOR COMPUTER REPLACEMENT LESSONS LEARNED

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DNGS SDS MONITOR COMPUTER REPLACEMENT LESSONS LEARNED

D-LLD-68000-10002-R001

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2019-04-29

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Internal Use Only

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Revision Summary

Revision Number	Date	Comments
R000	2015-06-26	Initial issue.
R001	2019-04-29	Revised to incorporate lessons learned for the project.

1.0 BACKGROUND

This Project Execution Plan (PEP), identified on the cover page of this report, documents the scope of work for the DNGS Shutdown Systems (SDS) Computers Aging Management Project (16-33955). The need for this work was identified in the approved Engineering Change Request (ECR) 5853 and in the Project Charter, D-PCH-68000-10001.

In the PEP, the Needs Statement summarizes the problems facing the Darlington SDS computer network. Basically, the SDS computers (totalling 57 computers for the entire station) are suffering from hardware obsolescence issues. At that time (2006), it was determined that the obsolescence had reached such a state that it was imperative to initiate efforts to engineer replacement systems for them.

One of highest priority tasks identified in the PEP was the immediate replacement of the SDS1 and SDS2 Monitor Computers (MC) with modern hardware and software platforms. As part of this effort, the Shutdown System Monitor Computer (SSMC) was eliminated by incorporating its functionality into the new MCs.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The project organization (as of the issue date of this document) is described below.

Role	Name of Individual and Organization Position
Project Approval Authority	Gregg McCabe, Director, Station Engineering Darlington
Project Sponsor/Customer	Dave Burger, Manager, Performance Engineering, DNGS
Project Owner	David Rogalski, Senior Manager, Computers and Control Design Department
Project Manager	Kevin McKay, Section Manager, Safety Related Computers, Computers and Control Design Department

3.0 LESSONS LEARNED

The purpose of this lessons learned report is to document the lessons learned from the SDS Monitor Computer replacement project so that they can be applied to other projects of similar nature. The primary basis for the content of this report comes from the lessons learned meeting held on May 29, 2015, NK38-CORR-68000-0495664.

3.1 Lesson Learned Summary

The SDS MC installation was praised for its excellent coordination between different teams, extensive engineering support availability, and for flow improvements to work plans.

Lessons learned from execution of Unit 2, were incorporated into the work plans for the remaining MC installations leading to significantly reduced installation duration and fewer subsequent installation challenges.

The project was praised for:

(1) Fostering a cooperative working relationship across various teams, including Engineering, Control Maintenance, and Operations.

(2) Readily available support from Engineering.

(3) Updated and improved work flows to SDS1 work plans.

(4) Updates to the remaining units work plans based on lessons learned from U2.

(5) Great planning on logistics such as the staging of tools.

(6) 100% functional Interim MC, which was transparent to operations.

(7) Quick in-situ testing of all I/O using SRST I/O test scripts.

(8) Smooth commissioning of SDSPI Gateway and PIDS.

Identified areas for improvement include:

(1) Discovery of several latent design issues during installation that were resolved with minimal impact to operations.

a. A/O open circuit (SCR # D-2015-05667 and D-2015-03302),

b. Some alarm messages may not clear if the sensor is in the Deadband range and suppression is enabled (SCR # D-2015-16217),

c. Microsoft SQL issue preventing log files from being archived following continuous operation (SCR # D-2016-12756),

d. Incorrect units and description in PI (SCR # D-2015-07346),

e. Database update timing issue causing Active Alarm List discrepancy (SCR # D-2015-08587 and D-2018-15016),

f. Configuration problem led to database corruption on U2 SDS2 – write cache patch was not incorporated in main release (SCR # D-2015-09992),

g. Potential for NOP calibration errors (SCR # D-2016-18739, D-2017-03310),

h. Improperly calculated running averages for NOP1 detectors in the MC software (SCR # D-2015-08899),

i. Zero byte files not being sent by MC (SCR # D-2015-07161),

j. The text for two DCC ANs were not correctly updated to reflect the modifications to the MCs (SCR # D-2015-06026),

k. Data in PI on OPG Business LAN generated by the SDSPI Gateway was not timestamped appropriately (SCR # D-2015-05915).

(2) Adjustments to mounting equipment due to space limitations and inappropriate screws/bolts being specified.

(3) Delays experienced during installation. Future work plans should be revised to streamline task sequences and incorporate parallelism (SCR # D-2015-02718, D-2015-04226, D-2015-18153, and D-2015-19014).

(4) Network port hardware failure in U2 SDS2 installation (SCR # D-2015-06077) and in U3 SDS1 installation (SCR # D-2015-14166).

(5) Fibre Patch Panel cables did not match drawings (SCR # D-2015-06073).

(6) Bad packet annunciations due to Scintrex card transmission errors on Channel D (SCR # D-2015-04669).

(7) AFS documents not completed sufficiently before AFS meeting (SCR # D-2015-06226).

(8) Did not provide sufficient timing delay in SRST 2.11 script blowdown to perform SGLL test (SCR # D-2015-12123).

(9) Tools used to extract data from MC for comparison with PIDS did not work well (SCR # D-2015-07153).

(10) Some PIDS WOTI markups were required.

(11) Inadvertent Class IV transfer (UST to SST) initiated in U1 SDS1 installation (SCR # D-2015-16739).

(12) Some vendor quality issues discovered during installation (SCR # D-2015-21428).

(13) A number of opportunities were identified where the Human Machine Interface (HMI) could be improved to reduce likelihood of human errors (SCR # D-2016-00356, D-2016-10347, and D-2016-10348).

3.2 Background

Not applicable for this revision of the report.

3.3 Recommendations

The following recommendations are to be maintained or improved for future MC modifications:

(1) To the extent possible, cabling and equipment should be pre-installed and tested in advance.

(2) To the extent possible, computer systems should be pre-mounted, pre-wired, configured and tested prior to installation (Offline Testing).

(3) The use of an Interim Monitor Computer (IMC) should be considered for complex modifications.

(4) Maintain the co-operative working relationships and good planning on logistics.

(5) Human Factors engineering should be involved early in the initial/prototyping design phase of the project. It is critical that clear requirements are established for the HMI and supported by end user. The HMI requirements should be used as input into the initial design.

(6) Ensure refresher training is provide to Operators if there is a long duration between when initial training is provided and when the modification is installed.

3.4 SCRs Submitted to Document Events

SCRs related to the SDS Monitor Computer installations are summarized in the table below.

SCR #	Title
D-2015-02718	U2 SDS1 Monitor Computer Project delays
D-2015-03302	U2 SDS1 Monitor Computer Replacement – Alarms Triggered Inadvertently
D-2015-04226	SDS1 Monitor computer installation delays
D-2015-04669	U2 SDS1 Monitor Computer Bad Packets Received
D-2015-05667	U2 SDS2 Monitor Computer Replacement – Alarms Triggered Inadvertently
D-2015-05915	Commissioning Test Failed in NK38-REF-69072-0507287 for Design EC 104850 SDSPI GATEWAY FOR SDS MONITOR COMPUTERS
D-2015-06026	U2 SDS1 and SDS2 Monitor Computer ANs not updated

SCR #	Title
D-2015-06073	Monitor Computer Fibre Patch Panel 68244/68344-CON7 Cable Numbers do not match drawings
D-2015-06077	U2 SDS2 Monitor Computer Replacement – Panel Computer Network Port Failure
D-2015-06226	U2 SDS1 Monitor Computer AFS Meeting – AFS Documents Not Ready
D-2015-07153	Commissioning Rework for Design EC 104850, SDSPI GATEWAY FOR SDS MONITOR COMPUTERS
D-2015-07161	Monitor Computer does not send empty files as expected
D-2015-07346	Incorrect engunits and exdesc for Monitor Computer PI tag entries in I/O List and PIDS PI Server
D-2015-08587	Unit 2 SDS2 Monitor Computer Active Alarm List Discrepancy
D-2015-08899	Possible glitch in shutdown system SDS1/2 monitor computer MARSH software unit 2
D-2015-09992	U2 SDS2 Monitor Computer Database Corruption - Rework
D-2015-12123	SRST failure in new Marsh testing computer
D-2015-14166	U3 SDS1 Monitor Computer Failure (new Marsh computer)
D-2015-16217	SDS1 Monitor Computer: Unexpected Margin to Trip Annunciation
D-2015-16739	Spurious Class IV transfer from UST to SST
D-2015-18153	Challenge to maintenance, CCID unable to complete scheduled task in ww 33
D-2015-19014	WW35: Delays to two NFWs: U3 Item 8905 SDS2 rundown pre-reqs; U4 SDS2 Monitor Computer installation) due to fuelling
D-2015-21428	SDS Monitor Computer (MC) Panel Computer Vendor Non-compliance
D-2016-00356	NOP calibration unexpected response
D-2016-10347	SDS monitor computer NOP calibration - Human Factors
D-2016-10348	SDS NOP Detector Calibration Human Factor Assessment Deficiencies
D-2016-12756	SDS Monitor Computer SQL Server Bug
D-2016-18739	SDS1 and SDS2 Monitor Computer Software Bug Affects First Instance of NOP Calibration after a Computer Restart
D-2017-03310	Potential for calculation of incorrect NOP gains if using Recall button to switch between NOP calibration displays
D-2017-17188	SDS Monitor Computer Software Update Work Orders Delayed due to OPS Assessing Unavailability
D-2018-15007	TPAR's on OM not completed causing SDS Monitor Computer software installation to be delayed
D-2018-15016	Unit 3 SDS1 Monitor Computer Message History Not Available
D-2018-16907	Missed Director Milestone CCD-102: Project 16-33955 SDS Monitor Computer NOP software - Installation

3.5 OPEX Review Findings

No directly related OPEX events were found.

3.6 Action Requests to Implement Changes

See Action Requests for individual SCRs listed in Section 3.4, as applicable.

4.0 COMMUNICATIONS PLAN FOR THE LESSONS LEARNED REPORT

The lessons learned, as documented herein, have been communicated to the Project Manager, who will be approving the report, and Computers and Control Design Department Section Managers. The report will be issued in Asset Suite for future reference.

5.0 CONCLUSIONS

The SDS Monitor Computer installations were completed on all 4 Darlington Units in 2015. In addition all Monitor Computer software changes were installed on Units 1, 3, and 4 as a follow up item from D-2016-10347.

Lessons Learned Report

Internal Use Only	
Document Number: NK30-LLD-35230-0680496	
Project Number: 13-40976	Project Execution Plan Number: NK30-PLAN-35300-00001
Revision: R000	Page 1 of 16

Title: **P1671-U7 FHR Project 13-40976 Execution Lessons Learned Report**

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P1671-U7 FHR Project 13-40976 Execution Lessons Learned Report

NK30-LLD-35230-0680496-R000

Project Number: 13-40976
PMP Number: NK30-PLAN-35300-000001

2017-3-13

Internal Use Only

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Revision Summary

Revision Number	Date	Comments
R000	2017-3-14	Initial issue

1.0 BACKGROUND

The FH systems at Pickering B are nearing their 40 year design life, leading to significant component obsolescence and end-of-life challenges.

Fuel handling system Single Point Vulnerability (SPV) equipment failures directly affect station performance objectives including unit shutdowns or de-ratings.

A review of the fuel handling systems based on INPO AP-913 Equipment Reliability Process was conducted to determine the scope of work required to return and maintain acceptable levels of reliability to the Pickering B fuel handling systems. The review identified equipment that is single point of vulnerability or equipment with a zero tolerance of unplanned failures. These components will be replaced by this project in the planned outages

This Lessons Learned Report collects the issues, events and successes experienced during the P1671 outage for the 13-40976 project.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Position	Roles/Responsibilities
Project Management	
Project Manager (PM) Craig Verwey	Accountable for safe, procedure compliant and cost effective implementation of the project. Overall project responsibility and accountability to stakeholders.
Project Leader II Rathin Bagchi.	Accountable to Project Manager for schedule and budget adherence and for overall project support.
Project Engineer(s) (PE) Mike Hodges	Production of project engineering deliverables and overall project support
Fuel Handling Technical (SE) Owen Clarke	Provide technical support related to the system as required.
Cost and Scheduling Analyst Ahmad Aliani	Accountable for overseeing the costs and updating of schedules and budgets
OPG Design	
Design Team Leader (DTL) N/A	Review and approve design documentation, provide design support for project execution and closeout.
FH Operations/Maintenance	
FH Operations Drew Greig	Provide operational support for permitry and field equipment / system.
FH Maintenance, FLM Brendan Shiel	Provide field execution support for the project.
OPG Field Engineering	
Field Engineering FLM Ray Naidu Project Technician-Mechanical William Chu	Preparation of ITPs and assessing. Provides Field Engineering support during execution.

3.0 LESSONS LEARNED

This lesson learned report covers the P1671 FHR Project execution during the P1671 outage.

A round table discussion was conducted with representatives from Vendor (ES Fox Ltd.), OPG Project Manager, MTL, PE, CMO and FE. The following items were reviewed and Lessons Learned / Areas for Improvement were identified as follow:

3.1 Lesson Learned – Scope and Schedule for execution.

The Scope going into the P1671 outage included:

- Replace aging U7 East/West D2O/Air Hoses for Fuel transfer mechanism
- East rolling shield mechanism overhaul.
- Replacement of IFB-B fuel basket loader rams M11,12,13,14,15,16 and catenary hoses
- East side ball screw thrust bearing replacement.
- Fuelling machine cable harness replacements on East and West Fuelling machines.
- Replacement of the Y-Drive brakes on the East and West sides.

3.1.1 Background

East/West D2O/Air Hoses for Fuel Transfer Mechanism

All identified scope for D2O/Air hose replacements was completed on schedule. There were no schedule conflicts, and the scope was well identified. There were a total of 36 welds requiring radiography NDE and all welds passed on the first attempt.

East Rolling Shield mechanism overhaul

All identified scope was completed as scheduled. Challenges existed with crew compliment due to the limited resources available to the vendor. This was due to the late identification of the need to perform ball screw cleaning, however the work was well managed and completed on schedule.

Replacement of IFB-B basket loader rams

Preparations for this work were underway to meet the originally scheduled work window. Crews were hired on to perform the work. Prior to the execution window opening the Fuel Handling Super Tool failed necessitating its replacement. The unavailability of the Super Tool caused the IFB Basket Loader work to be pushed and ultimately the work was removed from the outage. It may be re-scheduled during a future No-Fuel window.

East Ball Screw Thrust Bearing Replacement.

This work was scheduled during the later part of the outage in a 4.5 day window. The window required for execution was 8 days. The work was ultimately removed from scope due to the higher priority work of cleaning the ball screws. Difficulties included the need to use a seismically qualified scissor lift. The scissor lift had not been used in a number of years and required maintenance and inspection in order to be available for use. The project made the scissor lift available which was an added cost to the

project. Also as a result plates needed to be installed over the fuelling machine floor opening, preparations were underway when the work was removed from scope.

Fuelling machine cable harness replacements

Pre-requisites for cable harness replacements East and Weste were completed in preparation for execution of the work. Due to the timing of the available work window over the Christmas break the necessary resources were not available. This work was removed from scope as a result. Work may be scheduled for a future No-Fuel window.

Y-Drive Brake Replacement

Execution of this work began during the scheduled window of 5 days. Due to execution delays the work was halted part way through and was not completed. Upon restoration a bridge tilt occurred as a result of two couplings not being properly engaged. Fuel handling maintenance recovered from the bridge tilt and replaced the necessary couplings. A root cause analysis was completed for this bridge tilt event. SCR# 2017-00127

3.1.2 Recommendations

Develop Level 1 windows based on all of the work that needs to be performed inside the window. If the work does not fit into the allowed window, then remove the work from scope or extend the window as necessary to accommodate.

3.2 Lessons Learned Cost

Delays and scope change had a significant impact to the incurred P1671 project costs. Approximately 408K was spent on scope that was not completed.

3.2.1 Background – Cost figures below do not include vendor supervision or vendor project management cost.

East/West D2O/Air Hoses for Fuel Transfer Mechanism

Direct costs not including supervision and project management amounted to approximately 156K. The work was completed without significant schedule delays.

East Rolling Shield mechanism overhaul

Direct costs not including supervision and project management amounted to approximately 44K. The work was completed without significant schedule delays.

Replacement of IFB-B basket loader rams

Preparation and testing was completed on the IFB-B Basket loader rams. This included preparation of lift plans, training of personnel, obtaining all necessary equipment and tools. The work was removed from scope due to Super Tool problems. Approximately 99k was spent in preparations. A portion of the costs will be recouped when the work is completed as the rams will not require retesting if the work is completed in the near future.

East Ball Screw Thrust Bearing Replacement.

The East Ball Screw Thrust Bearing replacement was scheduled and workers were hired on for the work. Training of workers was conducted as well as readying a seismic scissor lift for use in the Unit 7 vault. A mockup exercise was conducted with the scissor lift in the Unit 2 vault to ensure it was adequate for use in Unit 7. All of the preparatory work incurred a cost of 198k to the project. The work was not completed due to performing ball screw cleaning in lieu of Thrust Bearing replacement.

Fuelling machine cable harness replacements

Approximately 61K was spent in preparation of the cable harnesses. This work was not completed, however the cables will not require retesting in the near future.

Y-Drive Brake Replacement

Approximately 150K was spent with no scope being completed. There was no preparation work done that would be of any cost savings if the work was completed at a later date.

3.2.2 Recommendations

More accurate cost estimates should be included in the scope removal forms to indicate how much cost will be incurred by removing scope relative to completing it at a later date.

3.3 Lessons Learned – Execution Schedule delay

Multiple delays occurred during the execution window for station issues

3.3.1 Background.

The Y-Drive Brake replacement included a number of pre-requisites that were not able to be completed prior to the window opening. The time required for these pre-requisites was underestimated in the schedule.

Multiple delays occurred during the execution of the Y-Drive Brake replacement. This ultimately led to removing it from scope and backing out of the work.

Delays were incurred due to permitry issues in which the PC1 was not included in the original permit.

A delay occurred when it was found that the equipment did not have identifier tags. Work was on hold while temporary tags were added.

Scaffolding was delayed on the West side due to lack of scaffolding resources.

3.3.2 Recommendations

Ensure in the case where pre-requisites need to be completed within the work window that an accurate understanding of the time required is included in the schedule. This may require Walkdowns be completed earlier than would normally be required in order to assess the schedule impact.

Although the daily project updates were sent out, not everyone was aware of delays. Ensure key personnel are contacted directly when schedule delays occur.

3.4 Lessons Learned – Resources

Hire optimum amount of resources to support the execution and mitigate cost impact and work to the original plan if at all possible.

3.4.1 Background.

Resource hiring was done only after schedule confirmation by outage/FH groups during execution challenge meeting 3 weeks prior to start.

Difficulties with resources arose due to the delay and ultimate removal from scope of the IFB-B Basket loader work. Workers were hired on for this work and were then let go when the work was de-scoped. Following the release of the resources the schedule for execution of the Y-Brakes and Rolling Shield was changed to have all

work performed in parallel. This change in strategy left the vendor with limited resources to perform all of the necessary work.

Coverage schedule was published by projects identifying details of coverage by various groups during the execution window.

3.4.2 Recommendations

Changes in scope by the outage department should be agreed upon by the project sponsor as well as the projects and mods management prior to moving for with major changes in project scope.

3.5 Lessons Learned – Material

As found material quality and traceability issues.

3.5.1 Background.

There were several challenges with availability of materials.

- The IFB Ram overhauls required a lifting beam be manufactured. The beam was completed in time for its intended use, but expedited services from the vendor needed to be requested. Sourcing this material was started well in advance of the scheduled work, but ultimately the completion of the lifting beam was done just prior to the scheduled work.

- One of the Rams (M16) for the IFB work had failed its pre-testing and was not available for replacement. New rams were ordered.

3.5.2 Recommendations

Follow outage material staged milestone for verifying staged material quality including contingency items. AR 28199232 has been setup to ensure all materials are walked down prior to the outage milestone for materials on site for outages P1761 and P1881.

3.6 Lessons Learned – Quality of construction

Quality issues with Y-Drive Brake replacement.

3.6.1 Background.

There were no quality issues with respect to the FT hose replacements. All welds passed radiography on the first attempt.

Following replacement of an air trap on the FT mechanism it was noted that a flange gap was not uniform. The trap was replaced a second time with a new trap. The faulty trap was received from the factory with the non-uniform gap.

The Y-Drive brake work had several issues with quality. On the West side a grease retaining o-ring was found loose on the shaft. This o-ring should have been on the internal of the hub, but was not reinserted into the o-ring groove following disconnection of the coupling.

On the East side Y-Brakes retaining rings were not reinstalled on either of the brakes. This caused a bridge tilt upon attempting to move the bridge.

3.6.2 Recommendations

A root cause analysis was performed to determine the corrective actions with regard to the Y-Drive brakes. SCR P-2017-00127 was input for the root cause and corrective actions associated with the bridge tilt. The root cause Report is NK30-REP-35330-0634546.

4.0 COMMUNICATIONS PLAN FOR THE LESSONS LEARNED REPORT

This lessons learned report to be rolled out to the ES-MSA contractor and to all Project Managers with the expectation to provide rollout to the staff/PCC.

5.0 CONCLUSIONS

Execution for this work went event free for any personnel safety issues. From a reactor safety standpoint, although there was no risk to the fuel, the bridge tilt could have happened with spent fuel on board which would have been a significant reactor safety risk.

Schedule and cost performance for the execution are below expectation due to scope removal that occurred after resources had been hired on. Backing out of the Y-Drive Brake work left the project with significant costs with no completed scope.

Projects will continue to work closely with outage group to obtain an agreed upon level I schedule in advance to mobilize construction crews including OPG resources for optimal cost & schedule performances.

6.0 APPENDIX A - SCRS LIST SEPT 1 TO DEC 31, 2016

	SCR #	Title	Condition Description
1	N-2016-26956	P1671 CAT-ID 89582 Replacements for 078-35200-M16 failed during pre-requisit leak testing Project 13-40976	During pre-requisit leak-check of overhauled and new M16 cylinders (CID 89582), both cylinders (one retrieved from FH storage and one new from stor) were found to be leaking beyond the acceptable criteris.
2	N-2016-27886	Project 40976: Delay in field execution of IFB Basket Loader Overhaul	B-IFB- basket loader ram replacements (Project 13-40976) have been delayed due to the need to replace the super tool and fuel Unit 8 prior to beginning work. The work was originally scheduled for NOV1 and was moved to NOV11. Further delays have now moved the start date to 29NOV. Vendor resources were brought in to begin work for NOV1 and have been charging to the project. Estimated cost impact for delays has been 250K.
3	N-2016-29647	Project 40976: P1671 - East Fuel Transfer Maching air trap TP1E factory defect necessatates replacement	Leakage observed in U7 TP1E during fill & vent for U7E FT system. With Further investigation it was noticed that main flange gap of the TP1E is uneven and indication of leakage was observed in the flange. This trap TP1 E was replaced during P1671 as part of FHR project scope. This equipment was replaced as a whole assembly and the flange connection was part of factor assembly which was beyond Project QC process. This deemed to be a manufactoruing defect which could not be detected visully prior to installation.
4	N-2016-29839	Project 13-40976 P1671 7-35300-FM W, WIRING HARNESS REPLACEMENTS WO#2784133 DELAY - Contractor never showed up for scheduled work	Contractor never showed up for scheduled work at start of shift Waited for 2 hours for contractor ,and left. Changed work for the day to other duties.
5	N-2016-30599	Project 13-40976 Delay in P1671 Y Drive Brake Replacement Due to limited HOR resources	There was a delay in installation of Scaffolding in West side FM Service Room for replacement of the Y Brakes due to limited HOR resources. This caused a delay in release of the permit. This may jeopardize completion of the West sdie Y Brakes due to the limited work window.
6	N-2016-30661	Project 13-40976 P1671 7-35335-ROLLG SHD E: REPLACE FOR FH RELIABILITY PROJECT PO#237983-0001 WO#2885597 Delay to Six Shift	Task is progressing slower than expected/assessed, resulting ina a delay to the six shift. TCD to be determined.
7	N-2016-30744	Project 40976: FH Reliability Project- Y-drive Brake delays	the East & West Y-drive Brake replacement work had a number of delays that will prevent the completion of this work in the P1671 FH Outage Window

8	P-2016-20132	Rush CAT ID Creation to Support P1671 078 IFB Scope Project 13-40976	Lifting Beam was needed to lift the IFB Basket Loader from the fuel bay for reliability maintenance work during P1671. Projects recommended a beam in February 2016 but the need for a Tech Spec was identified, for which engineering needed to provide the weight of the basket loader. VERWEYC 2016/08/10 16:23 : Although the need for this lifting beam / cat'id was known in February - March of 2016. The 'late' identification of the need for this cat'id in Aug 2016 was as a result of the time it took for plant design to provide the information required to create the cat'id.
9	P-2016-23102	P1671 Project 13-40967 - TM Cateneries Replacement Challenge Meeting Attendance	A final challenge meeting was held in support of corrective actions from N-2016-06245 which is to be held prior to onboarding Trades. Fuel Handling, Outage, Fuel Handling Outage, E.S Fox and Field engineering were invite. Only Fuel Handling and Field engineering attended the meeting.
10	P-2016-24116	Project 13-40976 P1671 FH East Catenaries Replacement. DELAY - Airlock opening delay	(BFPP) Airlock opening to support Catenaries Replacement Project (WO 2914766) was not available Sept 22, 23 and half a shift on Sept. 26 due to higher piority work. Schedule impact 25hours.
11	P-2016-24190	Project 13-40976 P1671 FH East Catenaries Replacement Delay - Outage Issuing Authority not available	(BFCP) Outage Issuing Authority was not available causing backlog to all work groups trying to obtain working rights. Delayed carpenters getting into Rm115 to perform scaffolding task. Schedule delay 3 hours.
12	P-2016-24474	Project 13-40976 P1671 FH East Catenaries Replacement Delay	Support for shielding door opening was delayed. Schedule impact 1hour. Worker's progress with other work while HOR worked with shield door opening.
13	P-2016-25002	Project 13 - 40976 FH East Catenaries Replacement Delay - Shortage of booties.	BFPP) Shortage of booties outside of 254' AL had crew searching between U1-U8. Cost impact: 4 workers x 2 hours. 1 supervisor x 2 hours. Schedule impact: 2 hours.
14	P-2016-29548	P1671 - Outage Lessons Learned - Leakage from T/M Magazine Bearing Inspection Cover Gaskets After Prolonged Periods with T/M's in a Drained Status	During P1671 both T/M's were in a drained state for over 3 weeks to allow for reliability work. When work was complete T/M's were filled to allow PMT to progress. Both T/M's developed Magazine inspection cover gasket leaks.

15	P-2016-29572	FH Reliability Work - Proposed descope	Risk assessment was requested to de-scoped FH reliability work: Basket loader Ram replacements
16	P-2016-30394	P1671 Work Protection / Delay	Single Vault WPP for SFCR (PC2 #17593) SWAP to individual WPPs for West Vault (PC2 #17624) & East Vault (PC2 #17625) After Master Keyring OTOs were Applied & Verified, and before Issuing the WPPs... during a final review of PC1s, it was noticed that the Block isolations for West Bridge Brakes and East Bridge Brakes were not included on the individual PC2s.
17	P-2016-30990	P1671 Delay to Critical Path - 2 of 4 PC14s not approved to test	Work was ongoing on the U7 Y-drive brakes and the MA could not give "Approval to Test" for 2 of the PC14s that were required to be applied. These PC14s can not be applied until approval is given. The other 2 PC14s for the Snout clamp/D2O did progress as scheduled.
18	P-2016-31103	P1671 Breakplan - U7- 7E BALLSCREW TOP BEARING NE ALARM GI ON	WHILE ATTEMPTING TO DRIVE THE E BRIDGE UP TO THE DOWNSTOP POSITION, Y-DRIVE P3 TRIPPED OFF AND BALLSCREW TOP BEARING FAILED N.E. ALARM GI CAME IN. UNABLE TO DRIVE THE BRIDGE DUE PERMISSIVE BEING LOST, PLEASE INVESTIGATE AND REPAIR. COUPLING WORK WAS JUST PERFORMED FOR THE EAST VAULT. w/o # 05105588
19	P-2016-31223	P1671 7-35330-Bridge W coupling grease retaining o-ring not positioned as per design	During walk down of U7 West Fuelling machine Y drive couplings. Maintenance and engineering found a coupling grease retaining o-ring sitting loose on drive shaft.
20	P-2016-31225	P1671 7-35330-Y Drive E/W grease nipples left installed on couplings	During walk down of U7 West Fuelling machine Y drive couplings. Maintenance and engineering found grease nipples installed on couplings in both the East and West service room. As per manufacture instructions (document comes with the coupling components). These nipples can throw the balance of the rotating shafts. Instructions, found in NK30-MMM-35333-00005, states: Insert a grease fitting in one of the grease fitting ports and leave the second hole unplugged. Rotate the coupling until the grease fittings are horizontal. Use only coupling grease and inject the grease through the fitting until the recommended amount specified in Table-4 has been loaded into the coupling. Place the grease plugs in both fitting holes prior to placing the coupling in service. Grease plugs come with the coupling CATID.
21	P-2016-31226	P1671/PO#260629/Delay to 6 shift schedule.	Delay to schedule due to inoperability to west bride. Unable to install Trolley Platforms. MOHUNB 2016/12/23 05:41 : Ref. WO 4734298-14.

22	P-2016-31248	P1671 Unit 7 Delay to Near Critical Path, West Bridge Y Drive Inspection	Requested to place U7W Bridge in pretest condition to allow Y-drive inspection. While reviewing prior to ordering RTPT it was discovered a Test Tag removal step had been missed. A late PC1N to allow inspection after RTPT also required further clarification.
23	P-2016-31527	P1671 Seismically qualified man lifts.	Seismically qualified man lifts used in the vaults. Currently we are allowed to use a genie boom in the vaults to install life lines above the vault ACU's, change lights bulbs in the light fixtures, rescue workers off the bridge and replace PAR's filters in PAR's units. We can't de-grease ball screws or adjust jigsaw panels with a genie boom because its' not seismically qualified. The genie boom gets parked in the same spot as it would be parked to perform anyone of these functions. I've been told that in a seismic event they are afraid that the buck on the genie boon could hit the face. The chances of a seismic event are extremely low and if a bucket is up near the face there is a person in it. In an event our first action would be is to get the worker out of the genie boom and safe state the genie boom. The genie boom does not stay in the vaults when it's not being used. The only scissor lift that is seismically runs on propane and should not be used in containment due to the Carbon Monoxide that it produces this machine is made to be used outside. Let alone the plates that need to be installed over the bridge opening that is labor intense and extends the outage window due to critical path activities in the vaults. Currently the seismically skyjack is broken in the hallway and had to be dragged out of the AL with panel lifters. We have also left one jig-saw panel off for leak checks on O-7 and will require a scaffold at least 9 feet tall in both vaults to reinstall these

			panels after leak check is performed (extremely labor intense) while we have a genie boom sitting in the NAA
24	P-2017-06129	Project 13-40976 P1671 Thrust Bearing Late De-scope	The East Ball Screw Thrust Bearing U7 replacement was scheduled and workers were hired on for the work. Training of workers was conducted as well as readying a seismic scissor lift for use in the Unit 7 vault. A mockup exercise was conducted with the scissor lift in the Unit 2 vault to ensure it was adequate for use in Unit 7. All of the preparatory work incurred a cost of 200k to the project with no completed scope. The work was not completed due to performing ball screw cleaning in lieu of Thrust Bearing replacement.

ONTARIOPOWER GENERATION

Lessons Learned Report

Internal Use Only	
Document Number: P-LLD-35300-0670091	
Project Number: 13-40976	Project Execution Plan Number: NK30-PLAN-35300-00001
Revision: R000	

Title: **P1781-U8 FHR Project 13-40976 Execution Lessons Learned Report**

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P1781-U8 FHR Project 13-40976 Execution Lessons Learned Report

P-LLD-35300-0670091-R000

Project Number: 13-40976
PMP Number: NK30-PLAN-35300-000001

2017-11-24

Internal Use Only

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Revision Summary

Revision Number	Date	Comments
R000	2017-11-24	Initial issue

1.0 BACKGROUND/SUMMARY

The Fuel Handling systems at Pickering B are nearing their 40 year design life, leading to significant component obsolescence and end-of-life challenges.

Fuel handling system Single Point Vulnerability (SPV) equipment failures directly affect station performance objectives including unit shutdowns or de-ratings.

A review of the fuel handling systems based on INPO AP-913 Equipment Reliability Process was conducted to determine the scope of work required to return and maintain acceptable levels of reliability to the Pickering B fuel handling systems. The review identified equipment that is single point of vulnerability or equipment with a zero tolerance of unplanned failures. These components will be replaced by this project in the planned outages

This Lessons Learned Report collects the issues, events and successes experienced during the P1781 outage for the 13-40976 project.

The P1781 outage was an unbudgeted unplanned outage with no significant work being done in the vault. The organization took advantage of this opportunity and performed bridge thrust bearing replacements. This was the only project work in the outage.

The west side thrust bearings on Unit 8 are on the side that is used for the UDM (Universal Delivery Machine) during most outages. The UDM side receives increased load on the thrust bearings when the UDM is being used. Replacement of at least one UDM side set of thrust bearings was required in order to disposition the remaining units. This work was originally scheduled on critical path in the P1861 outage, however the opportunity to perform this work off of critical path in P1781 was used.

This work was brought into the P1781 outage by SMB (Senior Management Board) on July 18, 2017. Preparations had already begun for the P1861 thrust bearing replacement. Preparations were accelerated for the P1781 outage.

Several changes were made in preparation and execution of this work from past outages based on Opex from previous outage work:

- During the execution of this work the Outage Control Center was manned by a project person. This allowed for projects to be informed as to any schedule conflicts or other problems when they occurred and to be able to address them in a timely manor.
- A challenge meeting was held with representation from ES Fox, Fuel Handling maintenance, Operations, Engineering, and Projects. The challenge meeting was conducted using N-FORM-10903 with a Black Hat representative. A supplemental event free challenge form was also used which addressed items

not covered on the N-FORM-10903 but that might be pertinent to Fuel Handling work.

- Although mockup training has been performed in the past, an emphasis was placed on ensuring that vendor personnel focused on performing proper three way communication, as well as having a procedure reader who performed proper place keeping during the execution. This had a significant impact on the workers performing as a team.

- Fuel handling maintenance provided oversight support through the entire execution. This was beneficial in ensuring that the experience that fuel handling has was leveraged for this work. It also helped ensure smooth coordination between vendor activities and fuel handling activities.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Position	Roles/Responsibilities
Project Management	
Project Manager (PM) Ebraheem Waraich	Accountable for safe, procedure compliant and cost effective implementation of the project. Overall project responsibility and accountability to stakeholders.
Project Leader II Rathin Bagchi.	Accountable to Project Manager for schedule and budget adherence and for overall project support.
Project Engineer(s) (PE) Mike Hodges	Production of project engineering deliverables and overall project support
Fuel Handling Technical (SRE) Owen Clarke	Provide technical support related to the system as required.
Cost and Scheduling Analyst Ahmad Aliani	Accountable for overseeing the costs and updating of schedules and budgets
OPG Design	
Design Team Leader (DTL) N/A	Review and approve design documentation, provide design support for project execution and closeout.
FH Operations/Maintenance	
FH Operations Norman Ploeg	Provide operational support for permitry and field equipment / system.
FH Maintenance, FLM Gerry Doherty	Provide field execution support for the project.
OPG Field Engineering	
Field Engineering FLM Ray Naidu Project Technician-Mechanical Vic Fantin, Phil Landis	Preparation of ITPs and assessing. Provides Field Engineering support during execution.

3.0 LESSONS LEARNED

This lesson learned report covers the P1781 Fuel Handling Reliability Project execution during the P1781 outage. The P1781 outage began on October 6, 2017.

3.1 Lesson Learned – Scope and Schedule for execution.

The P1781 outage was an unbudgeted outage. The only fuel handling reliability work allowed into the outage was the replacement of the west side ball screw thrust bearings

Background:

Vault preparations were not planned as part of the P1781 scope. Vault preparations were not considered when making the determination as to whether to bring the thrust bearing work into the outage. There was some discussion as to whether the project would need to fund the vault preps. It was determined that it would be completed under the station budget. Planning for vault preps was delayed while determining who would be doing it.

The work was executed on a 7day schedule with 2X10 hour shifts. The schedule was developed based on Opex from the P1561 thrust bearing replacement. The schedule included 8 days to replace all four of the west side thrust bearings plus 2 days to perform bridge synchronization.

The replacement work completed 2 shifts ahead of schedule. There were several delays to the schedule which are documented in the SCR section of this report. The delays did not have a significant impact on completing the work per the plan.

3.1.1 Recommendations:

Proper mockup training allowed for the work to be completed ahead of schedule. Whenever possible mockup training should be used for any critical schedule sensitive work.

Continue the process of having the Outage Control Center manned during outages whenever there is significant project work being performed.

3.2 Lessons Learned Cost

The work finished approximately 20 hours ahead of schedule so there were no costs incurred due to schedule slip.

Prior to performing the mockup training the mockup facility was required to be relocated due to the space in the east warehouse no longer being available. The mockup facility was relocated to the Training Mockup Building at a cost of approximately 50K.

Unit 8 has higher radiation levels in the area of the thrust bearings than the other B side Units. Rad levels were also higher than would normally be seen due to the time after shutdown. Work was started shortly after the vault was opened. Due to the higher rad levels an additional 8 persons were hired on to ensure that adequate resources would be available if some personal were dosed out. An additional 150K was incurred as a result.

Following completion of the work 4 workers and 1 supervisor were retained for approximately one week. The P1781 High Pressure turbine work extended the outage by approximately 1 month due to indications found during inspection. At the request of Fuel Handling an attempt was made to put the east and west rolling shield work into the outage. Following SMB the work was not allowed in the outage. This incurred an additional 20K to the 13-40976 project.

3.2.1 Recommendations:

Moving mockup facilities from one place to another should not be required. If a mockup is installed it should be in a place that will not require it to be relocated.

Although the rad levels caused additional spend, the work went smoothly. The thrust bearing replacement was the only major vault work being done during the outage, so there were no schedule conflicts to deal with. Consideration should be made to including vault work into this type of outage in the future.

It took longer than expected, several days, to make a determination as to whether the rolling shield work would be brought into the outage. In the future holding resources should not be done without the added scope being approved.

3.3 Lessons Learned – Execution Schedule delay

Proper planning of the work with a good schedule, Outage Control Center representation and implementation of OPEX helped to ensure that there were no significant schedule delays.

Ensuring that all hoists, tooling, and other equipment is calibrated or inspected as required prior to use will help to minimize schedule delays in the future.

3.4 Lessons Learned – Resources

Resources were brought on early to ensure that adequate mockup training could be completed prior to execution. The mockup training contributed significantly to the work being conducted ahead of schedule with safety and quality. Approximately 2 weeks of mockup training was conducted. About half of the workers on the job were New to Nuclear personnel. The decision was made to dress them in plastics several times as part of their initial training. This allowed the workers to be comfortable using plastic suits prior to performing the thrust bearing work.

3.4.1 Recommendations

Mockup training allowed the workers to work as a team and practice not only the technical aspects of the job, but also the communications. Although it was a significant expenditure it helped ensure the work was done properly to nuclear

standards. Continue with mockup training whenever practicable. If a mockup is not possible for future work consideration should be made for dynamic learning in which the workers practice three way communication and procedure use and adherence.

3.5 Lessons Learned – Material

There were no issues around parts. All parts were verified against the Bill of Materials during the workplan writing. The only issue that arose during execution was the availability of a mobile crane for installation and removal of the seismic plates over the bridge opening. A crane was borrowed from IRI which was being used as contingency for the P1711 critical path work.

3.5.1 Recommendations

Ensure availability of mobile equipment and any other equipment that requires periodic calibration or inspection. Assume nothing.

3.6 Lessons Learned – Quality of construction

There were no quality issues with this work. All personnel were properly trained to ensure quality was maintained.

3.6.1 Recommendations

Continue with mockup training and event free challenge meetings whenever practicable.

4.0 COMMUNICATIONS PLAN FOR THE LESSONS LEARNED REPORT

This lessons learned report to be rolled out to the ES-MSA contractor.

5.0 CONCLUSIONS

Execution for this work went according to plan for Safety, Quality and Schedule. Project costs were elevated due to the need to bring on additional resources due to increased rad levels. Performing work without the need to coordinate with other work being done in the vault contributed significantly to a smooth execution.

Projects will continue to work closely with outage group to obtain an agreed level I schedule in advance to mobilize construction crews including OPG resources for optimal cost & schedule performances.

Appendix A: SCRs List Oct 09 to Oct 20, 2017

	SCR #	Title	Condition Description
1	N-2017-23589	Project 13-40976 P1781 Thrust Bearing Replacement Delay due to CO2 Alarm.	While inside the Serice room executing north thrust bearing replacement, CO2 alarm activated. Schedule impact 2 hours.
2	N-2017-23286	13-40976 P1781 8-35330-Thrust Brg. W: Replace for FH Reliability Six Shift Delay.	Work Groups (BFCP/BFEP) unable to access upper feeder cabinet walkway/ North & South Thrust Bearing platforms due to excessive ambient temperatures (+60 degrees) Delay to six shift 5 hours, work groups reallocated.
3	P-2017-23280	PO # 267998-001 Delay to six shift 6 ton Grove not working Wo# 5239431-16	6 ton Grove would not start and run properly causing delay to six shift. Notified OCC and line management
4	N-2017-23285	13-40976 P1781 8-35330-THRUST BRG W: FH RELIABILITY WO#2885530 Six Shift Work Delayed, Unplanned O/T Required.	Work group (BFCP) scheduled to begin task in Unit 8 West FM Vault @ 20:00 10/10/2017 (WO#2885530-17/21/51). Actual start time was 00:02 10/11/2017. This delay resulted in additional cost due to O/T in effort to reduce the delay to the schedule. Cost Impact HOR 1, GF 1, BFCP 1 FM, 2 Workers, BFLP 2 Workers - 3.5 Hours Double Time each.

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Lessons Learned Report

Internal Use Only	
Document Number: I-LLD-31100-50000	
Project Number: 41023, 49229	Project Execution Plan Number: [I-PEP-31100-50010]
Revision: R000	

Title: **LESSONS LEARNED REPORT - RECONFIGURATION OF PNGS UNIT 1 DURING P1211**

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Lessons Learned Report - Reconfiguration of PNGS Unit 1 During P1211

I-LLD-31100-50000-R000

Project Number: 41023, 49229
PEP Number: [I-PEP-31100-50010]

2013-04-26

Internal Use Only

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Title: **LESSONS LEARNED REPORT - RECONFIGURATION OF PNGS UNIT 1 DURING P1211**

Revision Summary

Revision Number	Date	Comments
R000	2013-04-26	Initial issue.

Lessons Learned Report

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Revision: R000	Page: 1

Title: **LESSONS LEARNED REPORT - RECONFIGURATION OF PNGS UNIT 1 DURING P1211**

1.0 PURPOSE

Phase 1 Reconfiguration of Pickering Unit 1 was executed during P1211. This involved installing newly designed positioning assemblies (PA) on 32 West Face sites. These were left unlocked until full reconfiguration of the unit is performed during P1411.outage.

Post Job review and lessons learned meetings were conducted on multiple occasions. This report documents the lessons learned from the Phase 1 reconfiguration executed during the P1211 outage and recommends necessary actions that are to be taken for Phase 1 reconfiguration during P1411.

2.0 BACKGROUND

During operation, Fuel Channels (FC) are subject to an environment of high flow rate, temperatures, pressures, and neutron irradiation. These stressors cause changes in the pressure tube (PT) dimensions and material properties. One major dimensional change of the PT is the axial elongation (creep), and it is addressed by Positioning Assemblies (PA) and FC bearings.

Elongation data analysis has showed that the bearing travel limit will be reached for Units 1 and 4 at 154,000 and 175, 000 Equivalent Full Power Hours (EFPH) respectively. Based upon current operation hours (Reference: N-PLAN-01060-10002, Rev. 10), it is projected that that the fastest growing fuel channels from U1 and U4 will "fall off-bearing" in August 2013 and July 2016, respectively.

Pressure tube axial elongation is life limiting for Pickering Units 1 & 4. Fuel channel maintenance activities (reconfiguration) are required in order to reach the planned service lives (2020) of PND Units 1 and 4.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Following table outlines the responsibility of the project organization

Inspection and Maintenance, Project Management Position	**Roles/Responsibilities**
Department Manager *John Stopar*	Accountable for implementation of project
Execution Manager, Section Manager *Dan Rolfe*	Accountable for safe execution during P1211.
Project Leader *Sid Tavares*	Primary interface with OPG Design Projects, Projects Design, Candu Energy Inc., ES Fox, IMS Reactor Maintenance Department .
Project Engineers *Hassan Hassan* *Roy D'Sousa* *Kevin Chui* *Daniel Lau*	Provide Engineering support and Technical Support as required during mobilization and execution. Also supported with the developments of tooling used.
Projects and Modifications	**Roles/Responsibilities**
Design Projects Kevin Jayawardene	Perform the Modification (MTL) Team Leader role
Projects design Asiff Butt	Perform the Design Team Leader (DRL) role.

4.0 LESSONS LEARNED

No.	Description of Lesson Learned Issue	Recommendations'/Actions
4.1	**Safety**	
4.1.1	Although there was no safety events during phase 1 reconfiguration, concerns have been raised on the method for craning the Greenlee cabinets that were used for storage of the positioning assemblies.	Recommendation is to acquire new cabinets that are designed with approved lifting points and can hold an optimum number of positioning assemblies.

No.	Description of Lesson Learned Issue	Recommendations'/Actions
4.2	**ALARA/ Dose Performance**	
4.2.1	The planned job dose target for the installation of new hardware was 2.5R. This was to have encompassed the installation of hardware on 56 lattice sites. The actual job dose received was 5.2R for installation of new PA's at 32 lattice sites. With the inclusion of job dose for the set-up and dismantling of the platforms the total job dose was 5.45R; platform job dose is shared amongst other work programs and can be estimated at 250mRem (25% of 1R). Reference Appendix A.	Recommendations to reduce total job dose are: 1. Optimize the PA design to permit faster installation. 2. Optimize the installation sequence. Possibly traverse the reactor face in Y direction movements and incorporate an assembly line installation. 3. Further optimize Overhead shielding structure to improve overall resistivity; incorporate side shielding 4. Further optimize and develop new tooling to increase efficiency and ability to work within the protection of the shielding. 5. Develop a new tool or revise the stud guide tube to permit installation of the stud with both sets of hex and jam nuts pre-installed. 6. Possibly develop a job specific shielding box. 7. Execute reconfiguration outside of heat sink 9 to permit the use of reactor face shielding. 8. Training of proper use of shielding.
4.3	**Schedule**	
4.3.1	The plan was to install new PA hardware at the 56 lattice sites requiring special yokes and ones with known interferences. As a result of technical difficulties and outage time constraints PA's have been installed at 32 lattice sites only. See reference [1] and sections 4.5 and 4.8 for details.	Recommendations to further optimize schedule efficiency are: 1. Reference recommendations from step 4.2.1 (1,2,3,4,5) 2. Revise I-MP-31120-50001 and prepare co-coordinating work-plan with optimized installation sequence 3. Ensure that all work order task assessment for all platform moves and configurations are completed.

No.	Description of Lesson Learned Issue	Recommendations'/Actions
4.4	**FME Control**	
4.4.1	There were two FME events during execution. Reference P-2012-18071. 1. An employee dropped a 0.100" shim of the west face. This shim was attached by lanyard to the tool cart. During its use the lanyard was dislodged from the cart and the shim was dropped while inboard of the E-face. This shim was successfully recovered but it did impact schedule. 2. Dropped a lower hinge pin.	Recommendations to further reduce the risk of FME events are: 1. Improve lanyard systems. The lanyard used during P1211 had been attached to the tool cart and during the reactor face activities these were strained leading to an FME event. 2. Include FME features in the Tool design. 3. Develop a new tool or revise the stud guide tube to permit installation of the stud with both sets of hex and jam nuts pre-installed.
4.5	**Procedures**	
4.5.1	The procedure was "REFERENCE" however treated like a "CONTINUOUS". • As a REFERENCE, the procedure need not be completed. • As a REFERENCE, Appendix B table should be converted into a form. • The FME tool checks should be converted to a Form.	Recommendations to remove Appendix B from I-MP-31120-50001 and develop a separate form to capture required information required to support execution phase activities (installation and commissioning).
4.5.2	Confusion existed as a result of last minute changes: • Measuring of the stud protruding OB of the yoke. • Tool names and assigned tool numbers are to be consistent and used for simple instruction. • Use of event free tools and the TCN process should be used to clearly communicate last minute changes.	Recommendation is for better use of event free tools.
4.5.3	Procedural alignment with Detailed Commissioning Specification (DCS). • The procedure lacked detailed steps to identify the stud hole. • Inconsistencies between the context of the procedure and what was to be recorded in Appendix B.	Reference recommendations from step 4.5.1.

No.	Description of Lesson Learned Issue	Recommendations'/Actions
4.5.4	The procedure did not explicitly define the detailed installation steps and sequences for installation at sites with known interferences.	Appendix B of this document includes recommended steps obtained from U2 activities performed post P1211. It is recommended these steps are incorporated into I-MP-31120-50001 as recommended steps to be taken.
4.5.5	It was determined the fit between the yoke and the EF grove was affected by crud on the EF groove.	Recommendation is that I-MP-31120-50001 should include step address crud.
4.5.6	Work-Plan: There was no co-ordinating P1211 work-plan for reconfiguration and repositioning. This led to incomplete assessing resulting in workers working outside of the protection of the shielding canopy.	Recommendation is to prepare coordinating work-plan for P1411.
4.6	**Mock-up Training at the TMB**	
4.6.1	Training was completed at the Pickering Tooling and Mock-up Building (TMB). The mock-up requires improvements to be more representative of the field conditions. These are: 1. E-Face position was not in alignment with the stud size 2. The feeders and their positions not representative of lattice sites with known interferences. 3. The mock-up positioning assemblies did not include all of the design features. This led to training and procedural development issues. 4. Only one person could be trained at one time. This led to insufficient training time.	Recommendations to improved training are: 1. Construct a more representative mock or perform training at U2. 2. Develop a training plan. 3. Acquire representative new positioning assembly mock-ups.
4.7	**Site Training** No issues as staff was augmented staff acquired via the Master Service Agreement.	

No.	Description of Lesson Learned Issue	Recommendations'/Actions
4.8	**Technical issues - New Positioning assemblies**	
4.8.1	It was confirmed during execution that a defined installation sequence at the lattice sites with known interferences is required. Installation was attempted at lattice site A12. This was not successful due to the 2" feeder and New PA that had been installed at lattice site B12. It should be noted that the C12 feeder runs between A12 and A13 and poses fit restrictions. These are: • A12 end fitting groove to C12 feeder clearance checked at 1-3/4" inches. • A13 end fitting groove to C12 feeder clearance checked at 1".	Recommendation are: 1. For installation at A12, remove the PA installed at B12, then install the PA at A12 followed by the re-installation of the PA at B12. 2. EF jacking is required as defined in sequence in Appendix B of this document.
4.8.2	The new positioning yoke have been designed to fit on the nominal dimension of the EF seat. At numerous lattice sites, these yokes did not fit by the fact that the yokes could not be fully closed.	The recommendation is to have yokes designed to extreme tolerances.
4.8.3	Reference SCR N-2012-05705. It was found at lattice site PNGS U1D11W that the PA stud was not able to completely bottom out on the spot face. It is estimated that the gap between the shoulder of the stud and the spot-face was 1/8". Reference Appendix D.	Recommendations are: 1. A contingency design will be developed. This will involve a new washer that could be installed on the end of the stud to fill the gap between the stud and tube sheet. 2. Minor redesign to the stud is being examined to reduce the number of threads by one possibly two to shorten the treaded section.

No.	Description of Lesson Learned Issue	Recommendations'/Actions
4.8.4	During engagement of the stud into the tube sheet hole, an excessive manual installation torque was applied. To overcome this, the tube sheet hole was chased with a tap. This additional step was not planned for and as such significantly increased the planned time for installation. As a result of this, additional testing using identical positioning assemblies have been performed at unit 2; it was discovered that the studs were engaged into the tube sheet holes with minimal effort. OPG has further investigated the tube sheet "stake" marks (using the video taken during west face work during P1211 and pictures taken from unit 2 walk-down) that are located around the perimeter of the tube sheet threaded hole and serve the purpose of a secondary locking feature. It was discovered that there are differences with these features; some tube sheet holes have 3 and some have 4 stake marks. From visual examination it appears that the depth of the stake mark may vary. (See Appendix C.)	Recommendations are: 1. Design to ensure that the manufactured threads comply to the requirements of a 2A thread type. 2. Design to investigate if the tolerance of the tube sheet threads can be reduced from a 2A to a 1A (thread of the tube sheet hole is a 3A). 3. Design to determine if the hardness of the stud material could successfully cut through the tube sheet threaded hole with the application of an acceptable installation torque.
4.8.5	Cotter pin A concern was identified that the cotter pin may flip over so that the curved part of the cotter pin is not engaged with the hinge pin curvature. If this happens, it has been observed that the effort required to disengage the cotter pin from the hinge pin is significantly less. A mitigating installation action may be to apply a slight bend or curvature to the straight leg of the cotter pin. This has been tested on the mock-up PA with very good success. Please consider this information to support an installation solution to this condition.	Recommendations are: 1. A mitigating installation action taken was slight bend or curvature to the straight leg of the cotter pin was applied for the positioning assembles installed during P1211. 2. Perform a minor design change to replace the hinge pin design with a bendable cotter pin.
4.8.6	On the east face of Unit 1, it should be noted that there is only one C-clamp	Recommendations are:

No.	Description of Lesson Learned Issue	Recommendations'/Actions
	mounted on each positioning assembly (NA44-GAEN-31120-00069-U1). There are locations on the Reactor face where the positioning assembly C-clamp is located either on the upper or lower stud of an end fitting. For a small number of end fittings, for access purposes, the C-clamp has been positioned on the upper stud. Also, a very small number of C-clamps (it has unofficially reported less than 5) may have restricted access, as they may be behind the feeder coupling port.	1. Perform a review of existing Reactor face photos to determine if this is indeed the case and to identify those lattice sites. 2. Develop tooling with capability to manipulate the positioning that has direct interference from SSC (feeders).
4.9	**Technical issues - Tooling**	
4.9.1	Measurements taken using the vernier caliper not efficient. A tool to quickly measure the stud length outboard of the yoke is required.	Recommendation: Develop a tool to quickly measure the stud length outboard of the yoke is required.
4.9.2	Optimization of the stud guide tube is required ;	Recommendations to optimize the Stud Guide tube are: 1. Incorporate a feature to insert camera. 2. Incorporate a feature to assist in identifying clock position 3. Incorporate a feature to accommodate the IB & ON jam nuts. 4. Increase the strength characteristics of the tool; use stronger material or incorporate features to increase strength. 5. Shall be used in conjunction with a stud handling tooling (Feature to support stud on thread portion and engage with hex head).

No.	Description of Lesson Learned Issue	Recommendations'/Actions
4.9.3	The camera system was inadequate to effectively reference the tube sheet hole to the end-fitting E-face.	Recommendations to optimize the camera systems are: 1. Easily inserted to ensure that stud shoulder is in contact with tube-sheet. 2. Can be used to easily identify designated tube sheet hole. 3. Incorporate tooling with cameras. 4. Durable. 5. High Definition.
4.10	**Permitry** Platform moves may impact critical path.	Ensure that all required platform moves are configuration changes are properly assessed.
4.11	**Equipment**	

5.0 SCR SUBMITTED TO DOCUMENT EVENT

SCR Number	Category	Status	Titles and Description	Actions Taken/Comments
N-2011-06711	D-4	C	Project 49247: Total requisition value of PO 0210959 increased by more than 50%.	Work scope planned for Phase 2 brought into Phase 1 in order to expedite the design work. This was required as the design agency required more time to work on Phase 2 proposal.
N-2012-00692	D-4	C	MDR submitted by Candu Energy Inc. for OPG approval does not address accepted comment disposition (PJ 13-49247, Master EC 115276)	The Design Agency's section head / DTL has been coached about paying attention to the quality of design and attention to details.
N-2012-01504	D-4	C	MDR submitted by Design Agency (Candu Energy Inc.) for OPG approval has quality issues (PJ 13-49247, Master EC 115276) After completing the second round of review and comments process, the revised Modification Design Requirements, NA44-MDR-31120-00001, is submitted by external design agency (Candu Energy Inc.) for OPG approval. While performing final quality check by OPG for getting the MDR ready for OPG approval following discrepancies were discovered.	The Design agency team has been coached to pay attention to details. The document has been revised to fix the discrepancies. No further action is required via the SCR process. The SCR has been filed for trending purpose and can be closed as D-4.
N-2012-01668	D-4	C	Due to schedule constraints, the design agency (Candu Energy Inc.) has released the tech spec, NA44-TS-31120-10002 to OPG for acceptance. Prior to completion of the Design Specification (DS), NA44-DS-31120-00003 and the Modification Design Requirements, NA44-MDR-31120-00001. This was due to the long lead-time of the procurement (manufacturing and supply) of the Positioning assembly hardware.	Discussed with supervisor, project leader and design Stratum IV manager.
N-2012-01757	D-4	C	OPG acceptance of design agency drawings for initiating procurement process, Deviation from N-PROC-MP-0078, Sec 1.8.3 (a).	This SCR is to document the deviation from normal process of accepting the vendor's/ Design agency documents. Stratum IV approval has been obtained for this deviation. No action is required via SCR process.

SCR Number	Category	Status	Titles and Description	Actions Taken/Comments
N-2012-02915	D-4	C	Pickering A Positioning Assembly manufacturing drawings issued by Candu energy Inc represent intermediate design stage (PJ:13-49247). "During the final check of the stud drawings, it was determined that the finalized calculated lengths are inconsistent with what was stated in our Design report for 2 of the stud lengths. In carrying out an evaluation to address this, a case which had not been addressed for provisional registration was found to be more limiting". As a result of this issue the drawings issued to OPG for acceptance now do not include two longest stud types required for the PAs. CEI is now planning for a future design update/revision to deal with this issue. In addition, CEI has identified that there are more design features that will be changed in the final PA design. This will eventually impact manufacturing drawing of the PAs.	The design agency is aware of the gaps and is working on completing all the additional details that are required. The drawing will be accepted with conditions stating that it is limited to the first batch of say 50 assemblies for interim work during fall outage. The drawing will be revised by design agency before EC acceptance if there are any other changes necessary for issuing the design package. This SCR is for documenting the gap.
N-2012-02958	C -3	C	Reconfiguration Project 13-4_Material specified for positioning assembly yoke did not meet ASME Sec III Div1 NF-2331 requirement. (MEC 115276.)	1. Design agency developed resolution plan. 2. Testing of material to confirm toughness was performed. 3. Alternate materials selected. 4. Revised technical specification. 5. Revised purchase order.
N-2012-04247	D-4	C	Approved exception to deviate from N-GUID-00700-10001 COMS Process, PJ 13- 49247 DA: Candu Energy Inc N-GUID-00700-10001, R00 Appendix A requires that all participants should have successfully taken or re-taken PEL 69916 "COMS Process" within the 12 months prior to the COMS meeting.	Obtained Stratum IV manager approval, for deviation from N-GUID-00700-10001, Guide for COMS Process, Appendix A, requirement re PEL 69916 for CEI staff and initiated this SCR.
N-2012-05511	D-4	C	Design Agency-AECL OPG ECC guide, N-GUID-00700-10000 requires that Design EC revision should be completed and set to APPROVED within 2 working days of FICREQ approval. OPG Strat IV manager approval has been obtained to deviate from the 2-day timeline so that Design EC 117729 will be revised after the PA installation is complete in the P1211.	SCR is for documenting the deviation from N-GUID-00700-10000.

SCR Number	Category	Status	Titles and Description	Actions Taken/Comments
N-2012-05703 P-2012-18285	D-4 NE	C C	During P1211 Reconfiguration PA Hardware execution a number of target site installations were found to have had a larger gap than the tolerance indicated in step 4.2.28 of I-MP-31120-50001 R001. This caused a non conformance issue with the Inspection & Test Plan (272765239-19). The following sites were found to be in non conformance: C12, C13, D12, E12, L12, M12, N11, & R12.	Target sites were quarantined as per step 4.2.28 (condition III) of I-MP-31120-50001 R001 and no hardware installed. Certificate of Qualification holder (B&W) asked to provide a Non-conformance report for addition to the ITP Package. Reference I-CORR-31120-0451616 for disposition of NCR 6852 corresponding to ITP 2765239-19.
N-2012-05704 P-2012-18288	D-4 NE	C C	During P1211 Reconfiguration PA Hardware execution a number of target site installations could not be installed. The Yoke was not able to completely close on the End Fitting and/or the pin could not be installed due to this condition. This caused a non conformance issue with the Inspection & Test Plan (2765239-19). The following sites were found to be in non conformance: A12, E11, K12, P11, & R11.	Target sites were quarantined and no hardware was installed. Certificate of Qualification holder (B&W) asked to provide a non-conformance report for addition to the ITP Package.
N-2012-05705	D-4	C	During P1211 Reconfiguration PA Hardware execution a target site assembly could not be installed. The PA stud was not able to completely bottom out on the spot face as per step 4.2.7 and 4.2.8 of I-MP-31120-50001 R001. This caused a non conformance issue with the Inspection & Test Plan (2765239-19). The following site was found to be in non-conformance:D11.	Target site was quarantined and no hardware was installed. Certificate of Qualification holder (B&W) asked to provide a Non-conformance report for addition to the ITP Package.
N-2012-05707	D-4	C	During a review of Inspection & Test Plan #2765239-19 material data package, it was observed that two of the 150 PA Hardware Hex Nuts delivered have the same serial #. One of the PA assemblies is installed on U1 West at N11. The other assembly was not installed, and is identified for installation on B15.	P/A assembly identified for installation on B15 inspected and verified to contain a hex nut with the S/N 144, as described in the ITP package. Certificate of Qualification holder (B&W) asked to provide a Non-conformance report for addition to the ITP Package.

SCR Number	Category	Status	Titles and Description	Actions Taken/Comments
P-2011-11123	C3	C	Insufficient Information Provided to EDM Meeting on Fuel Channel Reconfiguration During the engineering decision making (EDM) meeting held on 28 April 2011, agreement was obtained from the quorum members that reconfiguration is the preferred technical alternative to address fuel channel elongation when compared to repositioning. During this meeting, aside from feeder clearance issues, no other issue was identified that had an impact on feeders from reconfiguration. Since then it has been found that the minimum feeder wall thickness is different for free and fixed ends and, as such, has potential implications on feeder life because the fixed end has smaller minimum wall thickness requirements.	Assess the effect of changing the fixed end of the fuel channel on feeder stresses and, consequently, revise the feeder replacement schedule for Units 1 and 4 to EoL. Based on this assessment determine if reconfiguration remains as the preferred technical alternative to address fuel channel elongation when compared to repositioning.
P-2012-18071	D-4	C	P1211 - FME event, dropped 0.100" Shim West Face During P1211 - Reconfiguration, a 0.100" shim was dropped down the West reactor face at H12 row while working on Maintenance Platforms. 0.100" shim was tethered to the Maintenance platform, attached by a tie wrap. While utilizing the shim, the tie wrap gave way and the shim was dropped.	Attempted to locate FME was successful.

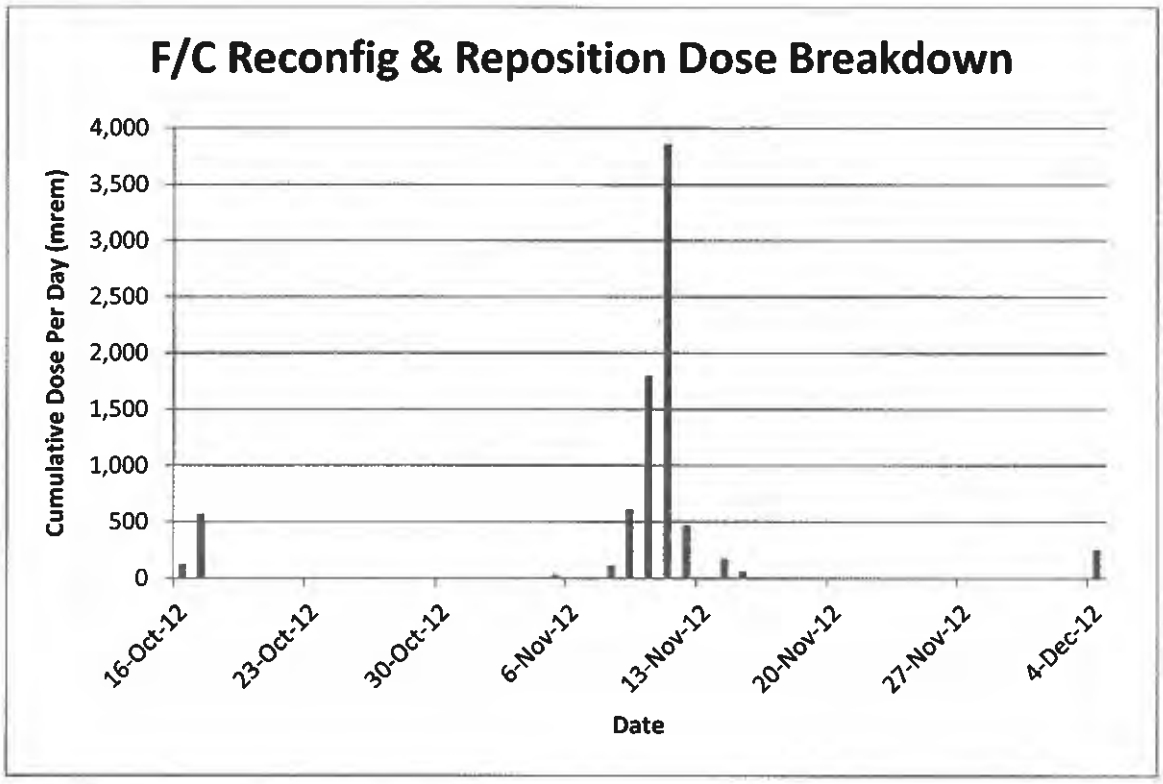
6.0 ACTION REQUESTS TO IMPLEMENT CHANGES

Outstanding design actions to be taken are captured in the issue and tracking file associated with MEC 115276. All actions associated with execution during P1411 shall be captured under AR 28155214.

Appendix A: Total Job Dose Data

Date	Dose (mrem)	
16-Oct-12	123	693
17-Oct-12	570	
1-Nov-12	2	7135
5-Nov-12	30	
7-Nov-12	1	
8-Nov-12	115	
9-Nov-12	614	
10-Nov-12	1798	
11-Nov-12	3860	
12-Nov-12	469	
13-Nov-12	6	
14-Nov-12	174	
15-Nov-12	65	
24-Nov-12	1	
4-Dec-12	255	255
TOTAL	8083	

The table includes does for installation/removal of platforms and repositioning of fuel channels on the east face of unit 1


F/C Reconfig & Reposition Dose Breakdown
Cumulative Dose Per Day (mrem)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
16-Oct-12
23-Oct-12
30-Oct-12
6-Nov-12
13-Nov-12
20-Nov-12
27-Nov-12
4-Dec-12
Date

Appendix B: Steps for installation of new PA at sites with known interferences

1. **Step to install the New positioning assembly at Pickering Unit 2, site A12:**

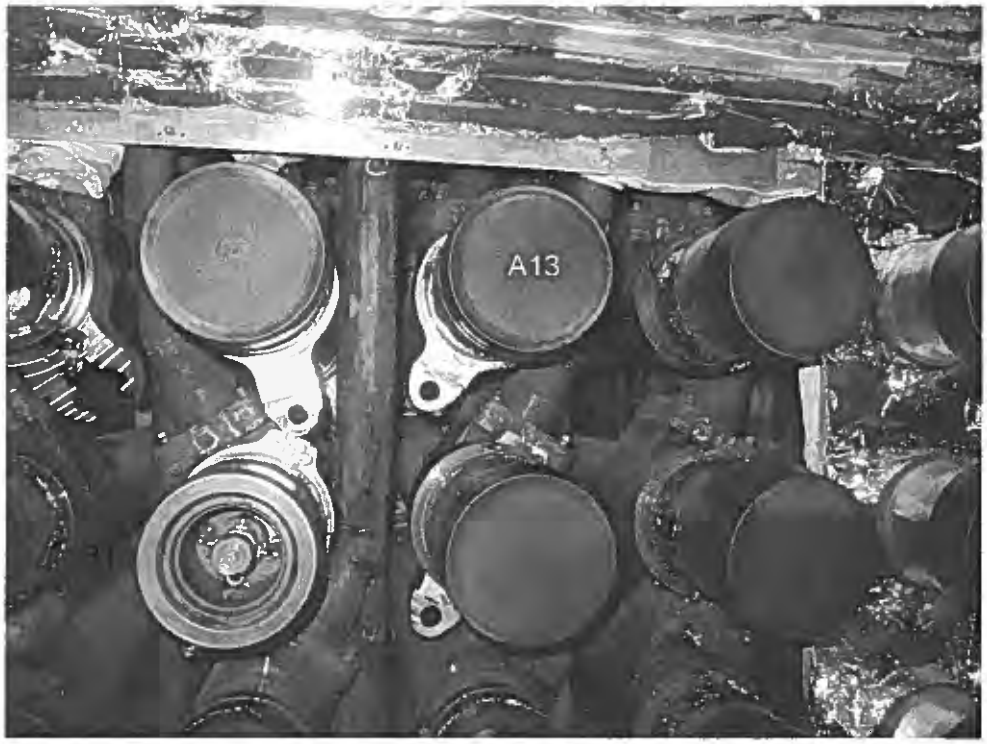
Figure

I. PA on B12 must be installed subsequent to this site.
II. Install EF jacks between C11 and C12.
III. Split the yoke and install the male section with the lower tongue positioned at approximately 7-8 o'clock.
IV. Install the female section of the yoke and position to insert the upper hinge and cotter pin.
V. Rotate the yoke counter clockwise so that the tongue is positioned at approximately 5 o'clock aligned with the assigned tube sheet hole; to permit the PA to pass above the EF from lower site open the tongue and rotate at the same time.

VI. To install the stud:
   a. Open the tongue partially.
   b. Install the stud guide tube through the tongue section of the PA.
   c. Align SGT with tube sheet hole.
   d. Insert and install stud.
   e. Remove SGT and then install IB nuts.
   f. Close the tongue section of the yokes and insert the lower hinge and cotter pins.

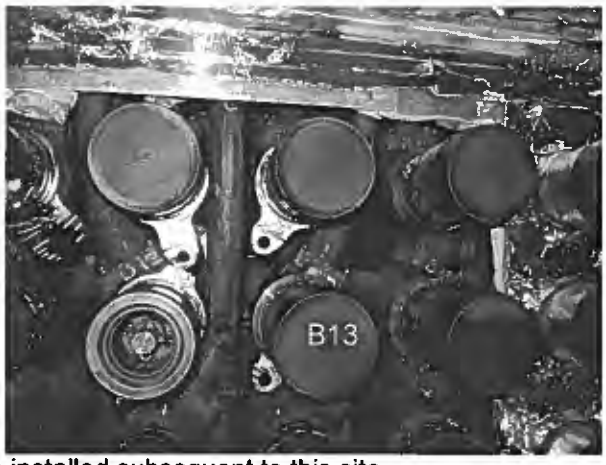
g. Install the OB nuts and torque.

2. **Steps to install the New positioning assembly at Pickering Unit 2, site B12:**



I. Install EF jacks between C11 and C12.
II. Split the yoke and install the female section with the lower tongue positioned at approximately 7 o'clock.
III. Install the male section of the yoke and position to insert the upper hinge and cotter pin.
IV. To install the stud:
   a. Open the tongue partially.
   b. Install the stud guide tube through the tongue section of the PA.
   c. Align SGT with tube sheet hole.
   d. Insert and install stud.
   e. Remove SGT and then install IB nuts.
   f. Close the tongue section of the yokes and insert the lower hinge and cotter pins.
   g. Install the OB nuts and torque.

3. **Steps to install the New positioning assembly at Pickering Unit 2, site A13:**



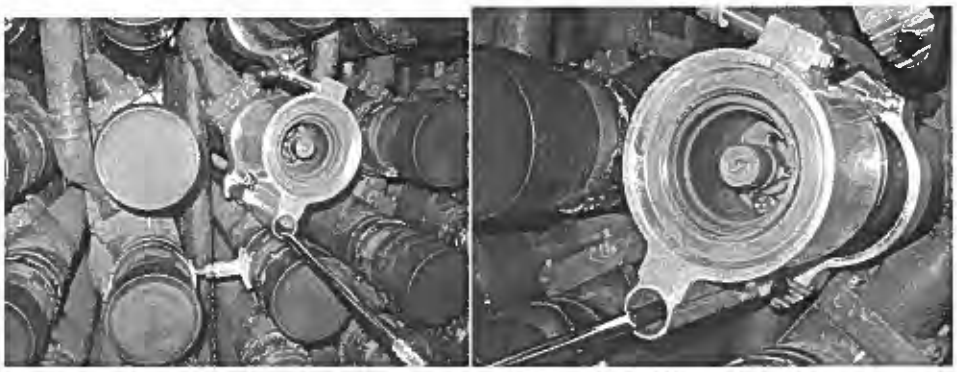
I. PA on B12 must be installed subsequent to this site.
II. Install EF jacks between C12 and C13.
III. Split the yoke and install the female section with the lower tongue positioned at approximately 5 o'clock.
IV. Install the female section of the yoke and position to insert the upper hinge and cotter pin.
V. Rotate the yoke counter clockwise so that the tongue is positioned at approximately 7 o'clock aligned with the assigned tube sheet hole; to permit the PA to pass above the EF from lower site open the tongue and rotate at the same time.

VI. To install the stud:
   a. Open the tongue partially.
   b. Install the stud guide tube through the tongue section of the PA.
   c. Align SGT with tube sheet hole.
   d. Insert and install stud.
   e. Remove SGT and then install IB nuts.
   f. Close the tongue section of the yokes and insert the lower hinge and cotter pins.

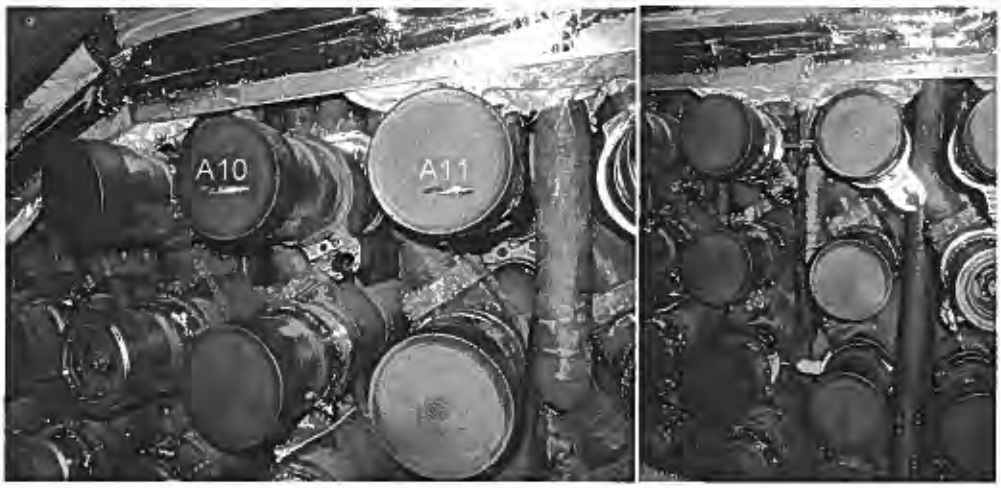
g. Install the OB nuts and torque.

4. **Steps to install the New positioning assembly at Pickering Unit 2, site B13:**

I. Install EF jacks between C12 and C13.
II. Split the yoke and install the female section with the lower tongue positioned at approximately 5 o'clock.
III. Install the male section of the yoke and position to insert the upper hinge and cotter pin.
IV. Rotate the yoke clockwise so that the tongue is positioned at approximately 7 o'clock aligned with the assigned tube sheet hole; to permit the PA to pass above the EF from lower site open the tongue and rotate at the same time.
V. To install the stud:
   a. Open the tongue partially.
   b. Install the stud guide tube through the tongue section of the PA.
   c. Align SGT with tube sheet hole.
   d. Insert and install stud.
   e. Remove SGT and then install IB nuts.
   f. Close the tongue section of the yokes and insert the lower hinge and cotter pins.
   g. Install the OB nuts and torque.



5. **Steps to install the New positioning assembly at Pickering Unit 2, site A10:**



I. Install EF jacks between C10 and C11 and between A10-A11.
II. Split the yoke and install the male section with the lower tongue positioned at approximately 7 o'clock.
III. Install the male section of the yoke and position to insert the upper hinge and cotter pin.
IV. Rotate the yoke clockwise so that the tongue is positioned at approximately 5 o'clock aligned with the assigned tube sheet hole; to permit the PA to pass above the EF from lower site open the tongue and rotate at the same time.
V. To install the stud:
    a. Open the tongue partially.
    b. Install the stud guide tube through the tongue section of the PA.
    c. Align SGT with tube sheet hole.
    d. Insert and install stud.
    e. Remove SGT and then install IB nuts.
    f. Close the tongue section of the yokes and insert the lower hinge and cotter pins.
    g. Install the OB nuts and torque.

6. **Steps to install the New positioning assembly at Pickering Unit 2, site B10:**

I. Install EF jacks between C10 and C11 and between B10-B11.
II. Split the yoke and install the male section with the lower tongue positioned at approximately 7 o'clock.
III. Install the female section of the yoke and position to insert the upper hinge and cotter pin.
IV. Rotate the yoke clockwise so that the tongue is positioned at approximately 7 o'clock aligned with the assigned tube sheet hole; to permit the PA to pass above the EF from lower site open the tongue and rotate at the same time.
V. To install the stud:
    a. Open the tongue partially.
    b. Install the stud guide tube through the tongue section of the PA.
    c. Align SGT with tube sheet hole.
    d. Insert and install stud.
    e. Remove SGT and then install IB nuts.
    f. Close the tongue section of the yokes and insert the lower hinge and cotter pins.
    g. Install the OB nuts and torque.

7. **Steps to install the New positioning assembly at Pickering Unit 2, site A11:**

I. Install EF jacks between C11 and C12 and between A10-A11.
II. Split the yoke and install the male section with the lower tongue positioned at approximately 7 o'clock.
III. Install the female section of the yoke and position to insert the upper hinge and cotter pin.
IV. Rotate the yoke clockwise so that the tongue is positioned at approximately 5 o'clock aligned with the assigned tube sheet hole; to permit the PA to pass above the EF from lower site open the tongue and rotate at the same time.
V. To install the stud:
    a. Open the tongue partially.
    b. Install the stud guide tube through the tongue section of the PA.
    c. Align SGT with tube sheet hole.
    d. Insert and install stud.
    e. Remove SGT and then install IB nuts.
    f. Close the tongue section of the yokes and insert the lower hinge and cotter pins.
    g. Install the OB nuts and torque.

8. **Steps to install the New positioning assembly at Pickering Unit 2, site B11:**

I. Install EF jacks between C11 and C12 and between B10-B11
II. Split the yoke and install the male section with the lower tongue positioned at approximately 7 o'clock.
III. Install the female section of the yoke and position to insert the upper hinge and cotter pin.
IV. Rotate the yoke clockwise so that the tongue is positioned at approximately 5 o'clock aligned with the assigned tube sheet hole; to permit the PA to pass above the EF from lower site open the tongue and rotate at the same time.
V. To install the stud:
    a. Open the tongue partially.
    b. Install the stud guide tube through the tongue section of the PA.
    c. Align SGT with tube sheet hole.
    d. Insert and install stud.
    e. Remove SGT and then install IB nuts.
    f. Close the tongue section of the yokes and insert the lower hinge and cotter pins.
    g. Install the OB nuts and torque.

9. Steps to install the New positioning assembly at Pickering Unit 2, V-12

It was discovered during U2 activities performed with the intent of refining the installation sequence that an interference exists between V11 and the PA installed above at U11; U11 was installed during the interim phase during P1211. As such and to permit installation of the PA at V11 during P1411 without having to remove the existing PA from lattice site U11 install as prescribed below:

1. Install Stud.
2. Split the yoke apart.
3. Orientate both halves of the yoke above the end fitting seat such that the upper hinge pin can inserted from the behind; to get the top hinge pin there is difficulty due to the feeder directly behind it.
4. Once the upper hinge pin is installed, continue with the normal sequence.

Appendix C: Tube sheet stake marks

Picture 1: Three stake marks, East face of PNGS Unit 2.

Picture 2: Three stake marks, West face of PNGS Unit 1.

Picture 3: Multiple stake marks, west face of PNGS Unit 1.

Picture 4: Four stake marks, west face of PNGS Unit 1.

Appendix D: Gap between shoulder of stud & tube sheet spot-face at PNGS U1D11W

Figure 5: Gap between the shoulder of the stud and the tube-sheet spot-face. Using this picture and AGS tubing pigtail as a reference being 1/4", it can be estimated that the gap that existed is significantly about 1/8".

ONTARIOPOWER GENERATION

Lessons Learned Report

Internal Use Only
Document Number: I-LLD-31100-50001
Project Number: 13-41023
Revision: R000

Title: LESSONS LEARNED REPORT - RECONFIGURATION OF PNGS UNIT 1 DURING P1511

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LESSONS LEARNED REPORT - RECONFIGURATION OF PNGS UNIT 1 DURING P1511

I-LLD-31100-50001-R000

Project Number: 13-41023

2015-09-03

Internal Use Only

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FIGURE 2: WORK DOWN CURVE – UNLOCKING OLD PAS AND FINAL LOCKING 19

FIGURE 3: RECONFIGURATION EXECUTION, RADIATION DOSE VS. PLAN 20

Revision Summary

Revision Number	Date	Comments
R000	Sept. 03/15	Initial Issue.

1.0 PURPOSE

Phase 2 Reconfiguration of Pickering Unit 1 was executed during P1511. This involved the installation of the remaining Positioning Assemblies (PAs) along with full face reconfiguration. For this, the current free end (West face) PAs were partially locked, followed by the unlocking of the PAs on the opposite face (East face), and then final locking on the West face (new fixed end). Contingency shifting was not required for any site.

Post Job reviews and a lessons learned meeting were conducted. This report documents the lessons learned from the Phase 2 Reconfiguration executed during the P1511 outage and recommends necessary actions that are to be taken for Unit 4 Reconfiguration during P1641.

2.0 BACKGROUND

During operation, Fuel Channels (FC) are subject to an environment of high flow rate, temperatures, pressures, and neutron irradiation. These stressors cause changes in the Pressure Tube (PT) dimensions and material properties. One major dimensional change of the PT is the axial elongation (creep), and it is addressed by PAs and FC bearings.

PT axial elongation is life limiting for Pickering Units 1 & 4. FC maintenance activities (reconfiguration) are required in order to reach the planned service lives (2020) of PND Units 1 and 4.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Inspection and Maintenance, Project Management Position	Roles/Responsibilities
Department Manager *Graham MacDonald*	Accountable for implementation of project
Project Leader *Sid Tavares*	Primary interface with OPG Design Projects, Projects Design, Candu Energy Inc., ES Fox, and IMS Reactor Maintenance Department
Project Engineers *Kevin Chui* *Kevin Meade* *Dan Kuchar* *Rob Harness*	Provide Engineering support and Technical Support as required during mobilization and execution, Also supported with the developments of tooling used.
Result Coordinators *Jonathan Tenjak* *Brian Down* *Craig Freeburn* *Dave Dudley*	Independently monitor and verify completion of Work Packages. Also provide Shift Update/Status Reports, Logging of Delays, and Filing of SCRs.

Projects and Modifications	Roles/Responsibilities
Design Projects *Kevin Jayawardene*	Perform the Modification Team Leader (MTL) role
Projects design *Asif Butt*	Perform the Design Team Leader (DTL) role.

4.0 LESSONS LEARNED

No.	Description of Lesson Learned	Recommendations/Actions
4.1	**Safety**	
4.1.1	Contractor had a few Health/exhaustion events where EMS was called. Reported high air temperatures from the breathing air in their suits.	Coordinate with outage to ensure ACUs are running during Unit 4 Reconfiguration. Waiting outside the vault in a plastic suit zipped up with no air longer than 30 minutes may increase chance of heat exhaustion. Review the trades work schedule and determine if additional scheduled days off are in order.
4.1.2	There were numerous trip hazards/obstructions at times in between the Rolling shield and the platform.	Add task to U4 schedule to create a walkway over each Rolling Shield.
4.2	**ALARA Dose Performance**	
4.2.1	The new canopy allows for easy installation/removal and provided excellent dose protection.	Continue use for Unit 4.
4.2.2	The dose from U2 training was not included in the ALARA Plan.	Dose projections for U3 training needs to be added to the P1641 ALARA plan. Ensure trades personnel informed in advance for dose associated with training.
4.2.3	Have dedicated head sets for U4. Borrowing from Teledose meant limited use/availability.	Investigate buying headsets dedicated for Reconfiguration activities.

No.	Description of Lesson Learned	Recommendations/Actions
4.2.4	Due to the extra platform moves the IMS workers received higher than expected dose.	Factor more platform moves into the ALARA plan for P1641 IMS workers.
4.3	**Schedule**	
4.3.1	Having 3 Project Technicians on weekends posed problems if one called in sick or had time off.	Investigate having 4 Project Technicians on shift during weekends.
4.3.2	Having 4 Eng/Tech personnel on some shifts and 2 on other shifts was inconsistent and posed coverage problems.	Investigate having 3 Eng/Tech personnel on each shift (2 Technical Officers and 1 Shift Coordinator). The shift coordinator could coordinate between IMS, Contractor, and Outage and also provide backup technical coverage.
4.3.3	There were multiple shift logs sent out each shift causing confusion amongst work groups and the OCC.	Have one consolidated Shift Log amongst FLMs, PTs, and Engineers with accurate and verified data. Determine in advance what data the OCC requires from IMS and/or the constructor.
4.3.4	Sometimes Short on Forklift Operators and Yellow RP qualified personnel.	Ensure more Forklift Operators and Yellow RP qualified personnel available during training/execution.
4.3.5	There were different turnover times for the BTU holders and workers. This caused delays. Later in the execution these were aligned.	Ensure turnover times for all work groups are aligned prior to execution.
4.4	**FME Control**	
4.4.1	Tape on the tools indicating they were “reactor ready” sometimes came off.	Use paint sticks or some other definite means of tracking “reactor ready” tools.

No.	Description of Lesson Learned	Recommendations/Actions
4.4.2	Some FME capture devices were not trained on/developed later.	Ensure all aspects of FME control are covered during training.
4.5	**Procedures**	
4.5.1	Some Project Technicians used the working copy of the ITP and others used the master copy. This caused confusion when reading through the master copy for verification.	Only have one Master ITP with the Channel # as the Page #. When the window sequence is defined, inject tabs into binder with the windows to make searching for the channel easier.
4.5.2	Use of N-FORMs by Constructor missed a lot of circle/slashes and/or checkboxes.	Emphasis during training and throughout execution on paper work expectations. Verify completion after each reader rotation and ensure proper turnovers. Investigate including a PEV for readers.
4.5.3	Linking the N-Forms to the ITP for completion assurance worked well. Synchronization with the Work plan needs to be improved.	Investigate how to better link the N-Forms to the Work plan. Procedures should also include more detail (checklist) about what to confirm during final inspection.
4.5.4	Update FME guideline to identify Constructor as owner of FME prevention.	Continue to improve on the design of tools with FME integrated into the design. FME capture (i.e. blankets, tethers, etc.) should be owned by the constructor.
4.5.5	The safe work plan did not accurately reflect U1 Reconfiguration activities.	Revise Safe Work Plan for U4.
4.5.6	End fitting jacking requires a procedure.	A procedure is currently in development.
4.5.7	Some advice from technical support/PTs was ignored. Limited use of 3-way communication.	Ensure there is clarity and group practice in advance of execution on how to address quality concerns with readers and trades paperwork. Investigate

No.	Description of Lesson Learned	Recommendations/Actions
		having an engineer on one of the headsets.
4.6	**Mock-up Training at the TMB / Site Training**	
4.6.1	Some mechanics/PTs were confused with the loading plan. Changes in the window order also caused confusion.	For Unit 4 reconfiguration training incorporate more training for the tool/cart loading prior to execution. Incorporate plan for broken/unused tool management. Perform training using IMS Trailer before execution to simulate better field conditions. Try to stick to the planned sites during execution.
4.6.2	There was confusion when it came to roles and responsibilities for camera setup/maintenance.	Incorporate camera training/setup in Unit 3. Develop a video setup/maintenance plan with roles and responsibilities along with how many cameras (including spares) to have in vault. Investigate having final video inspections performed independently. Ensure there is 24/7 camera support.
4.7	**Technical issues - New Positioning assemblies**	
4.7.1	Due to inadequate clearances around sites A10 and B10 from adjacent feeders the designated yokes were machined down to fit correctly. This required simple machining that was done in-house and worked very well.	Keep simple machining in-house under OPGs CofA. Investigate using a jig to visit target window C1 at the beginning of the job to perform clearance checks around anticipated difficult sites.

No.	Description of Lesson Learned	Recommendations/Actions
4.8	**Technical issues - Tooling**	
4.8.1	Due to minimal clearance on some sites the stud guide tube could not be installed. Going forward there needs to be the ability to install a stud without the stud guide tube.	Develop contingency stud install tooling and add to training.
4.8.2	The cameras were not reliable and broke on a few occasions. The bullet cam that was later used was not ideal for final inspections.	Require small stick cam for final inspections with articulating head. Require more robust regular length stick cams. Possibly add a hard casing to the head of camera. Investigate the possibility of using cheaper cameras for training only. Our handheld inspection camera needs to identify 'top up' so the image is not upside down in trailer Create chamfer on the raised inner tube of the stud guide tube to prevent damage to cameras and tools or investigate ways to create a chamfered camera protective housing.
4.8.3	Dial indicators on End Fitting jacks worked well however need better FME control.	Investigate ways to improve FME (on dial indicators, protective caps, etc).
4.8.4	Some removal tooling broke during work on the East face due to excessive force. The available tooling that was robust lasted longer and was more effective.	For Unit 4 reconfiguration ensure the unlock tool is robust similar to the Darlington unlocking tool (PANLUT).
4.8.5	The End Fitting protective caps worked well however there were not enough at times.	Order more EF protective caps and modify them with a hole to allow for protruding Closure Plug plunger.

No.	Description of Lesson Learned	Recommendations/Actions
4.8.6	There were concerns about the functionality of the stud protrusion tools. Therefore the functionality was checked on a regular basis during execution.	Add a step to Unit 4 procedure to check stud protrusion tool functionality before and after each work window.
4.9	**Permitry**	
4.9.1	Prior to Unit 2 training there were delays due to a dormant permit. Dormant permits need to be checked well in advance.	This has already been addressed for Unit 3. There are no dormant permits.
4.10	**Equipment – Platforms/Canopy**	
4.10.1	Creation of a swing gate that can be attached to a short section of the bridge slab handrails is needed to eliminate reliance on the carpenters to erect a scaffolding swing gate for work protection. This will greatly reduce critical path time.	Investigate developing a Clip-on swing gate for the South side of the platform. Also develop a handrail storage cart.
4.10.2	Pump cart tipped over due to short hose lengths.	Investigate designing/purchasing more robust carts with a lower center of gravity and longer hose lengths.
4.10.3	There was some confusion regarding which curtains go where. Also curtains would tend to move/close frequently during execution.	Label curtains. Investigate developing a mechanism to lock/hold shielding curtains in position.
4.11	**Quality**	
4.11.1	CCV (End Fitting ID) Caps worked well when used.	Reconsider leaving caps on the entire face until confirmed final locked. Consider installing caps on the entire West face instead of every other column for better CCV. Investigate leaving ID caps on quarantined sites. Add a section to the procedures to explain how to deal with

No.	Description of Lesson Learned	Recommendations/Actions
		quarantined sites and maintain proper CCV. Investigate creating a PEV for handling quarantined sites.
4.11.2	During reconfiguration, we performed regular reviews of all the paperwork as part of completion assurance to ensure every checkbox was checked appropriately, signatures were complete, and all scope was completed. There were many eyes on the screens and paperwork during the project, but with the amount tooling issues, technical challenges on East face, turnovers, etc; it made sense to perform one final independent review of the video footage. While reviewing the video there were 22 sites that did not have a conclusive video record. For the majority of the sites, the worker using the camera did not show the ID cap prior to inspecting either of the two studs, so it was not 100% clear which channel he/she was viewing. In some cases, the ID cap was shown, but the worker camera would bounce around to different studs, so CCV for that video inspection was effectively lost. To remove all doubt these sites were revisited to confirm final state of channel (ie. all hardware removed, including washers) . Some of the revisits however were required because it did appear there may have been washers left behind. During execution we encountered more washers than expected on the East face (there were no drawings or documents which identified how many were previously installed), and it was challenging with the camera to a) count/identify the washers behind the nuts during the initial inspection, and b) confirm they were all removed during the post inspection. There was learning curve associated with finding/removing washers, and the sites with washers left behind were in the just the 3rd window (of 32) visited on the East, so there was not yet a good rhythm with washer related	There should be more emphasis during training regarding proper video inspection technique (this skill should also be evaluated in the PEV). Develop a Reconfiguration Training plan to include specific training for proper video inspection technique. An OPG QC Tech should inspect the working window to confirm completion once all sites within the window are complete (including quarantines). This could either be done in person on the face or through video review. This is to confirm configuration of installation. Plan for an outage window to resolve any final walkdown issues that need to be resolved for P1641.

No.	Description of Lesson Learned	Recommendations/Actions
	tooling/processes/inspections.	
4.12	**Communications**	
4.12.1	Having separate rooms for the East and West face communications worked well.	Plan to use the IMS SFCR Trailer stationed near U4 for P1641. Readers and Monitors are in the middle of the trailer and Office space on each end. May need a second trailer to avoid have discussions/turnovers while readers are on Comms.
4.12.2	There was sometimes confusion as to what hardware should be on/off platform. Mechanics did not have headsets.	Have at least one FLMa on Comms during loading/unloading of hardware on/off platform.
4.12.3	Housekeeping/organization was sometimes an issue but there was no REP to allow for cleaning. There were cables scattered on the platform that posed tripping hazards and risk of damage.	Create REP for IMS/Constructor to wear Comfo to allow them to cleanup/organize platforms during shift turnover. Determine who is responsible for housekeeping, and define clear expectations. Ensure there is better cable management on the platforms.
4.13	**Other**	
4.13.1	IMS procurement of tools through the supply chain was very slow.	Ensure there is alignment with the IMS SPOC and ensure they have a list of priority items based on the outage.
4.13.2	Closer tool staging location required for U4 Reconfiguration. Walking from East Annex to	Investigate finding a closer tooling laydown/repair area.

No.	Description of Lesson Learned	Recommendations/Actions
	Unit 1 airlock was not ideal.	
4.13.3	Roles and responsibilities were vague for PWU and BTU jurisdictions.	Ensure the Project Execution Plan includes detailed jurisdictional responsibilities.

4.1 SCRs Submitted to Document Events

Reference NA44-REP-31120-00002 R001 for a list of all SCRs submitted to document events for P1511 Fuel Channel Reconfiguration.

During execution, a total of 51 hours of delays were encountered while on critical path. Of this, 43 hours of delays were outside of control of the Project (Fuelling Machine Bridge unavailability, power failures, etc). Appendix A contains the work down curves for the total job.

4.2 Action Requests to Implement Changes

Outstanding design actions to be taken are captured in the issue tracking file associated with MEC 115276. Actions associated with this lessons learned report are summarized below. AR# **28179932-01** will be used to ensure all actions listed here are tracked in the IMS Reactor Maintenance Projects Sharepoint directory. AR# **28179932-02** will be used to ensure all the actions listed below are complete.

Task #	Subject
1	Ensure operation of the ACUs is added to the Unit 4 Work plan.
2	Add task to U4 schedule to create a walkway over each Rolling Shield
3	Add dose projections for U3 training to P1641 ALARA plan
4	Investigate buying headsets dedicated for Reconfiguration activities
5	Revise Safe Work Plan for Unit 4
6	Develop loading plan for Unit 4 Execution
7	Develop a video setup/maintenance plan
8	Develop contingency stud install tooling and add to training
9	Order more cameras for Unit 4 including a shorter camera for final inspections and investigate ways to increase robustness
10	Order more EF protective caps and modify them with a hole to allow for protruding Closure Plug plunger
11	Develop a handrail storage cart
12	Develop a Clip-on swing gate for the South side of the platform
13	Purchase new pump carts
14	Develop a mechanism to lock/hold shielding curtains in position
15	Add new CCV management strategy to installation/removal procedures
16	Develop a Reconfiguration Training plan to include specific training for proper video inspection
17	Setup IMS SFCR trailer for U3 training
18	Develop robust unlock tooling

19	Investigate new tooling laydown/repair area for U4 execution
20	Develop End fitting jacking procedure
21	Add procedure reading expectations to training plan for Unit 4.
22	Include direction / instructions addressing how to handle difficult removal sites in training / PEVs for P1641 reconfiguration personnel. Also include a PEV for proper video inspection.
23	Revise FME guideline I-GUID-31120-50003 to include additional examples (w/ photos) of FME barrier placement for P1641 Reconfiguration Project.
24	Incorporate OPEX from P1511 Reconfiguration Tooling Design into P1641 Reconfiguration Project Tool Designs (ECs 131909 & 111227).
25	Improve FME control on the dial indicators used for end fitting jacking.
26	Ensure the Project Execution Plan includes jurisdictional responsibilities.
27	Prepare a jig to confirm sufficient clearance exists between feeders and sites with known interferences.
28	Add a step to Unit 4 procedure to check stud protrusion tool functionality before and after each work window.

In addition to the above actions AR # **28179908** has been entered to separately track corrective actions associated with the P1511 reconfiguration SCRs. There are 6 assignments as follows:

Task	Subject	Due Date	Responsible
01	Address difficult removal/unlocking sites in training.	2015/11/16	N- IMSFCMP
02	Revise FME guideline	2015/12/15	N- IMSFCMP
03	Incorporate OPEX into tool design	2015/12/14	N- IMSFCMP
04	Create WO task for walkway	2015/09/15	N- IMSFCMP
05	Improve CCV cap coverage.	2015/10/30	N- IMSFCMP
06	Improve training for video inspections.	2015/10/30	N- IMSFCMP

5.0 DOSE PERFORMANCE

The expected dose for Unit 1 Reconfiguration was 56.4 Rem with an actual value of 55.6 Rem. The Radi-shielding on the face along with the modified NUMET shielding canopy proved to be better than expected shielding, over 60% of emitted radiation protection when used correctly.

As previously mentioned the ALARA plan did not include projections for U2 training and did not include dose estimates for revisiting the large number of quarantined sites. Appendix B includes a Radiation Dose vs. Plan curve that summarizes the total dose for the job.

Appendix A: Work Down Curves

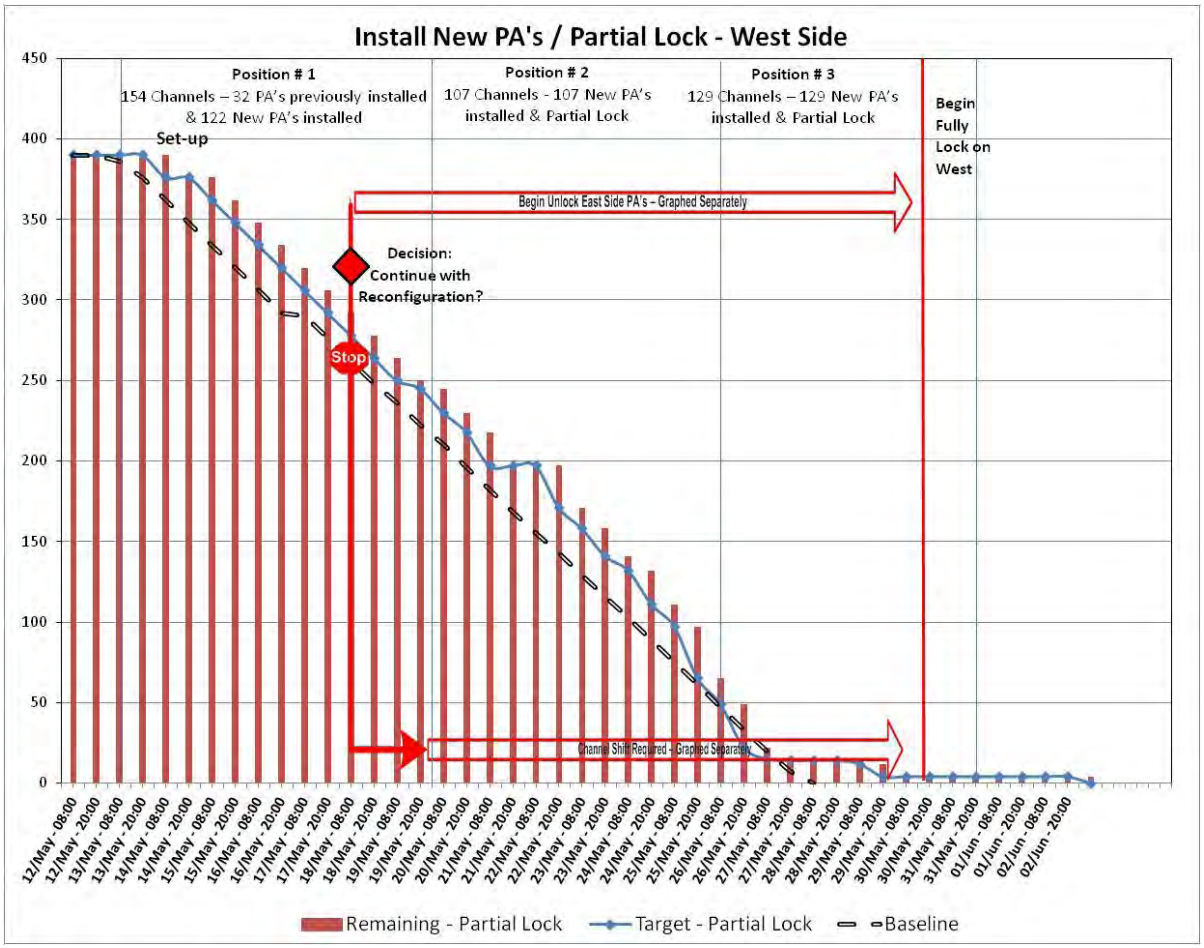

Figure 1: Work Down Curve – Partial Locking of New PAs

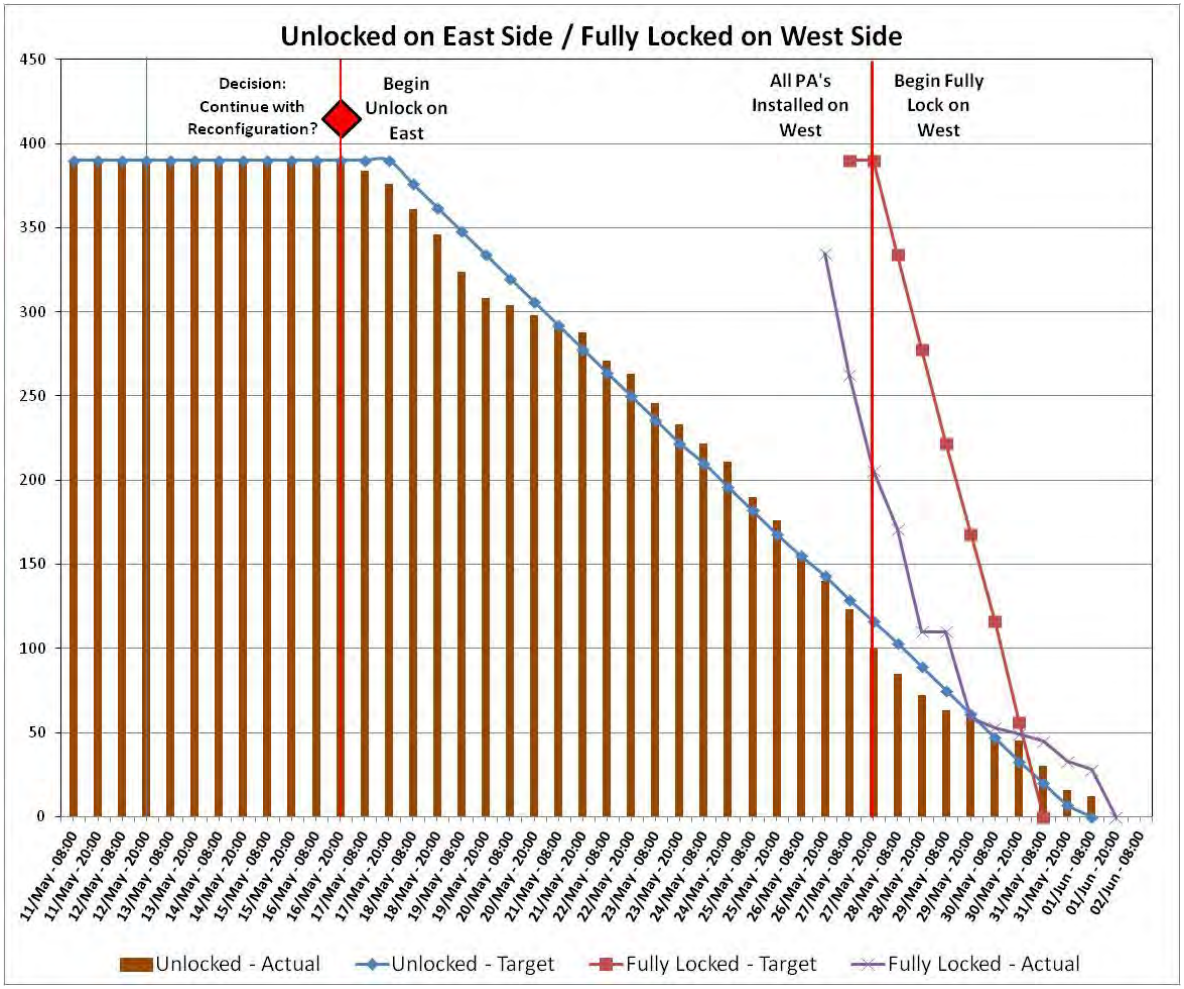

Figure 2: Work Down Curve – Unlocking Old PAs and Final Locking

Appendix B: Dose Data

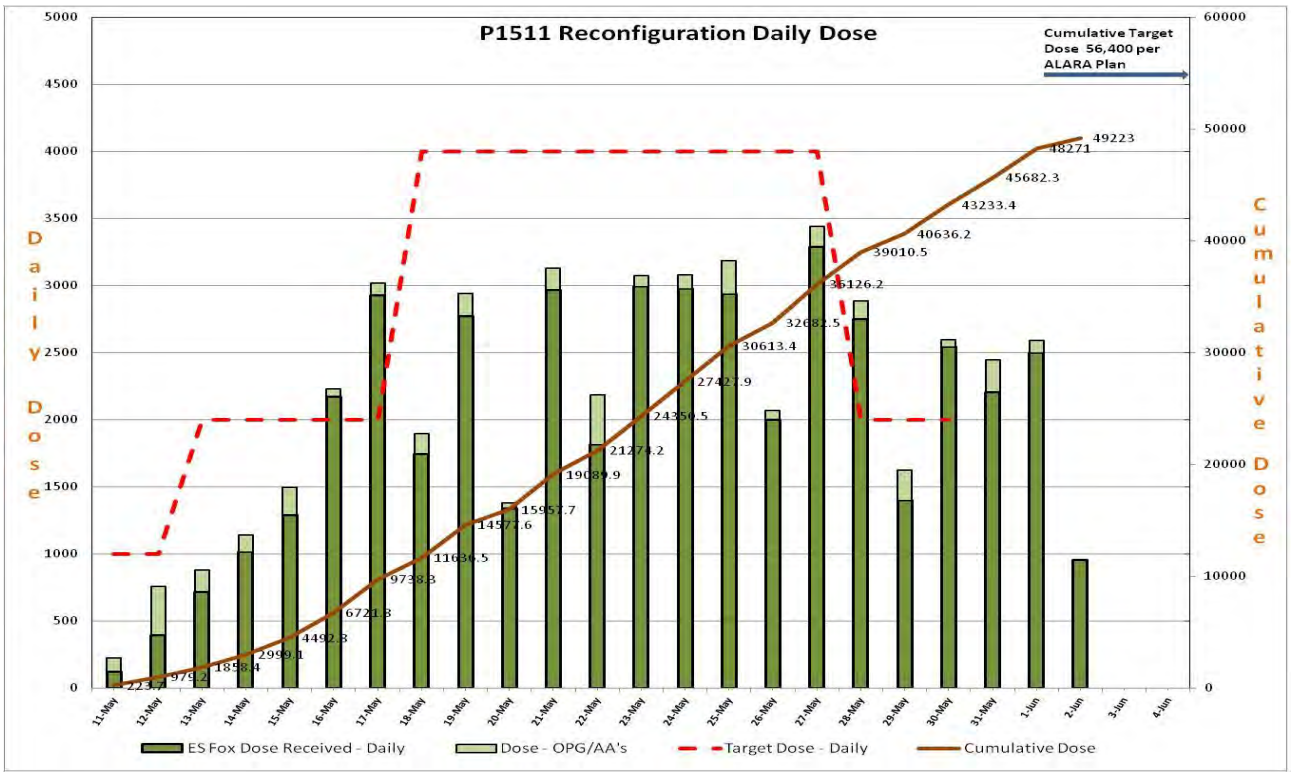

Figure 3: Reconfiguration Execution, Radiation Dose vs. Plan

Note: Support activities not included in these dose values.

ONTARIOPOWER GENERATION

Lessons Learned Report

Document Number:	I-LLD-31100-50002
Project Number:	13-41023
Revision:	R000

Title:
LESSONS LEARNED REPORT – RECONFIGURATION OF PNGS UNIT 4 DURING P1641

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LESSONS LEARNED REPORT - RECONFIGURATION OF PNGS UNIT 4 DURING P1641

I-LLD-31100- 50002-R000

Project Number: 13-41023

2016-03-18

Internal Use Only

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Revision Summary

Revision Number	Date	Comments
R000	2016-03-18	Initial Issue.

1.0 PURPOSE

Reconfiguration of Pickering Unit 4 was executed during P1641. This involved the installation of new positioning assemblies (PAs) on the current free end (East face), partially locked the PAs, followed by unlocking of the PAs on the existing locked end (West face), and then final locking of the PAs on the east face (new fixed end). Contingency shifting was not required for any site.

Post Job reviews and a lessons learned meeting were conducted. This report documents the lessons learned from Reconfiguration executed during the P1641 outage and recommends necessary actions that are to be taken during future outages.

2.0 BACKGROUND

During operation, Fuel Channels (FC) are subject to an environment of high flow rate, temperatures, pressures, and neutron irradiation. These stressors cause changes in the pressure tube (PT) dimensions and material properties. One major dimensional change of the PT is the axial elongation (creep), and it is addressed by PAs and FC bearings.

PT axial elongation is life limiting for Pickering Units 1 & 4. Fuel channel maintenance activities (reconfiguration) are required in order to reach the planned service lives of PND Units 1 and 4.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Inspection and Maintenance, Projects Management Position	**Roles/Responsibilities**
Department Manager *John McCaig*	Accountable for implementation of project
Project Leader *Sid Tavares*	Primary interface with OPG Design Projects, Project Design, Candu Energy Inc., ES Fox, and IMS Reactor Maintenance Department
Project Engineers *Kevin Meade* *Rob Harness* *Kevin Chui*	Provide Engineering Support and Technical Support as required during mobilization and execution, also supported with the developments of tooling used.
Result Coordinators *Jonathan Tenjak* *Brian Down* *Criag Freeburn*	Independently monitor and verify completion of Work Packages. Also provide Shift Update/Status Reports, Logging of Delays, and Filing of SCRs.
Contract Manager	Interface between various supports groups

David Dudley	aligned with ES Fox to ensure they are getting the help needed.
Contract Monitor *Bageerathan Logeswaran* *Eric Norrmalam* *George Zakhem*	Independently monitor field activities such as compliance to OPG safety principles, site policies, and procedures.
Projects and Modifications	**Roles/Responsibilities**
Design Projects *Kevin Jayawardene*	Perform the Modification Team Leader (MTL) role
Projects Design *Asif Butt*	Perform the Design Team Leader (DTL) role

4.0 LESSONS LEARNED

No.	Description of Lesson Learned	Recommendations/Actions
4.1	**Safety**	
4.1.1	Contractor had a few exhaustion events due to high air temperatures from the breathing air in their suits.	Ensure breathing air hoses are not being over used on both sides of the platform at the same time to reduce the chance of heat exhaustion. Ensure the breathing air is inspected before the start of the execution.
4.1.2	OPG did not have a qualified person to operate the man lift in the event of an emergency as per the rescue plan. Contractor had to provide a qualified operator.	Investigate on assigning an OPG qualified person to operate the man lift in future outages.
4.1.3	During contingency PA removal on the west side it was noticed that the air hoses were not prechecked to ensure its functionality.	Ensure air hoses are inspected and whip checks installed prior to the start of work.
4.2	**ALARA Dose Performance**	
4.2.1	The new canopy allows for easy installation/removal and provided excellent dose protection.	Continue use for future outages.

No.	Description of Lesson Learned	Recommendations/Actions
4.3	**Schedule**	
4.3.1	The communication plan, I-plan -31120-50004 worked well. No issues with communicating progress to OCC.	Continue to implement similar communication strategies for future outages.
4.4	**FME Control**	
4.4.1	Some workers were confused on what to do during an FME event.	Ensure FME Event Decision Tree in I-GUID-31120-50006 is communicated to all work groups in order to have a clear understanding of what to do during an FME event.
4.4.2	FME guideline to identify Constructor as owner of FME prevention worked well.	Implement a similar guide for future outages and communicate the roles and responsibilities of contractors during training.
4.4.3		
4.5	**Procedures**	
4.5.1	Use of N-FORMs by Constructor missed a lot of circle/slashes and/or checkboxes.	Emphasis during training and throughout execution on paper work expectations. Verify completion after each reader rotation and ensure proper turnovers.
4.5.2	Linking the N-Forms to the ITP for completion assurance worked well. Synchronization with the Work plan needs to be improved.	Investigate how to better link the N-Forms to the Work plan. Procedures should also include more detail (checklist) about what to confirm during final inspection.
4.5.3	During unlocking activities on West face, in the 'N2' window, 14 sites were fully unlocked without first releasing the 'West Hold Point' in Step A of N-FROM-11672. Before proceeding	Investigate on assigning someone to manage the documents / transfer of documents from east to

No.	Description of Lesson Learned	Recommendations/Actions
	to step B, IMS and ES Fox signatures are mandatory to confirm that the fuel channel is partially locked on the East face prior to altering PA hardware on the West.	west trailer. The document owner is responsible for completion assurance checks to ensure that working window binders staged for ES Fox readers are ready for execution. Ensure wording is clear for all required hold points. Need dedicated trailer space to store completed working binders.
4.5.4	Platform procedures requires revision.	Numet Maintenance Platform and Canopy Installation and removal procedure (I-MP-30701-50000) needs to be revised to capture how the P6 section of the platform should be installed at Pickering A due to the rolling shield restriction. Also include note to ensure platform canopy is installed on the south side of the vault. Also revise procedures I-MP-30701-50003, I-INS-30701-50010 and I-MP-30701-50000 to capture requirement for platform clearance checks to be performed every time the platform is reconfigured or modified to ensure the platform and canopy does not interfere with permanent plant equipment.

No.	Description of Lesson Learned	Recommendations/Actions
4.6	**Mock-up Training at the TMB / Site Training**	
4.6.1	Some mechanics/PTs were confused with the loading plan. Changes in the window order also caused confusion.	Ensure loading plan is verified and approved by appropriate authorities before the start of training. Ensure there is a proper roll-out to all required work groups.
4.6.2	Bending of hitch pins was a late addition to the training plan.	Ensure all aspects are covered during training.
4.7	**Technical issues - New Hinge Pins**	
4.7.1	During installation of yokes around sites A11, A13, B11 and B13, the position of the adjacent feeders and graylocs were found to be different that conditions observed during training and rehearsal activities in unit 3. Due to inadequate clearance, upper hinge pin were modified to install from the front and permit attachment of lock wire to hold it in place. This provided the additional clearance required for PA yoke installation.	Ensure this strategy for installation is documented for potential future use. During future initial walk down activities record/identify grayloc and feeder positioning for anticipated difficult sites.
4.8	**Technical issues - Tooling**	
4.8.1	The End Fitting protective caps worked well however need better FME control to secure the magnets.	Investigate ways to improve FME (on dial indicators, protective caps, etc).
4.8.2	At few occasions the Dial Indicator jacking caps maxed out even before reaching the allowable jacking limit.	Investigate on ways to expanding the jacking stroke limit on jacking caps.
4.8.3	End Fitting ID caps were loose and fell off sometimes from the channel.	Ensure the End Fitting ID cap lanyard is cut to the right length to have a tight fit.
4.8.4	Some contractors had confusion on what unlocking tool to use. Sometimes they used the contingency unlocking tool instead of the	Ensure tools are clearly and visually

No.	Description of Lesson Learned	Recommendations/Actions
	manual unlocking tool to unlock the channel.	distinguishable.
4.9	**Equipment – Platforms/Canopy**	
	When the west FM bridge was at the home position, constructor identified a loose handrail on the reactor side of the platform. IMS entered the vault to repair the handrail and discovered that clamping hardware used to secure the handrail to the platform detached from the platform and dropped a few inches down into the drip tray. The hardware consists of one bracket and two 3/8" long machined screws. The bracket and one screw were recovered, but the second screw could not be located during an extensive search of the drip tray and surrounding area. The platform configuration was positioned at the centre of the bridge when the issue was identified.	Ensure pre and post integrity checks are completed as per I-MP-30701-50008 for canopy, platform, and dolly.
4.10	**Quality**	
4.11.1	CCV (End Fitting ID) Caps worked well.	Consider leaving caps on the face until confirmed unlocked for better CCV. Had trouble identifying quarantined sites during re-visit.
4.11.2	During reconfiguration, we performed regular reviews of all the paperwork as part of completion assurance to ensure every checkbox was checked appropriately, signatures were complete, and all scope was completed. There was also an independent verification of the video footage conducted by OPG at the TMB in parallel to execution. While reviewing the video during as-left inspection following attempt of final lock of site V17 on the east face, it was discovered that the site did not meet the final locked criteria. Specifically, the inboard nuts were found to be not in contact with the yoke. A visual comparison to the as-left inspection following partial lock of V17 was performed, confirming no visible movement occurred.	There should be more emphasis during training regarding proper video inspection technique Ensure adequate training is provided to OPG PB verifiers and Procedures should also include more detail (checklist) about what to confirm during final inspection. . An OPG QC Tech should inspect the working window to confirm completion once all sites within the window are complete (including

No.	Description of Lesson Learned	Recommendations/Actions
	The site was corrected by untorquing the inboard nuts, running them up against the yoke to eliminate the gap, and then re-torquing the jam nut against the hex nut. N-FORM and ITP for V17 had to be altered to accommodate the change. Also during independent video verification it was found that some sites in the east and west did not meet the final lock/unlock criteria. These sites had to be re visited and corrected as well.	quarantines). This could either be done in person on the face or through video review. This is to confirm configuration of installation. Independent video review worked well as another form of inspection and similar practices should be maintained in future outages.
4.11	**Communications**	
4.12.1	Having separate rooms for the East and West face communications worked well.	Plan to use the IMS SFCR Trailer for future outages. May need a second trailer to avoid having discussions/turnovers while readers are on Comms.
4.12.3	Housecleaning/organization was sometimes an issue in the trailer.	Determine who is responsible for housekeeping, and define clear expectations.
4.12	**Other**	
4.12.1	IMS procurement of tools through the supply chain was very slow.	Ensure there is alignment with an IMS SPOC and ensure they have a list of priority items based on the outage.
4.12.2	While installing PA hardware on the east face field staff were delayed due to a power failure. When the worker attempted to turn the vacuum on to remove debris a loss of power occurred and video feed was interrupted.	Ensure vacuum has its own separate power source from the cameras to prevent any power failure.

4.1 SCRs Submitted to Document Events

Reference NA44-REP-31120-00003 for a list of all SCRs submitted to document events for P1641 Fuel Channel Reconfiguration

During execution, a total of 10.5 hours of delays were encountered while on critical path. These delays were outside of control of the Project (Predecessor delay, Fuelling Machine Bridge unavailability, power failures, etc). Appendix A contains the work down curves for the total job.

4.2 Action Requests to Implement Changes

Outstanding design actions to be taken are captured in the issue tracking file associated with MEC 115276. Applicable actions defined in this lessons learned report relating to the Single Fuel Channel Replacement (SFCR) program will be tracked under AR# 28187440. All other actions listed in this report will be documented and addressed if another Fuel Channel Replacement program is scheduled.

5.0 DOSE PERFORMANCE

For Reconfiguration, ALARA Plan dose budget was 43.867 Rem, and actual dose at completion was 18.435 Rem. The combination of Radi-Shield tiles and the modified NUMET shielding canopy provided better than planned shielding attenuation.

Please refer to the Radiation Dose vs. Plan curve in Appendix B.

Appendix A: Work Down Curves

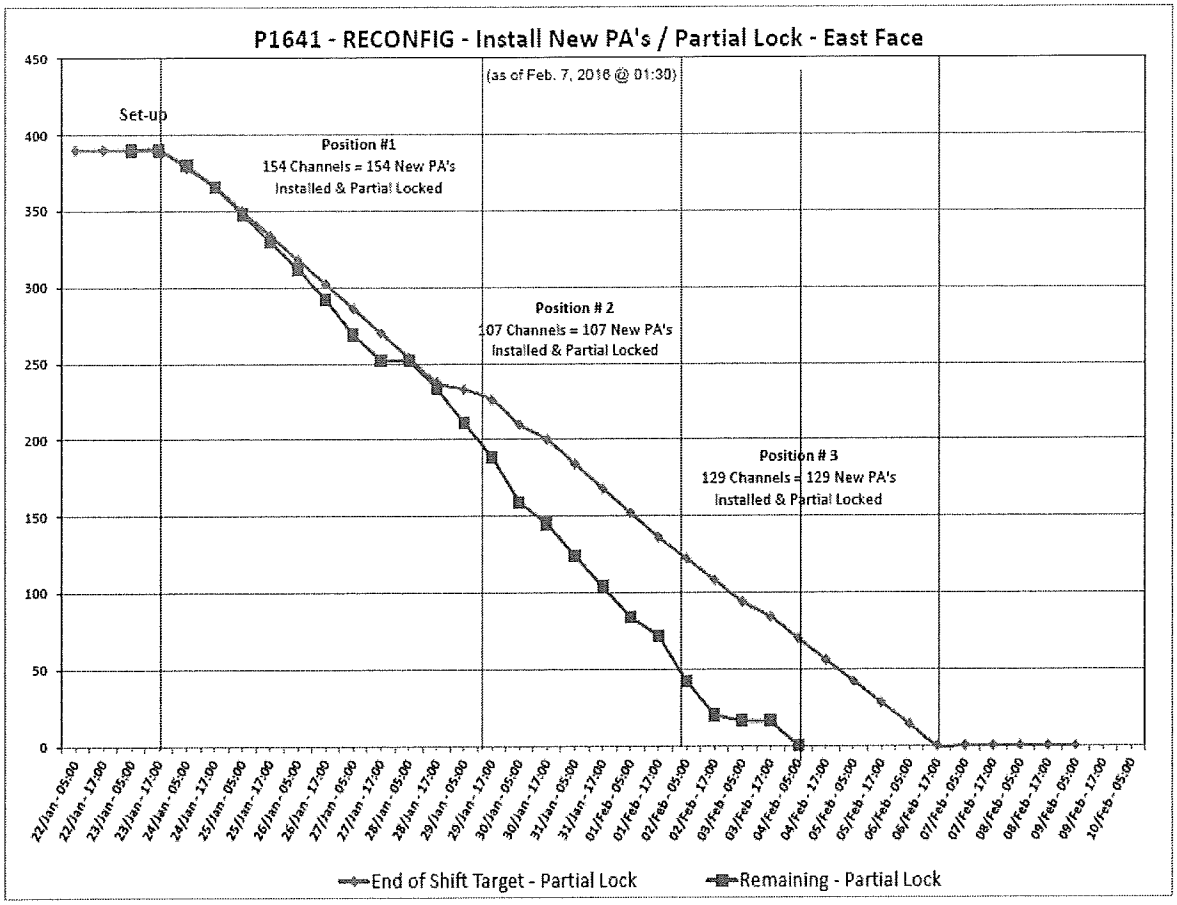

Figure 1: Work Down Curve – Partial Locking of New PAs

Appendix A (Continued)

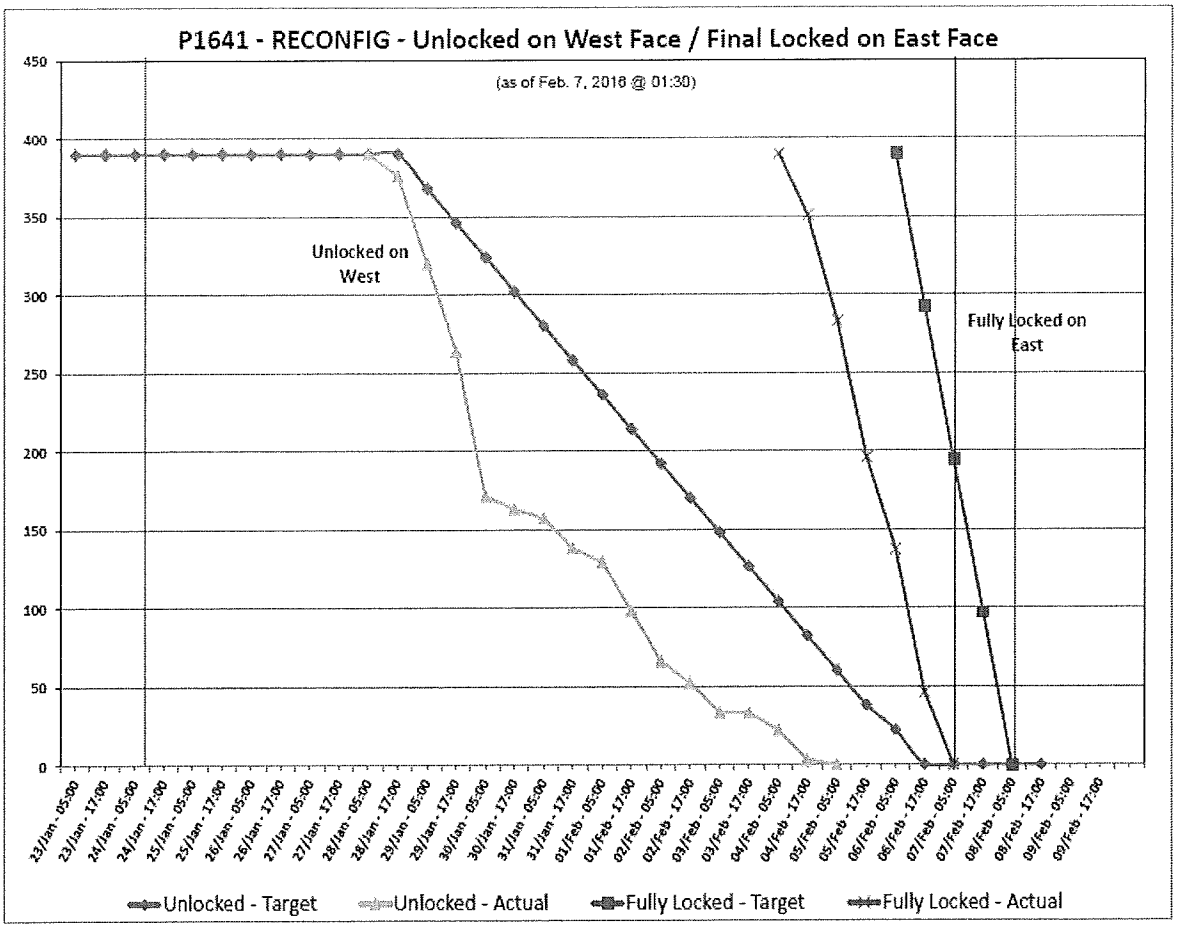

Figure 2: Work Down Curve – Unlocking Old PAs and Final Locking

Appendix B: Dose Data

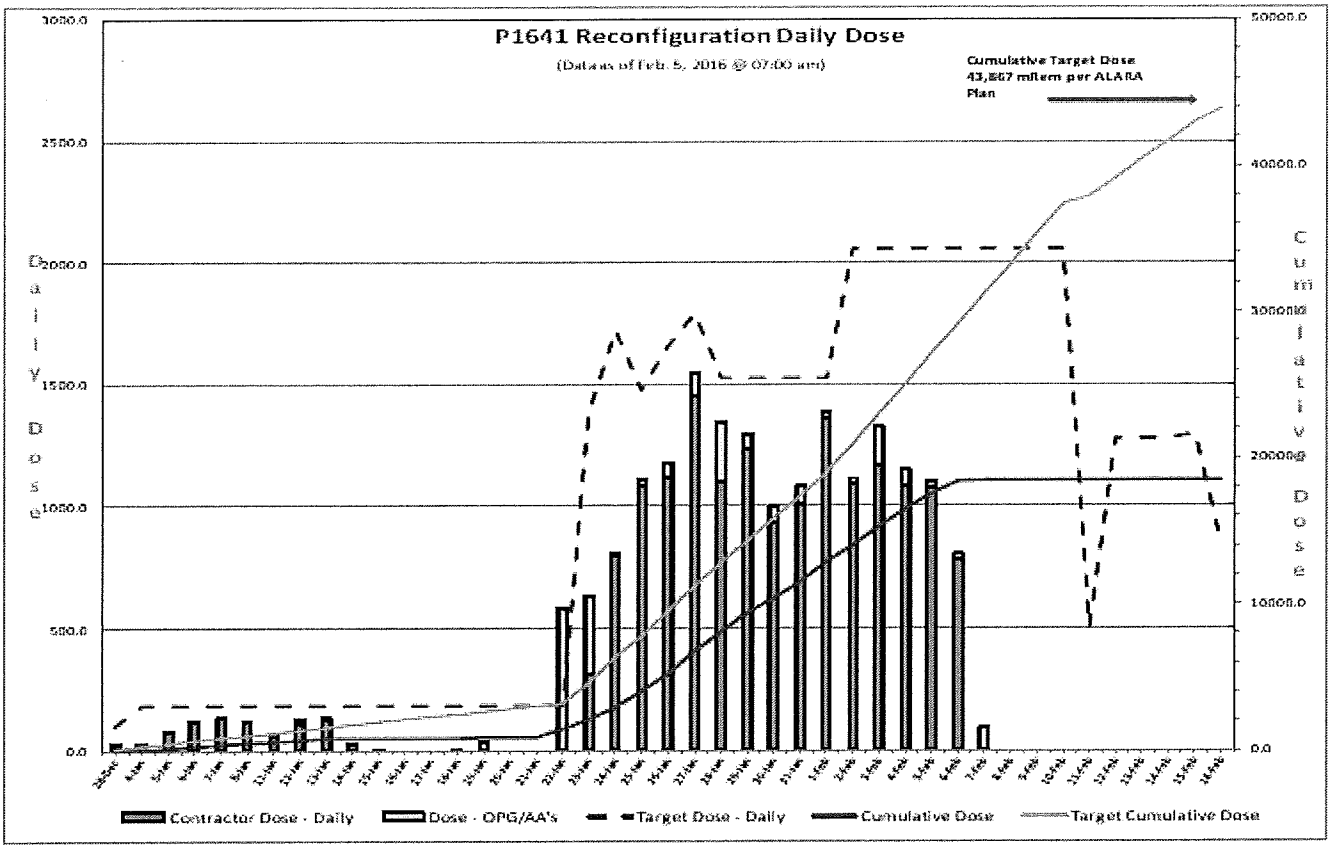

Figure 3: Reconfiguration Execution, Radiation Dose vs. Plan

Note: Support activities not included in these dose values.

ONTARIOPOWER GENERATION

Lessons Learned Report

Internal Use Only	
Document Number: NA44-LLD-35300-0599494	
Project Number: 13-46634	Project Execution Plan Number: NA44-PLAN-35300-0368387
Revision: R000	

Title: **P1641-U4 WEST FM CABLE CATENARIES REPLACEMENT**

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P1641-U4 WEST FM CABLE CATENARIES REPLACEMENT

NA44-LLD-35300-0599494-R000

Project Number: 13-46634
PEP Number: NA44-PLAN-35300-0368387

2016-06-01

Order Number: [TBC]
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Revision Summary

Revision Number	Date	Comments
R000	2016-06-01	

1.0 BACKGROUND

The FH systems at Pickering A are also 35 to 40 years into their 40 year design life, leading to significant component obsolescence and end-of-life challenges.

Fuel handling system Single Point Vulnerability (SPV) equipment failures directly affect station performance objectives including unit shutdowns or de-ratings.

A review of the fuel handling systems based on INPO AP-913 Equipment Reliability Process was conducted to determine the scope of work required to return and maintain acceptable levels of reliability to the Pickering A fuel handling systems. The review identified equipment that are single points of vulnerability or equipment with a zero tolerance of unplanned failures. These components will be replaced by this project in the planned outages

This Lessons Learned Report collects the issues, events and successes experienced during the P1641 for U4 West FM Cable Catenaries replacement WO# 2663688 executions.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Position	Roles/Responsibilities
Project Management	
Project Manager (PM) Craig Verwey	Accountable for safe, procedure compliant and cost effective implementation of the project. Overall project responsibility and accountability to stakeholders.
Modification Team Leader (MTL) Rathin Bagchi.	Accountable to Project Manager for schedule and budget adherence and for overall project support.
Project Engineer(s) (PE) Ali Kajbaf	Production of project engineering deliverables and overall project support
Fuel Handling Technical (SE) Kaylee Villemaire	Provide technical support related to the system as required.
Cost and Scheduling Analyst Ahmad Aliani	Accountable for overseeing the costs and updating of schedules and budgets
OPG Design	
Design Team Leader (DTL) Ian Campbell	Review and approve design documentation, provide design support for project execution and closeout.
FH Operations/Maintenance	
FH Operations Marcus Freeman	Provide operational support for permitry and field equipment / system.
Control Maintenance, FLM John Smith	Provide field execution support for the project.
OPG Field Engineering	
Field Engineering FLM Ugo Simoni Project Technician-Electrical Rich Salisbury	Preparation of ITPs and assessing. Provides Field Engineering support during execution.

3.0 LESSONS LEARNED

This lesson learned report will cover U4 West FM Cable catenaries replacement executed during P1641 outage under WO# 2663688. Project EC 113690.

Round the table discussion was conducted with representatives from Vendor (Black & Mac), OPG Project Manager, MTL, PE, CMO and FE . Following items were reviewed and Lessons Learned / Area for Improvement were identified as follow:

3.1 Lesson Learned – Scope Of Work.

Scope was to replace 8 aging U4 East/West FM catenaries cables, remove & reinstall interferences. Scope was clear and Assessment was accurate.

3.1.1 Background

Due to unavailability of outage window, only West side cables were completed and the East side cable replacement will be executed in future planned outage.

PCB testing of the cables were done through station PO with Kinectrics.

3.1.2 Recommendations

Projects to work with outage team to include U4 East cables in next planned outage.

Projects to review options for adding a separate contract with Kinectrics in advance for the PCB testing to avoid any delay.

3.2 Lessons Learned – Configuration Management

No configuration issues were observed during the walk downs. Installation was completed and commissioned with no issue.

3.2.1 Background.

No configuration issues were observed during walk downs, however, the cable holes on the RDF structure surrounding 4-63534-JB907 are not waterproof, but drawing NA44-FCF-63534-02797 indicates the structure is to be water proof. SCR P-2016-05143 was initiated to capture "As found condition"

To minimize disturbance during isolation for removing existing lighting fixture, coordinated efforts were made to identify lighting circuit inside RDF enclosure for isolation on the back shift.

3.2.2 Recommendations

WO# 4963187 was initiated "CFHP, INVESTIGATE AND CORRECT RDF CABLE PENETRATION". Result of investigation to be used for U4 East FM cable catenaries (P1841).

3.3 Lessons Learned – Resources

Vendor & OPG resources for execution.

3.3.1 Background.

This was Construction contract only. Contractor staff level was sufficient. Due to outage window, it was decided 2x10 hrs shifts. Dedicated FE, CMO and Project resources were assigned during execution window.

Coverage schedule was published by projects identifying details of coverage by various groups during the execution window.

3.3.2 Recommendations

Continue with developing detail coverage schedule for project oversight resources. Perform 48 hours look ahead analysis and provide notice for any planned station support as required.

3.4 Lessons Learned – Material

There was some issue with availability of material for pre requisite activities.

3.4.1 Background.

Cable grips and drums arrived at site with some delay, but no impact on cost or schedule. Insulating Blankets (Cat ID 689122) has not delivered on time for pre requisite activities causing 14 hours delay. See SCR N-2016-04341.

3.4.2 Recommendations

Follow outage material staged milestone for verifying staged material including contingency items.

3.5 Lessons Learned – Schedule Delay and Cost

Outage window was not allocated as per agreed schedule. It was delayed for numerous times in a way that project was not able to terminate and re-hire resources resulting in significant cost impact

3.5.1 Background.

As per original schedule, start date was set for Feb. 29, but it delayed until April 26. Once outage window was allocated and access provided project team completed installation within plan and even 2 shifts early.

Schedule pushed out in numerous times day by day and it was not possible to terminate and re hire resources as it takes minimum 3 weeks to hire and train new workers. Also there are some delays for start of PMT. Delays were managed as much as it was possible by allocating resources to other active projects. Overall we have been able to mitigate about 62% of the delay costs. Schedule delay cost is about $175K. Refer to SCRs N-2016-10712 and N-2016-04832. About 55 related SCRs were initiated, for complete list see Appendix "A".

3.5.2 Recommendations

Better planning could help reduce some delay cost. Resources will be hired and mobilized only after schedule confirmation from outage during the outage preparation challenge meeting.

3.6 Lessons Learned – Station and FH Support

Station RP support, FH Operation and Maintenance support were reasonable.

3.6.1 Background.

Station Support (RP, Ops, FH) was acceptable, however, in two cases there was delays due to unavailability of RP (SCR N-2016-04245) and RP, MCR shift change (SCR N-2016-10805).

After coordination with RP after first SCR, it was agreed to submit REP at night before, no more delay observed after that.

3.6.2 Recommendations

Close coordination with RP and SWC & Project team. Advance notice to FH resources for any planned support.

3.7 Lessons Learned – Documentations (Work plan, Reports, SCRs)

Work plan marked up a few times.

Vendor reports not issued or issued with no attachment (one time only).

3.7.1 Background.

Work plan was approved in 2015 but had to be marked up to include "Interference removal and installation" which was discovered during walk down. Other mark ups were to provide flexibility to the Vendor during installation to avoid any delay. This was a factor in completing the installation two shifts early. Vendor's daily report was late in one case and no attachment in another case. Issue was resolved immediately and has not been repeated.

3.7.2 Recommendations

Review of Work plan with stakeholders. All lessons learned during this execution will be incorporated in the future work plan in advance and approvals will be obtained to avoid multiple mark ups during execution.

Monitor vendor reports frequently to identify any gaps and inform their management for improvement.

3.8 Lessons Learned – Work completion verification in site

Site verification of work completion to be verified by joint walk down with trades GF and HOR to ensure no scaffold/FME/Housekeeping issues are left behind during permit removal.

3.8.1 Background.

Permit removal was done with HOR walk down after cable replacement in FM service room was complete. Fuel handling moved in to reposition the FM for fill & Vent & PMT when a section of handrail was found on their way which stopped repositioning of the FM.

Project scaffold crew was sent in immediately to investigate and remove the scaffold as required. It was observed that this section of hand rail was erected by the project scaffold team and overlooked for removal since the hand rail piece did not have proper tags. Holder of record also could not identify the same during his walk down for permit surrender.

3.8.2 Recommendations

All the scaffolds and hand rails to be marked with proper tags during erection.

HOR will perform joint walk down with all trades group (GF) to ensure condition of work site is ready for permit surrender.

4.0 COMMUNICATIONS PLAN FOR THE LESSONS LEARNED REPORT

This lessons learned report to be rolled out to the ES-MSA contractor and to all Project Managers with the expectation to provide rollout to the staff/PCC.

5.0 CONCLUSIONS

Execution for this work went event free for any safety & quality issues. However schedule and cost performance for the execution are below expectation due to significant delay (>45 days) for start date compared to the plan.

Projects will work closely with outage group to obtain an agreed level I schedule in advance to mobilize construction crews including OPG resources for optimal cost & schedule performances.

ONTARIOPOWER GENERATION

Lessons Learned Report

Internal Use Only	
Document Number: NA44-LLD-35300-0599494	
Project Number: 13-46634	Project Execution Plan Number: NA44-PLAN-35300-0368387
Revision: R000	

Title: P1641-U4 WEST FM CABLE CATENARIES REPLACEMENT

Appendix A: SCRs List Feb 16 to May 24, 2016

U4 WFM, SCRs Feb 16 to May 24/2016

SCR #	SCR Date	Title	Unit	Cond. Descr	Initiator	FLM	Initiating Mgr	Cat
N-2016-04245	2016/02/16	Project 13-46634...BM P.O. #226043-0001...WO2663688....Schedule Delay - RP resourcing (Feb. 16/2016)	PR&MOD	Contractor could not commence with WO2663688-40 in the morning as RP could not support entry into the SAA until the afternoon. Schedule and cost impact are two workers plus one FM @ 5hrs plus one GF @ 2 hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-04341	2016/02/17	Project 13-46634 P1641 ...BM P.O. #226043-0001...WO2663688....Schedule Delay - material required. (Feb. 17/2016)	PR&MOD	Contractor cannot commence scheduled prerequisite work due to lack of material. MR6434319 CID689122 is still required in the field. Schedule and cost impact is two workers @ 8hrs plus one FM @ 4hrs plus one GF @ 2hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-04467	2016/02/18	Increase contract value PO226043 Line #001 Project 13-46634 PCA 226043-2016-005	PR&MOD	Discovery issue found , Interefrences in RDF enclosure needs to be removed to access cable trays for cable replacement. At contract award time MA/HOR support was provided by station, since then due to change in startegy ESMSA vendors providing MA/HOR support during the execution. Additional support required for PCB contaminated cable disposal as per approved procedures.- this contamination was found during previous execution in U1 for similar cables. Estimate for MA/HOR was obtained from vendor and PCA initiated to include into the construction contract.	BAGCHI, RATHIN	VERWEY, CRAIG	BALACHOREK, RAY	D4
N-2016-04747	2016/02/22	Project 13-46663 P1641 B&M PO#226043-0001 U4 Catenary Project DELAY - Lack of RP resources.	PR&MOD	Crew assigned to install scaffold for the U4 West Catenary Cable Replacement Project as per WO#-2663688-30 were delayed due to RP resources. Work group was notified by RP that there was a lack of resources to support BMCP this shift. This caused a delay of 4 men X 8hrs plus supervision.	ROBICHAUD, DARRYL	MALONEY, RONALD	HOGGART, MURRAY	D4

N-2016-04832	2016/02/23	Potential delay, Project 13-46634, WO# 2663688 West FM Cable Catenaries Outage schedule delay.	PR&MOD	P1641 execution window for West FM Cat Cable replacement job has a potential delay for 7 days. Contract for execution of West FM Cable Catenaries has already awarded, pre requisite tasks are in progress and resources were secured. There is a project cost impact due to this delay at $18K per day. Discovered while reviewing project status.	KAJBAF, ALI	VERWEY, CRAIG	BALACHOREK, RAY	D4
P-2016-05143	2016/02/26	Project 13-46634 P1641 U4 west electrical catenary replacement. AS FOUND CONDITION - Structure around 4-63534-JB907 is not Waterproof	4	While performing walk down for U4 west electrical catenary replacement it was found that the holes cables are passing through on the RDF structure surrounding 4-63534-JB907 are not waterproof. There are also other panels contained in this structure. NA44-FCF-63534-02797 also indicates that this water structure is to be waterproof. See attached photos.	SALISBURY, RICH	SIMONI, UGO	HOGGART, MURRAY	D3
N-2016-05328	2016/02/29	Project #13-46634 P1641 BM P.O.#226043-0001...WO#2663688.. DELAY - Schedule pushed back. (29-Feb-2016)	PR&MOD	Contractor has resources available for Cable Catenaries Replacement but the work has been pushed back from the origianl start date. Cost impact is four workers @ 4hrs each. Other work was availble for the other 4hrs. MALONEYR 2016/03/01 09:16 : Upon further discusssion with contractor supervisor, it was determined that there were 3 workers on delay as opposed to 4 workers shown.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
P-2016-05348	2016/02/29	Project 13-46634 P1641 U4 west electrical catenary replacement. B&M PO#226043-0001 As Found Condition - Loose JB Over 4-73110-ACU26 In W Valve Room	4	Work group installing scaffold in the west valve room as per wo#2663688-30 discovered a loose junction box feeding into 4-73110-ACU26. The original concrete anchors have come loose and the JB is coming away from the concrete ceiling. This is an as found condition.	*****	MALONEY, RONALD	OWEN, ANDY	D4
N-2016-05448	2016/03/01	Project#13-46634 P1641 Cable Catenaries Replacement BM P.O.#226043-0001...WO#2663688.. DELAY - Schedule pushed back. (01-Mar-2016)	PR&MOD	Contractor has resources available for Cable Catenaries Replacement but the work has been pushed back from the origianl start date. Cost impact is five workers @ 34hrs total plus one FM @ 6hrs plus one GF @ 2hrs. Two of the five workers were on another project for 3hrs each.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-05659	2016/03/03	Project #13-46634 P1641 BM P.O.#226043-0001...WO#2663688.. DELAY - Schedule pushed back. (03-Mar-2016)	PR&MOD	Contractor has resources available for Cable Catenaries Replacement but the work has been pushed back from the origianl start date. Cost impact is five workers @ 34hrs total plus one FM @ 6hrs plus one GF @ 3hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4

N-2016-05605	2016/03/03	Project #13-46634 P1641 BM P.O.#226043-0001...WO#2663688.. DELAY - Schedule pushed back. (02-Mar-2016)	PR&MOD	Contractor has resources available for Cable Catenaries Replacement but the work has been pushed back from the origianl start date. Cost impact is two workers @ 5hrs each plus one FM @ 5hrs plus one GF @ 2hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-05766	2016/03/04	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (04-Mar-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is five workers @ 30hrs total plus one FM @ 6hrs plus one GF @ 3hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-05947	2016/03/07	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (07-Mar-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is two workers @ 8hrs each.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-06084	2016/03/08	Project #13-46634 P1641 BM P.O.#226043-0001...WO#2663688.. DELAY - Scheduled Work Start Date Pushed Out (08-Mar-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is two workers @ 5hrs each.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-06330	2016/03/10	Project #13-46634 P1641 BM P.O.#226043-0001...WO#2663688...DELAY - Scheduled Work Start Date Pushed Out (10-Mar-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is two workers @ 8hrs each plus one FM @ 4hrs plus one GF @ 2hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-06276	2016/03/10	Project #13-46634 P1641 BM P.O.#226043-0001...WO#2663688...DELAY - Scheduled Work Start Date Pushed Out (09-Mar-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is two workers @ 5hrs each.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-06443	2016/03/11	Project #13-46634 P1641 BM P.O.#226043-0001...WO#2663688...DELAY - Scheduled Work Start Date Pushed Out (11-Mar-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is three workers @ 18hrs total plus one FM @ 6hrs plus one GF @ 3hrs plus one coordinator @ 3hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-06992	2016/03/17	Project #13-46634 P1641 BM P.O.#226043-0001...WO#2663688...DELAY - Scheduled Work Start Date Pushed Out (17-Mar-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is two workers for 10hrs total plus one FM for 6hrs plus one GF for 2hrs	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-07112	2016/03/18	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688...DELAY - Contractor has workers on stand-by to start Cable Catenaries Replacement(18-03-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is two workers for 10hrs total plus one FM for 6hrs plus one GF for 2hrs	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4

N-2016-07283	2016/03/21	Project #13-46634 P1641 BM P.O.#226043-0001...WO#2663688...DELAY - Scheduled Work Start Date Pushed Out (21-Mar-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is one worker @ 5hrs plus one FM @ 4hrs plus one GF @ 4hrs plus one electrical coordinator @ 8hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
SCR #	SCR Date	Title	Unit	Cond. Descr	Initiator	FLM	Initiating Mgr	Cat
N-2016-07385	2016/03/22	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (22-Mar-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is two workers @ 10hrs total plus one FM @ 6hrs plus one GF @ 6hrs plus one coordinator @ 8hrs	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-07510	2016/03/23	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (23-Mar-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is three workers @ 18hrs total plus one FM @ 6hrs plus one GF @ 6hrs plus one coordinator @ 8hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-07652	2016/03/24	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (24-Mar-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is one worker @ 5hrs total plus one FM @ 5hrs plus one GF @ 6hrs plus one coordinator @ 3hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-07645	2016/03/24	Project 13-46663 P1641 W/O 2670791 0-51300-CB27 BREAKER REMOVAL - Incorrect Details in WOT Instructions	PR&MOD	When inspecting installation of new relay 0-51300-CB28-R22A on 3-66300-PL102 as per EC128576 it was noticed that it was a 3C-1D type relay when it should be a 5C-1D type relay. Upon further investigation it was found that the incorrect spare relay was taken from 3-66300-PL101 and installed in 3-66300-PL102. The reason the incorrect relay was used was because there was an error/discrepancy in the task assessment for work on PL101(task 21) and PL102 (task 24). Task 21 had the correct information whereas task 24 indicated to remove the wrong spare relay and unfortunately the instructions in task 24 were followed.	*****	SIMONI, UGO	HOGGART, MURRAY	D3
N-2016-07930	2016/03/29	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (29-Mar-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is two workers @ 5hrs each plus one FM @ 4hrs plus one GF @ 2hrs plus one coordinator @ 4hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4

N-2016-08061	2016/03/30	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (30-Mar-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is three workers @ 18hrs total plus one FM @ 6hrs plus one GF @ 3hrs plus one coordinator @ 4hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-08276	2016/04/01	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (01-04-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is six workers @ 48hrs total plus one FM @ 5hrs plus one GF @ 2hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-08235	2016/04/01	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (31-Mar-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is seven workers @ 50hrs total plus one FM @ 8hrs plus one GF @ 3hrs plus one coordinator @ 4hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-08467	2016/04/04	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (04-April-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is two workers @ 16hrs total plus supervision.	PRESTON, ALBERT	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-08551	2016/04/05	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (05-April-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is seven workers @ 43 hrs total plus one supervisor @ 4hrs	PRESTON, ALBERT	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-08714	2016/04/06	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (06-April-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is six workers @ 42 hrs total plus one supervisor @ 6 hrs total plus one GF @ 6 hrs total plus one coordinator @ 6 hrs total	PRESTON, ALBERT	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-08824	2016/04/07	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (07-April-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is seven workers @ 54.5 hrs total plus one supervisor @ 6 hrs total plus one GF @ 6 hrs total plus one coordinator @ 6 hrs total	PRESTON, ALBERT	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-08957	2016/04/08	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (08-April-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is six workers @ 41 hrs total plus one supervisor @ 3 hrs total plus one GF @ 4 hrs total plus one coordinator @ 3.5 hrs total	PRESTON, ALBERT	MALONEY, RONALD	HOGGART, MURRAY	D4

N-2016-09140	2016/04/11	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (11-April-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is three workers @ 24 hrs total plus one supervisor @ 2 hrs total plus one GF @ 2 hrs total plus one coordinator @ 2 hrs total	PRESTON, ALBERT	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-09277	2016/04/12	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (12-April-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is four workers @ 23 hrs total plus one supervisor @ 3 hrs plus one GF @ 3 hours and one coordinator @ 3 hours	PRESTON, ALBERT	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-09409	2016/04/13	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (13-April-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is four workers @ 18 hrs total plus one supervisor @ 3 hrs plus one GF @ 3 hours and one coordinator @ 3 hours	PRESTON, ALBERT	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-09525	2016/04/14	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (14-April-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is three workers @ 13 hrs total plus one supervisor @ 3 hrs plus one GF @ 3 hours and one coordinator @ 3 hours	PRESTON, ALBERT	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-09647	2016/04/15	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (15-April-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is five workers @ 34 hrs total plus one supervisor @ 8 hrs plus one GF @ 4 hours and PMT @ 4 hours on dayshift. Cost impact for afternoon shift is 2 workers @ 9.5 hrs total plus one supervisor @ 5 hours.	PRESTON, ALBERT	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-09609	2016/04/15	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (14-April-2016)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is two workers @ 16 hrs total plus one supervisor @ 8 hrs	PRESTON, ALBERT	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-09873	2016/04/18	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (18-April-2016 Day Shift)	PR&MOD	Contractor has workers on stand-by to start Cable Catenaries Replacement once start date has been confirmed. Cost impact is five workers @ 40 hrs total plus one supervisor @ 8 hrs plus one GF @ 6 hours plus PMT @ 4 hours on dayshift.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4

N-2016-09998	2016/04/19	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (19-April-2016 Day Shift)	PR&MOD	Contractor has workers on stand-by to start Unit 4 West Cable Catenaries Replacement once start date has been confirmed. Cost impact is five workers @ 40 hrs total plus one supervisor @ 8 hrs plus one GF @ 6 hours plus PMT @ 4 hours on dayshift.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-09945	2016/04/19	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (18-April-2016 Afternoon Shift)	PR&MOD	Contractor has workers on stand-by to start Unit 4 West Cable Catenaries Replacement once start date has been confirmed. Cost impact is five workers @ 40 hrs total plus one supervisor @ 8 hrs. on afternoon shift.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-10147	2016/04/20	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (20-April-2016 Day Shift)	PR&MOD	Contractor has workers on stand-by to start Unit 4 West Cable Catenaries Replacement once start date has been confirmed. Cost impact is five workers @ 40 hrs total plus one supervisor @ 8 hrs plus one GF @ 6 hours plus PMT @ 4 hours on dayshift.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-10108	2016/04/20	Project 13-46663 P1641 ELECTRICAL CATENARY REPLACEMENTS B&M PO#226043-0001 DELAY (19-April-2016)	PR&MOD	Crew on shift to support scaffold required for wo#2663688-29 in the west FM service room. Project schedule has been pushed, this caused a delay to the project of 4 men x 8hrs plus 1 supervisor x 8hrs on the afternoon shift.	ROBICHAUD, DARRYL	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-10103	2016/04/20	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (19-April-2016 Afternoon Shift)	PR&MOD	Contractor has workers on stand-by to start Unit 4 West Cable Catenaries Replacement once start date has been confirmed. Cost impact is five workers @ 40 hrs total plus one supervisor @ 8 hrs plus one HoR @ 8hrs on afternoon shift.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-10108	2016/04/20	Project 13-46663 P1641 ELECTRICAL CATENARY REPLACEMENTS B&M PO#226043-0001 DELAY (19-April-2016)	PR&MOD	Crew on shift to support scaffold required for wo#2663688-29 in the west FM service room. Project schedule has been pushed, this caused a delay to the project of 4 men x 8hrs plus 1 supervisor x 8hrs on the afternoon shift.	ROBICHAUD, DARRYL	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-10308	2016/04/21	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (21-April-2016 Day Shift)	PR&MOD	Contractor has workers on stand-by to start Unit 4 West Cable Catenaries Replacement once start date has been confirmed. Cost impact is five workers @ 32 hrs total plus one supervisor @ 6 hrs plus one GF @ 6 hours plus PMT @ 4 hours on dayshift.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4

N-2016-10258	2016/04/21	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (20-April-2016 Afternoon Shift)	PR&MOD	Contractor has workers on stand-by to start Unit 4 West Cable Catenaries Replacement once start date has been confirmed. Cost impact is five electrical workers @ 40 hrs total plus one electrical supervisor @ 8 hrs plus four Carpenter's @ 8hrs plus one carpentry supervisor @ 8hrs plus one HoR @ 8hrs on afternoon shift.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-10415	2016/04/22	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (22-April-2016 Afternoon Shift)	PR&MOD	Contractor has workers on stand-by to start Unit 4 West Cable Catenaries Replacement once start date has been confirmed. Cost impact is five electrical workers @ 40 hrs total plus one electrical supervisor @ 8 hrs plus four Carpenter's @ 8hrs plus one carpentry supervisor @ 8hrs plus one HoR @ 8hrs on afternoon shift.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-10410	2016/04/22	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (22-April-2016 Day Shift)	PR&MOD	Contractor has workers on stand-by to start Unit 4 West Cable Catenaries Replacement once start date has been confirmed. Cost impact is five workers @ 32 hrs total plus one supervisor @ 6 hrs plus one GF @ 6 hours plus PMT @ 4 hours on dayshift.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-10382	2016/04/22	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (21-April-2016 Afternoon Shift)	PR&MOD	Contractor has workers on stand-by to start Unit 4 West Cable Catenaries Replacement once start date has been confirmed. Cost impact is five electrical workers @ 40 hrs total plus one electrical supervisor @ 8 hrs plus four Carpenter's @ 8hrs plus one carpentry supervisor @ 8hrs plus one HoR @ 8hrs on afternoon shift.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4

N-2016-10712	2016/04/25	Project 13-46634 P1641 PA U4 FH Reliability Improvement Project. Delay Charges.	PR&MOD	West FM Cable Catenaries Replacement WO# 2663688 was planned for execution during P1641. Approved Outage window was set for Feb. 29, 2016. Installation Challenge meeting (readiness) was completed on Feb. 8, 2016. Three weeks is required to hire and train skilled resources. Contractor was instructed to hire and train required resources for the job based on approved plan. Some pre-requisite (Scaffolding and RDF roof access hole) tasks were completed. Outage window delayed for numerous times in a way that project was not able to terminate and re-hire resources. Some Contract resources were assigned to other active jobs mitigating almost 64% of the delay charges, however accumulated $135k contractor delay charges were charged to the project. Scope start now April 25 14:00 It discovered while reviewing daily project costs between Feb 29 and April 22.	KAJBAF, ALI	VERWEY, CRAIG	BALACHOREK, RAY	D4
N-2016-10693	2016/04/25	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (25-April-2016 Day Shift)	PR&MOD	Contractor has workers on stand-by to start Unit 4 West Cable Catenaries Replacement once permit is established. Cost impact is five electrical workers @ 40hrs total plus one electrical supervisor (FM) @ 8.5hrs plus one electrical GF @ 5hrs plus PMT @ 4 hours plus five Carpenter's @ 8hrs plus one Carpenter supervisor (FM) @ 4hrs plus one Carpenter GF @ 2hrs plus one HoR @ 4hrs plus one HoR supervisor @ 4hrs on day shift.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-10805	2016/04/26	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scheduled Work Start Date Pushed Out (25-April-2016 Afternoon Shift)	PR&MOD	Contractor was delayed signing on to permit due to RP and MCR shift changes. Cost impact is 5 Electricians @ 25hrs total plus one electrical supervisor (FM) @ 5hrs plus four Carpenters @ 20hrs total plus one Carpenter supervisor (FM) @ 5hrs.	WARMINGER, JODY	MALONEY, RONALD	HOGGART, MURRAY	D4
N-2016-11416	2016/05/01	Project 13-46634 P1641 Unit 4 West Cable Catenaries Project BM P.O.#226043-0001...DELAY Due to Phone Outage (30-April-2016 Afternoon Shift)	PR&MOD	Due to telephone outages, workers were evacuated from the Unit 4 SAA and FMSR for the Unit 4 West Cable Catenaries Project from 22:45 until 23:45. Cost impact is 5 workers plus 1 supervisor for 1 hour each.	WARMINGER, JODY	MALONEY, RONALD	BALACHOREK, RAY	D4

N-2016-11830	2016/05/04	Project 13-46634 P1641 PA FH Reliability Improvement Project. Execution delay - no Hot Work Permit.	PR&MOD	West FM Cable Catenaries Replacement WO# 2663688 is in progress. Electrical GF went to get Shift Manager Approval for Hot Work Permit. Per Shift Manager, Hot work could not progress due to ban on hot work activities. Ref. SCR P-2016-11745. This issue has a delay cost impact of 48 hrs (6 Electricians for 8 hrs each). The issue was discovered during morning project progress conference call.	KAJBAF, ALI	VERWEY, CRAIG	BALACHOREK, RAY	D4
N-2016-12289	2016/05/09	Project 13-46634 P1641 BM P.O.#226043-0001...DELAY - Post Maint. Testing not started...(May 8/2016)	PR&MOD	Contract staff were asked to be present over the weekend to support PMT. PMT did not commence. Cost impact is 2 electrical workers @ 3hrs each plus 1 electrical supervisor @ 3hrs plus one HoR @ 4hrs.	WARMINGER, JODY	MALONEY, RONALD	GRIGORESCU, EMIL	D4
N-2016-12285	2016/05/09	Project 13-46634 P1641 BM P.O.#226043-0001...DELAY - Post Maint. Testing not started (May 7/2016)	PR&MOD	Contract staff were asked to be present over the weekend to support PMT. PMT did not commence. Cost impact is 1 electrical worker @ 2hrs plus 1 electrical supervisor @ 2hrs plus 1 one electrical worker @ 6hrs plus one HoR @ 6hrs. (Electrical supervisor and one worker were charged 4hrs each to another project).	WARMINGER, JODY	MALONEY, RONALD	GRIGORESCU, EMIL	D4
P-2016-12320	2016/05/09	Project 13-46634 P1641 U4 W FM Catenary cable replacement. Delay due to Radiation Levels.	3	Rubber area was set up in U3 NORTH OF A/L1 to dispose PCB contaminated cables from U4 W Fuelling Machine. Due to high back ground readings the Rubber area was deemed not suitable for the intended work. RP located alternate location (U3 A/L 5) for the rubber area and it was set up during the week end and was declared fit for work. Contractors mobilized in the new rubber area on May 9 and started cable cut and disposal work. This evolution caused delay of one & half shifts for 3 labourers and supervisor for cable cut & disposal work.	BAGCHI, RATHIN	VERWEY, CRAIG	BALACHOREK, RAY	D4
N-2016-12482	5/10/2016	Project 13-46663 P1641 West FM Catenary Cable Replacement Delay BM PO 226043-0001 (10-May-2016)	PR&MOD	Crew on WO 2663688-43 BGS - INSTALL PANELING ON WEST RDF ENCLOSURE were delayed 3 men plus supervisor for 8ST hours. Other work group had priority. This caused a delay of 32ST hours.	*****	MALONEY, RONALD	GRIGORESCU, EMIL	D4

N-2016-12459	2016/05/10	Project 13-46634 P1641 PA FH Reliability Improvement Project. DELAY - PMT Execution schedule delay .	PR&MOD	West FM Cable Catenaries Replacement Post Maintenance Test (PMT) was scheduled for Monday May 9 and Tuesday May 10. PMT could not start as planned. To support FH, project instructed B&M Electricians to stay standby for support if required. Expected delay is for 1 GF, and 2 Electrician per 8hrs shift. PMT was re-scheduled for Tuesday # 2 shift. Some progress was made. The job could not proceed due to some voltage 48 V issue. Ref SCR-P-2016-12405. Support was sent to remove blanket to allow CFHP and MC to continue with trouble shooting. SCR was initiated to capture delay for record. This issue was discovered during morning follow up.	KAJBAF, ALI	VERWEY, CRAIG	BALACHOREK, RAY	D4
N-2016-12482	2016/05/10	Project 13-46663 P1641 West FM Catenary Cable Replacement Delay BM PO 226043-0001 (10-May-2016)	PR&MOD	Crew on WO 2663688-43 BGS - INSTALL PANELING ON WEST RDF ENCLOSURE were delayed 3 men plus supervisor for 8ST hours. Other work group had priority. This caused a delay of 32ST hours.	*****	MALONEY, RONALD	GRIGORESCU, EMIL	D4
N-2016-12598	5/11/2016	Project 13-46663 P1641 BM PO 226043-0001 West FM Catenary Cable Replacement Delay (11-May-2016)	PR&MOD	Electricians supporting PMT were delayed waiting for PMT to begin this caused a delay for 2 workers @ 13hrs total (1 man 8ST, 1 5STman was able to move to other work for 3ST hours) plus FM @ 3hrs plus GF @ 3hrs plus PMT for 3ST hours total delay hours 22ST hours Crew on WO 2663688-43 BGS - INSTALL PANELING ON WEST RDF ENCLOSURE were delayed 3 men plus supervisor for 8ST hours. Other work group had priority. This caused a delay of 32ST hours. Same as N-2016-12482. Carpenters & Laborers delay time was mitigated as they were redirected to other work. Total Project delay 54ST hours	*****	MALONEY, RONALD	GRIGORESCU, EMIL	D4

N-2016-12598	2016/05/11	Project 13-46663 P1641 BM PO 226043-0001 West FM Catenary Cable Replacement Delay (11-May-2016)	PR&MOD	Electricians supporting PMT were delayed waiting for PMT to begin this caused a delay for 2 workers @ 13hrs total (1 man 8ST, 1 5STman was able to move to other work for 3ST hours) plus FM @ 3hrs plus GF @ 3hrs plus PMT for 3ST hours total delay hours 22ST hours Crew on WO 2663688-43 BGS - INSTALL PANELING ON WEST RDF ENCLOSURE were delayed 3 men plus supervisor for 8ST hours. Other work group had priority. This caused a delay of 32ST hours. Same as N-2016-12482. Carpenters & Laborers delay time was mitigated as they were redirected to other work. Total Project delay 54ST hours	*****	MALONEY, RONALD	GRIGORESCU, EMIL	D4
N-2016-12755	2016/05/12	Project 13-46663 P1641 West FM Catenary Cable Replacement BM PO 226043-0001 DELAY - Other work group had priority. (12-May-2016)	PR&MOD	Crew on WO 2663688-43 BGS - INSTALL PANELING ON WEST RDF ENCLOSURE were delayed 3 men plus supervisor for 8ST hours. Other work group had priority. This caused a delay of 32ST hours. Same as N-2016-12482 & N-2016-12598	*****	MALONEY, RONALD	GRIGORESCU, EMIL	D4
N-2016-12755	2016/05/12	Project 13-46663 P1641 West FM Catenary Cable Replacement BM PO 226043-0001 DELAY - Other work group had priority. (12-May-2016)	PR&MOD	Crew on WO 2663688-43 BGS - INSTALL PANELING ON WEST RDF ENCLOSURE were delayed 3 men plus supervisor for 8ST hours. Other work group had priority. This caused a delay of 32ST hours. Same as N-2016-12482 & N-2016-12598	*****	MALONEY, RONALD	GRIGORESCU, EMIL	D4
N-2016-12867	2016/05/13	Project 13-46634 P1641 West FM Catenary Cable Replacement DELAY BM PO 226043-0001 (13-May-2016)	PR&MOD	Crew on WO 2663688-43 BGS - INSTALL PANELING ON WEST RDF ENCLOSURE were delayed 1 man plus supervisor for 8ST hours and 2 men for 4hours ST each (two men left early). Other work group had priority. This caused a delay of 24ST hours. Same as N-2016-12482, N-2016-12598 & N-2016-12755	*****	MALONEY, RONALD	GRIGORESCU, EMIL	D4
N-2016-13094	2016/05/16	Project 13-46634 P1641 West FM Catenary Cable Replacement Delay BM PO 226043-0001 (16-May-2016)	PR&MOD	Crew on WO 2663688-43 BGS - INSTALL PANELING ON WEST RDF ENCLOSURE were delayed 3 men plus supervisor for 8ST hours, other work group had priority. This caused a delay of 32ST hours. In addition Electricians supporting this work were not able to mitigate cost adding another 14ST hours. Total delay hours were 46ST hours. Same as N-2016-12482, N-2016-12598, N-2016-12755 & N-2016-12867	BAKER, KIMBERLY JOSEPH	MALONEY, RONALD	GRIGORESCU, EMIL	D4

P-2016-13085	2016/05/16	Project 13-46634 P1641 Scaffold handrail left in Unit 4 WFMSR, PO 226043-0001 (13-May-2016)	4	A scaffold handrail was left installed in the West FMSR below T-port as a safety barrier. The handrail was part of extensive scaffolding in the Service Room to support the West Catenary Cable replacement project. All scaffolding was removed at the end of the project, however, the handrail was left in place. Workers assumed the handrail was part of the existing permanent scaffold just below the platform. Workers did not identify the assumption to the foreman. Walkdowns performed did not identify the discrepancy prior to work surrender.	WARMINGER, JAMIE	MALONEY, RONALD	GRIGORESCU, EMIL	D3
N-2016-13316	2016/05/18	Project 13-46634 P1641 West FM Catenary Cable Replacement Delay BM PO 226043-0001 (18-May-2016)	PR&MOD	Crew on WO 2663688-43 BGS - INSTALL PANELING ON WEST RDF ENCLOSURE were delayed 3 men plus supervisor for 8ST hours, other work group had priority. This caused a delay of 32ST hours.	*****	MALONEY, RONALD	GRIGORESCU, EMIL	D4
N-2016-13478	2016/05/19	Project 13-46634 P1641 West FM Catenary Cable Replacement Delay BM PO 226043-0001 (19-May-2016)	PR&MOD	Crew on WO 2663688-43 BGS - INSTALL PANELING ON WEST RDF ENCLOSURE were delayed 3 men plus supervisor for 8ST hours, other work group had priority. This caused a delay of 32ST hours. Same as N-2016-13316	*****	MALONEY, RONALD	GRIGORESCU, EMIL	D4
N-2016-13852	2016/05/24	Project 13-46634 P1641 BM P.O.#226043-0001...WO#2663688... DELAY - Scaffold Interference (24-May-2016)	PR&MOD	Contractor cannot reinstall the paneling for the Unit 4 West RDF enclosure under WO/T#2663688-43 as scheduled today due to interfering scaffold which has been erected under WO/T#4963187-03. The scaffold directly interferes and is attached to the RDF panel structural members. Impact to project is three Sheet Metal workers @4.5hrs each plus supervision @ 4.5hrs plus one electrical worker @ 4.5hrs plus supervision (FM) @ 2hrs plus one GF @ 1hr plus PMT @ 3hrs.	WARMINGER, JODY	MALONEY, RONALD	GRIGORESCU, EMIL	D4

Lessons Learned Report

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Document Number: P-LLD-09013-00001	
Project Number: 13-41027,13-49158,13-49299	Project Plan Number:
Revision: R000	Page 1 of 81

Title:
FUKUSHIMA BEYOND DESIGN BASIS EVENT (BDBE) – LESSONS LEARNED REPORT

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FUKUSHIMA BEYOND DESIGN BASIS EVENT (BDBE) – LESSONS LEARNED REPORT

P-LLD-09013-00001

Project Numbers: 13-49299, 13-49158, 13-41027

19-Feb-19

Internal Use Only

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Revision Summary

Revision Number	Date	Comments
R000	2019-02-19	Initial Issue

1.0 BACKGROUND

As a result of the event at the Fukushima Daiichi Nuclear Power Plant on March 11, 2011 and the direction of the Canadian Nuclear Safety Commission (CNSC), Ontario Power Generation undertook reviews which have confirmed the safety of the OPG Nuclear fleet for all design basis events.

The bounding scenario for the Beyond Design Basis Event (BDBE) has been defined by OPG and its industry partners as a sustained and total loss of AC power with degraded site access and consequential loss of heat sinks resulting from the coincident failure of the bulk electrical system and the loss of existing standby and emergency generators at the nuclear stations. This approach is consistent with what has already been implemented/ planned by other Canadian nuclear facilities and nuclear operators in the United States.

Following review of operation experience and in response to the CNSC Fukushima Action Items (FAIs), the Full Phase 1 Project was undertaken to improve the capability of response to very low probability BDBEs to address the station needs for make-up water and power during the first 72 hours following such an event, in order to mitigate the very low probability of severe fuel damage.

The Fukushima Phase I project scope was to prevent fuel failure by mitigating a severe accident by providing makeup water to the Steam Generators, Heat Transport and Moderator Systems as well as achieved through purchase of emergency mitigation equipment, storage facilities for the equipment, and revision and issue of the Operations and Maintenance procedures.

The Fukushima Phase II project builds on the scope from Phase I. The objective for the Phase II scope of work is to provide a capability to maintain the Moderator System as a heat sink and to maintain containment conditions. This leads to the ability to restore each unit to a normal cold shutdown condition even if outside power is not restored after 72 hours.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES (CURRENT)

Position	Roles/Responsibilities
Project Management	
Project Manager (PM) Alex Maxim – OPG	Accountable for safety, procedural compliance and cost effective implementation of the project. Overall project responsibility.
Modification Team Leader (MTL) Khash Fatemi - OPG	Accountable for schedule and budget adherence. Verification of project engineering deliverables and overall project support. Perform ECC MTL role
Cost and Scheduling Analyst (CSA) Shawn Reilly- OPG	Accountable for overseeing the costs and updating schedules and budgets.
Design	
Design Team Leader Gulam Mollah- OPG	Production of design engineering deliverables and installation/closeout support. Acceptance of design documentation. Perform ECC DTL role and produce ECC design deliverables.

3.0 LESSONS LEARNED

Issues Related to planning, design, installation, commissioning, and turnover of the new, portable and permanent Fukushima Emergency Mitigation Equipment are documented below. Recommendations regarding risk mitigation and issue resolution strategies are outlined for the benefit of other modifications.

3.1 LESSONS LEARNED SUMMARY

3.1.1 Scope

Project Complexity

Background: The Fukushima project consisted of an amalgamation of multiple modifications grouped under a single project. During the execution of the project, there were multiple instances of insufficient resources being allocated to the project by contractors and OPG support, this was due to the perception by the support groups that Fukushima is a routine project.

Recommendation: The Fukushima project would have been easier to execute if the modifications were separated. Ideally, it should have been a program with multiple projects, this would have prevented the perception that a regular project support team was sufficient to handle the workload.

Beyond Design Basis Event (BDBE) Process

Background: The process for a Beyond Design Basis Event was not fully understood until the Fukushima project was being executed. The project was identifying and applying design requirements and the Beyond Design Basis Event process in parallel with the execution of the project. This attributed to a negative impact on the cost and schedule.

Recommendation: While it is acknowledged that this special project required immediate action, to prevent the risk of major costs and schedule impacts to a project it is recommended that the design requirements and special applicable processes should be clearly defined during the planning of a project.

Scope Definition

Background: The Fukushima project consisted of unique modifications, the scope was still being developed late into the project. This resulted in a significant change in cost and schedule along the way.

Recommendation: If project scope is not clear from the start and scope needs to be developed throughout the duration of the project, the areas of the project with an unclear scope should be addressed only after scope is finalized. This would prevent significant changes in cost and schedule as experienced during Fukushima projects.

Contractual Inefficiencies

Background: The Fukushima project was complex both in design and installation. During the life of the project there were many instances were the ES MSA contractor was overwhelmed and there was a shortage of resources to support the project. A second contractor was not considered during the planning phase of the project to distribute the workload on a large project.

Recommendation: For complex projects with multiple modifications, having more than one ES MSA contractor should be considered and evaluated.

3.1.2 Conceptual Design

Design Simplification

Background: During the detail design it was found that some of the methods originally planned for addressing the BDBE concerns were too simplistic. An example of this is the MV Tool. The original design consisted of powering the motorized valve for emergency cooling through battery carts. It was later identified that this method was not practical or possible due to the large number of batteries required to power the valve. As a solution, it was decided to use an Uninterruptable Power Supply (UPS) to power the valve following a BDBE.

Recommendation: The over-simplistic conceptual design of some modifications underestimated the effort, cost and time required to design and install them. To avoid having an overly simplistic methods attention to detail is vital during conceptual design phase. Ensure that the CDR is reviewed by all stakeholders prior to submission for acceptance, where the recommendations are finalized.

3.1.3 Detailed Design

Design Agency

Background: The design team that prepared the majority of the detail design was not familiar with OPG processes and with the level of quality required for acceptance by OPG design. They were physically remote and interface with the station was difficult and not effective.

Recommendation: As a recommendation, it is beneficial to contract design agencies that are not remote and have experience interfacing with the station. Having a design agency that understands OPG processes and Design requirements have a lower risk of impacting project schedule and cost. In addition, recommendations from OPG Design should be taken into consideration when awarding contract to ES-MSA design vendors.

Complex Design Solutions

Background: Some of the detailed design involved an extremely complicated solution, very labor intensive and therefore much more expensive as well as much more time-consuming.

Recommendation: Constructability review during the detail design development should focus on promoting the most cost-effective design solutions. Engage Field Engineering in constructability reviews early in design stage by providing them with design drafts for comments.

Drawing Quality

Background: The drawing quality was very poor from the vendors for two reasons. The original copy was scanned multiple times to incorporate both EC revisions and FIC's. Each scan became noticeably worse. As well, many changes were incorporated in colour (red and green). Due to the fact that a large colour plotter was unavailable to OPG, the drawings were printed out in black and white the red ink was very faint and difficult to read.

Recommendation: To maintain the quality of the drawing it is recommended to have a master copy of the drawing to which all the changes are made to instead of copying and scanning the original multiple times.

FIC Process

Background: The FIC process was not always correctly implemented. Specifically, FIC's were not always implemented on the latest copy of the drawing. Meaning on some occasions there was a FIC which was added to the copy of the drawing which did not have the most recent FIC incorporated. This caused confusion and a likely error causing a situation.

Recommendation: The best way to maintain an updated FIC is to create a master FIC and make changes to that.

Design Reviews

Background: Constructability reviews on Design Engineering changes were not completed thoroughly. This lead to deficiencies discovered in the design very late in the project and many issues were raised after installation leading to an increase in the duration and cost of the project.
Recommendation: Ensure proper constructability reviews are conducted on any Design Engineering changes. Field Engineering should be involved early in the design process for the constructability reviews.

Lack of allotted time for design EC review

Background: A Design vendor different from the one that produced the detail design was asked to provide installation/commissioning support to multiple design EC packages. As the detail design was approved and accepted by OPG, it was assumed that a thorough review by the new Design Agency is not needed. However, when requested to provide clarifications and solution

during installation, the new Design Agency often noticed that design details were missing or incorrect. Hence, design had to be changed as the installation progressed. This lead to BOM item changes, parts unavailability, new CATIDs required etc. This also resulted in large amount of comments by Field Engineering at the end of installation.

Recommendation: Having design vendor review previously created design EC packages can be avoided in its entirety by not changing design agencies within the duration of the project. If a design vendor turnover cannot be avoided then OPG is to ensure that the new Design Agency takes ownership of the design by providing them with them with sufficient time to review design EC packages.

Unclear Submission Protocol

Background: The document submission protocol for a BDBE at the start of the design vendor engagement was unclear. Documents that were submitted by the vendor for acceptance sometimes never actually went through. Communication for correct protocol on document transmission was not adequately done at the start of the project.

Recommendation: The submission protocol should be discussed thoroughly in the Project Kick-Off meeting and should be documented in the minutes of meeting and the project management plan.

3.1.4 Procurement/ Materials

Procurement Oversight

Background: During the procurement phase of the project there was a lack of procurement oversight by the Projects Team. There were issues with regards to the trailers compliance with transportation regulations. Both the trailer for 1.4MW generators and for the airlock bottle compressors were found to be undersized and required modifications. There were problems with assembling the equipment that did not come fully assembled from the manufacturer. Examples of this is the CT drawer for U1 Indoor switchgear which came separately with no tools to install.

Recommendations: There must be appropriate oversight to ensure the procurement process meets the requirements of the project. This must be clearly documented in the POP (Project Oversight Plan) and procurement oversight activities must be documented in the ORS (Oversight Reporting System) database.

Live line Indicators

Background: The live line indicators installed in the 4 kV switchgear were not factory tested nor tested on-site leading to a delay in AFS.

Recommendation: Ensure Design Commissioning Specifications capture all equipment and ensure all components are tested at the factory. In the case when factory testing is not feasible, equipment should be system tested on site.

3.1.5 Installation planning

Work Plans

The Quantity of Work Plans

Background: There were a significantly large number of Work Plans that needed to be produced which resulted in the MTL's frequently being overwhelmed by the amount of work required.

Recommendations: It is recommended to consider having more than one ES MSA vendor for such a large project. Resources and work could be allocated more efficiently and effectively. For large complex projects there should be a dedicated OPG FTL to monitor the work plans and ensure the Master copy correctly reflects the field work progress.

Quality Work Plans

Background: Some work plans did not contain flexibility to change the installation sequence when needed, causing work stoppage when a certain issue had to be addressed. Other work plans had unclear instruction of how the sequence can be adjusted as well as a lack of work plan dry run reviews conducted with the execution groups.

Recommendations: Ensure work plans are detailed and clear to avoid a work stoppage when issues arise. For large complex projects and mods assign OPG FTL to co-ordinate dry run reviews with execution groups (at least three weeks in advance) to ensure quality of the work-plan and the logic and sequence of the instructions are adequate.

Environmental Conditions around the UPS cabinets.

Background: UPS cabinets were located under a pipe that would collect condensation which would drip on the cabinets. A drip tray had to be designed and built above the cabinets to mitigate condensation issues. This issue was identified late in the execution stage due to failure of assessing site conditions during design walk-downs.

Recommendation: Ensure when designing sensitive equipment there is no possible area for condensation to occur and damage the equipment. Quality design walk-down should be conducted to specifically observe site conditions.

Detailed Commissioning Report

Background: The Design Agencies were not experienced with the table format for the Detailed Commissioning Specifications (DCS), which would make it very simple to produce the Commissioning Report. Lack of clarity in the first DCSs draft and vendors inability to understand the CR report requirements lead to additional review cycles to arrive at an acceptable format for the DCSs.

Recommendations: OPG must ensure that the Design Agencies preparing the DCSs are familiar with the expectations for the DCS structure. Projects should leverage collaborative reviews to improve quality and reduce review cycles.

3.1.6 Installation

Vendor Resources Background: During the execution phase of the Fukushima project, there were many instances where there were delays and additional costs incurred by the project due to a lack of vendor resources. An example of this is evident during the execution stage of the Fukushima project. The U1 and U4 MV Tool installations were being executed in parallel with the U1, 4 and 058 EPR installations. Due to a lack of vendor resources, there were times when an installation had to be put on hold to focus on another installation which had priority.

Recommendation: It is recommended to consider having more than one ES MSA vendor for large projects. Resources and work could be allocated more efficiently.

IOP Process and work control

Background: For both EPR and UPS installations, the project injected a large amount of electrical work late, as a result station resources and work programs were impacted.

Recommendation: The IOP process shall be followed and have proper recovery plans placed when milestones are not met. Projects to engage the station early in the planning stage, and discuss critical evolutions with control and the affected work groups. Projects and Mods implemented an execution spreadsheet that is being reviewed at the SWMS meeting every month as a result of the impact from the Fukushima project. Project teams must ensure that the spreadsheet is kept up to date, and discussions with work control (ICC and Outage organizations) are ongoing throughout the project lifecycle.

Unit 1 EPR Trench Delay

Background: The Unit 1 EPR trench work is an example of outdoor work impacting budget and schedule due to the lack of consideration of weather. The Unit 1 Outdoor switchgear required to be connected to the station by running cable underground across the Unit 1 roadway outside of the TAB. The rain delayed the trench digging and the allocated specialized resources did not have alternate work to complete. There were no contingency plans taking into consideration the weather forecast before allocating resources to dig the trench.

Recommendation: Mitigation of the inclement weather impact on outdoor projects budget and schedule must be included in the project planning.

Construction Walk downs

Background: There were installation details missing from the detail design and not identified during construction walk downs. Adequate and detailed walk downs were not performed during planning. The project approach to problems was reactively instead of proactively, which caused delays in schedule and cost increase as construction was put on hold during the RFI/FICREQ process. For example a significant number of cable supports were not included in the original design and were added through FICs. Detail design should have input from FTL for installation not identified in advance.

Recommendation: Project is expected to field validate the detail design through thorough walk downs during the planning phase. It is also recommended that Field Engineering and OPG Projects perform walk downs to identify any potential lack of details in the design. Field Engineering constructability reviews should be completed early in the design stage.

Phase Sequence Checks

Background: The installation for the UPS project was completed however the phase sequencing test was not completed. This lead to a delay in commissioning of the UPS.

Lesson Learned: Ensure that the phase sequencing test is captured in the DCS's for electrical equipment as required.

RFI Tracking

Background: Tracking of RFI/FICs became difficult as they were often directly communicated to DE's outside of the RFI/FIC process as well vendor QA process (Document Control was not aware of RFIs response coming in and going out). The lack of communication between OPG and Vendor resulted in delays in the field.

Recommendation: Vendor should create an internal RFI system to track RFI/FICs requests and ensure timely response.

Productivity

Background: During the execution phase of the project, vendor failed to execute at optimum productivity. Task were taking longer lead times than expected resulting in a delay in schedule.

Recommendation: OPG Projects and CMO should increase oversight to ensure productivity is optimized.

3.1.7 Station Support

Station Project Support

Background: It was a challenge to get the Station personnel to become familiar with the BDBE modifications unique approach. Due to the extremely long duration of the project a large number

of new personnel had to be constantly involved. This lead to excessive time and resources being spent in aligning newer personnel with project.

Recommendation: When Station personnel supporting unique projects are changed, the turnover should include an in-depth presentation of the uniqueness of those projects to ensure a seamless transition and to avoid delays and potential cost increases.

3.1.8 Permits

Delays to the project due to lack of Permits

Background: During the execution phase of the Fukushima project, there were many documented instances where there was an impact on the project schedule and cost due to missing work permits. (e.g. P-2016-12951, P-2015-29729).

Recommendation: Permits must be available in time for execution to prevent field work stalling. Both Vendor and OPG Project Management must closely monitor the progress of the work permits issuance and work closely with Station to have permits in place in time for the field work. Assign FTL to co-ordinate field evolutions and handover from one work group to another.

Complex Permit

U058 Power Restoration

Background: The permit for U058 Emergency Power Restoration tie-in was a complex permit and likely a first-time evolution. Due to a lack of proper coordination between the installation contractor and OPS, there were grounds left installed in the field without proper documentation. This had the potential to connect 4 kV to the ground.

Recommendation: Complex, large or new configuration permits must have a specialized project FTL to ensure that all the participating work groups are aligned and that no detail is overlooked.

Portable Generators

Background: The commissioning of the portable generators with the newly installed switchgears was challenging from a permits perspective as the portable generators were built for commercial use and did not have the work protection features required within OPG.

Recommendations: There should be a work protection review for the commercial equipment ordered to be used within OPG to ensure that all special work protection requirements are addressed in the scope of work for the procurement of said equipment.

Conventional Safety Requirements

Background: An additional challenge was caused by the CO2 fire suppression system installed inside the generators which were not acceptable per OPG Conventional Safety requirements. Commissioning could continue only after the removal of the C02 bottles.

Recommendation: There should be a conventional safety review for the commercial equipment purchased to be used within OPG to ensure that the equipment is in compliance with the OPG conventional safety requirements.

3.1.9 Commissioning

Resource Alignment for U1 EPR Switchgear Commissioning

Background: During the commissioning of the U1 EPR Switchgear a compressed schedule and a lack of resources caused delays. Due to a compressed schedule to commission the U1 EPR Switchgear the commissioning was scheduled during a weekend. Prior to the weekend resources were aligned to have the commissioning test completed. This included providing an AZ driver driving for deployment and working with East Complex facilities to disconnect the Diesel Generator from the storage pad.

During commissioning, it was found that the heater required to start the generator was not working. This halted the commissioning test and another generator was required to run the test. The test was executed on the weekend, and East complex facilities were not present to support the disconnecting of the second generator for testing. The project team had to re-align support resources in order to continue with the commissioning.

Recommendation: In order to minimize the possibility of delays during commissioning under a compressed schedule. Projects should set in place a contingency measure for commissioning, in addition, proper support personnel should be present during the commissioning in the case of adverse conditions during a test.

OPG Oversight

Background: Due to the large size of the project OPG project oversight was not done thoroughly.

Recommendation: To ensure proper oversight is conducted assign OPG project FTL/coordinators for station interfaces, for specialized/complex work protection permits, for WPL updates during execution, and to ensure proper handoffs between the various groups during execution.

High Pot Testing

Background: Projects team was unaware that the 4 kV equipment needed to be high pot tested. This resulted in a delay in commissioning and additional unplanned cost.

Recommendation: Projects should collaborate with Design and Field engineering after completion of detailed design to review the scope of meggering and high pot testing for electrical equipment. All required high pot test and megger test should be captured in the DCS and planned for in the p6 schedule.

Fire Protection Issue

Background: The U1, U4, and U058 switchgears required design changes that resulted in the switchgear being enclosed to protect against elements. The changes in the design raised concerns whether the fire protection code was met. This lead to a delay in the AFS and the Project ended up taking an open item to resolve (ref AR: 28207581-14).

Lesson Learned: Any changes made to the design must be immediately reviewed by all stakeholders and departments involved.

Expediting Commissioning Reports

Background: While the commissioning for PNGS EPR was not yet complete, (Vendor had not received signed WPL / ITPs) vendor design team was told to complete the Commissioning Report with all requirements shown “passed” in “Red” color and provide to OPG design for review. Idea behind this was that as commissioning requirements would be completed, “pass” in red would turn into black color. This was initially done to save time during OPG review cycle. This is not per normal ECC process and was later rejected by OPG design.

Recommendation: Follow normal ECC process for the commissioning reports and send out to OPG Design for approval once all requirements are complete. For any deviation from ECC process ensure OPG stakeholder and DA alignment prior to deviation.

3.1.10 AFS

Delay to AFS due to lack of communication with Procedures Group

Background: Numerous delays were experienced due to a misalignment between Projects & Modifications, Training and the Procedures Group. A notable example was during AFS, Procedures group was reluctant to create procedures, raising COMS concerns. At times these COMS concerns were pre-design issues. The procedures group were not involved with the COMS meetings, they had no opportunity to voice their procedural concerns prior to AFS. TPAR's were submitted late not giving procedures group enough time. This delayed the procedures from being issued before AFS.

Recommendation: The procedures group and training group should be involved in the planning of the project's procedures. Concerns should be communicated during the planning phase of the projects to allow time for the concerns to be addressed. The Projects team shall ensure that TPAR's are issued early in the process and immediately upon design completion (at least 9 months prior to AFS per procedure).

AFS documentation

Background: The quality of the contractor generated AFS documents (CR, AFS declaration, AFS report) was less than optimal which led to multiple review cycles. In some cases key requirements from design were identified late (i.e. Live Line Indicators, Hi Pot Testing) and were not captured in the DCS.

Recommendation: Projects and Design team to ensure DCS captures all required commissioning requirements immediately upon completion of detailed design and prior to work-plans being issued. Projects and Design team to ensure AFS expectations (what good looks like) are laid out early for ES MSA partners, and leverage collaboration to ensure alignment and minimize review cycles.

Spare Parts

Background: The required spare parts were not procured in a timely manner, leading to an additional open item in AFS (ref AR 28207581-10)

Lesson Learned: As per procedure N-PROC-MP-0090, procure the spare parts prior commissioning so that they can be turned-over during AFS. Spare part procurement should be tracked in the P6 schedule. Spare parts memo should be issued with the detailed design to ensure procurement/ delivery is done prior to AFS.

3.1.11 Closeout

Delays in Procedural Revisions Post AFS

Background: During the closeout phase of the Fukushima Project, there was a lack of communication and clarity of scope when it came to procedures.

Below are some delays:

1) The revision of procedure P-EME-09013-OPS-00019 was delayed because the procedures group was unfamiliar with the changes to the fueling strategy outlined in memo P-REF-09013-0596911. The revision of the procedure was to incorporate the fueling truck and fuel tote deployment. The TPAR submitted to incorporate the changes were unclear and had to be revised on multiple occasions. In order to align the procedures group, a meeting was held involving projects, the procedures group, and CS operations.

2) After the completion of AFS, there were many procedural revisions that were required. These revisions were not realized until the closeout phase. TPARS were required to be drafted and the procedures group had to revise many procedures under a compressed schedule.

Recommendation: Projects must ensure that TPARS with adequate quality are issued on time (at least 9 months prior to AFS).

Generator Trailer & Truck Issue

Background: The original procurement strategy was to procure the generator trailers separately from the trucks to minimize cost. The design for the generator trailers were altered after the trucks were delivered, resulting in the trucks to being undersized. This lead to an additional open item to resolve.

Recommendation: Both the generator trailer and truck should procured together from a single vendor so that any changes in design will be captured and addressed immediately.

Staff Turnover

Background: The Fukushima project was a long project spanning 6 years, experiencing multiple turnovers in many roles. These roles include design, project management, and contractor MTLs. Each turnover required significant effort to ensure requirements and responsibilities associated with the roles were understood by the new staff. A major example of staff turnover during the project was the change of the project design agencies. This was a challenging turnover which resulted in many delays throughout the project. Approved drawing documents were turned over and design confirmations were not included in the turnover budget because the drawings were already approved by the previous design agency. There were instances during execution were field conditions did not match the design drawings, this caused delays and impacted the budget.

Recommendation: Project team to ensure proper turnover measures are being followed for staff turnover. When a change is confirmed, the individual currently in the role should inform the project team to ensure the replacement is included in all communications. The switch of responsibilities is to incorporate documentation turnover and a thorough understanding of the project status.

Lessons Learned Documentation

Background: The Fukushima Project was a long and complex project that included many design and installation challenges. The Lessons learned from these challenges during the life of the project were not appropriately captured. The project had many turnovers of several positions without capturing the lessons learned from previous experiences.

Recommendation: It is recommended that a tracking file is put in place to log the lessons learned for long lead projects during execution. This will more efficiently document the lessons learned from a project.

3.2 SCRs Submitted to Document Events

SCR #	Title	Cond. Descr
P-2018-11077	Seismic Scaffolding Adjacent to 1-76801-BY1 does not maintain required clearance to SQ equipment	After seismic concerns raised in P-2018-11071 were identified, 014 Class III SRE walked down battery banks installed for Fukushima project. 1-76801-BY1 / PS1 are battery banks and UPS installed as part of Fukushima modifications in the U1 274 RAB. This equipment is seismically qualified. Seismically qualified scaffold was erected Feb 2018 for WO 4873591. Scaffold Builders Handbook, N-INS-09180-10000 Section 1.11 (e) (6), states "Scaffolds whose height exceeds 1.5 times the least lateral dimension are installed as follows: (…) Clearance between a restrained scaffold and seismically-qualified or safety-related devices is not less than 2.5cm (1 in)." As can be seen in the attached photos, minimum clearance of 2.5cm (1") is not maintained between scaffold elements and this seismically-qualified equipment.
P-2018-09971	P5-8 Certified Continuing Training Schedule Churn	This SCR has been filed at the request of the Operations CRC. The project group(s) incorporating the Fukushima Phase II modifications did not adhere to timelines specified in N-PROC-AS-0028, Appendix J, Technical Procedure Change Control for Scheduled Outages. This resulted in churn for the training of P5-8 certified staff. To compensate for a lack of approved procedures after plant modification, certification training delivered an orientation package for the changes made to the plant at the end of 2017 (14-NOV-2017 to 13-DEC-2017). Since this is not procedure based training, training material will have to be prepared and delivered to P5-8 certified staff later in 2018, more than 6 months after the plant was modified. Similar issues were encountered during the installation of the Callisto 2 Monitors, the Gutor Class II Inverter (UPSC replacement) and the High Voltage Bushing Monitoring System. Engineering installed these systems without ensuring training was delivered prior to system modification. At this time there has still been no training delivered to certified staff on the High Voltage Busing Monitoring System. Because there was a significant delay on the Gutor Class II Inverter installation there was sufficient time to ensure procedures were available for commissioning, and for modifying the full scope nuclear simulator to reflect changes to UPSC.
P-2018-07510	Fukushima work incomplete - post scaffold removal.	Remnants of FUKUSHIMA project work remains in the station and this is a major contributor to scaffold material shortage. Projects start but when the money runs out they walk away leaving all sorts of outstanding work . several very large scaffolds remain in the field on U1 , U2 and U4 on several elevations. This was identified under P-2018-02222 and P-2018-01687 . The condition has not been corrected.
P-2018-06497	Fukushima Project 41027: Action Tracking 28204629/33 Exceeding 6 month close out window.	Contractor is attempting to use its due diligence to actively take the actions to mitigate the various Site Deficiencies and other Procedural Requirements, as per Action Assignments 28204629 and -33. However, due to a combination of coordination, technical, and climatic issues, closure of some of the actions has become delayed, in some cases potentially exceeding the 6 month Post-AFS Window.
P-2018-05080	Equipment stored in close proximity of Fukushima UPS/Battery cabinets U4 274 RAB (Behind Operator office)	During a walk down of the FUKUSHIMA Mods with WANO rep we observed IRI equipment stored in close proximity of the Fukushima UPS and battery cabinets on U4. There is a chance that equipment on castors can roll in to the cabinets and cause damage. See attached pictures. Also there needs to be a barrier installed around the cabinets to ensure Operations have access to the back of the cabinets,
P-2018-03988	Fukushima Project (49158) - EME tent # 2 - Warranty issues - Overhead doors installed incorrectly	S/W overhead door was not closing properly and other doors were jammed in EME tent # 2. AFS for this modification was completed in Sept 2017. Facilities inspected all four doors. All four doors were found installed incorrectly.

P-2018-02222	MS-P FUKUSHIMA work not completed	Scaffold remains in the field after work is complete in passport for Fukishima project . a walk down of 225 identified approx. 300' long x 9' wide x 25' of scaffold remains in the field. Outage program at present is at risk due to material shortage. LONGC 2018/02/02 12:45 : WO#3217821
P-2018-01687	MS-P FUKUSHIMA work not completed	Fukushima work is not completed in the field . The work in the field identifies the wrong work order. The work orders only have one task but several scaffolds are in the field in different locations. Work reports are not an effective way to track what is in the field. WO#3217821 is what is on the scaffolds in the field but all the work shows complete in Passport. Another work order is referenced under instructions WO#5010820 where all tasks but the scaffold removals are complete. Again only one task to cover off many scaffolds. OHSA identifies a need to track all scaffold in the field. When one task covers many locations this erodes the traceability.
P-2017-28246	Capacity Test on 058-55400-BY1 Not Perfomed As Scheduled	Due to the uncertainty of the status of BY1, a capacity test under WO 05056993 was scheduled to be performed in 2017WW49 to determine if the battery can be left in service. This WO cannot be performed at this time due to the unavailability of 058-54320-BUC, out of service for Fukushima modifications and PM work. With BUC out of service, the risk is too great to remove an EPS 125V battery from service. With BY1 out of service for testing, the station would be in a total loss of redundancy on the system, and failure of the redundant battery would result in a 24 hr, six unit shutdown clock. 058-55400-BY1 was found to be in a degraded condition following a February 2017 capacity test (see P-2017-04357). Replacement of the battery bank is required (WO 5135754). Replacement was originally scheduled for 2017WW49 but due to delay in procuring new batteries, is now scheduled for 2018WW10. EPS 125V batteries have a design limit of 80%, below which they cannot meet their design function of five consecutive black starts of the EPGs. EPS 125 Vdc system can be placed on single supply from one of two redundant batteries to maintain EPG availability. Timeline of events on BY1: 1. February 2017: Capacity 86.7%, 26.6% degradation from August 2015 installation. Excessive as classified by IEEE-1188. 2. May 2017: Capacity 84%, End of Life (EOL) predicted to be July 2017 based on limited trending data. 3. July 2017: Capacity recovery procedure recommended by OEM raised capacity to 93.6%. EOL conservatively predicted to be June 2018, however still uncertain based on battery history. Failure of BY1 while supplying 058-55400-BUA would result in unavailability of EPG1. BY1 is required to power EPG1 generator protective relays, generator circuit breaker close/trip functions and half of EWPS building emergency lighting. Interim capacity test scheduled for 2017WW49 was intended to gauge level of degradation and remove uncertainty to EOL predictions prior to planned replacement.
P-2017-28238	CSGP: Unable to Progress Maintenance on 058-55400-BY1	CSGP is unable to perform work on 058-55400-BY1 under WO#5056993 and WO#4850299 due to work on 058-54320-BUC and Fukushima project work.
P-2017-27889	ww47 CSEP schedule not completed	during ww47 the following work was not completed due to resources diverted to higher priority station requirements (p1711/p1781/p1861/fukushima) wo 3102004-26/3102004-27/2689528-01/4855745-02/5055692-01/5054794-01/4907368-01/4896750-01/4916727-01/4832677-01/4916759-01/3051968-01/3051967-01/3051966-01
P-2017-27781	wo#5017337-74 058 ec #125976 bdbe u058 power restoration rework to apply grounds	Walked down the isolation to install the grounds for the cable repair 058-54320-410 buc ds4c. In order apply grounds to complete cable repair Contractors will have to open up two previously finished connections upstream of the cable to install the grounds required for the cable repair.

P-2017-27654	Fukushima mod: Delay during permit application for P058 EPR final tie in to EPS BUC.	Unexpected voltage found at EPG3A,B,C starter during WPP application, this caused several hours of delay.
P-2017-27331	FUKUSHIMA-U1-54130-DS7 Phase rotation backwards.	While performing a phase rotation verification on 1-54130-ds7 under wo#5118427-21 we verified that the phasing is incorrect.
P-2017-27329	Document work orders that were not completed for WW4/8	following work orders were not completed during WW48 related to the Fukushima project5118427-14/5010820-23,54/5261023-01/4942106-33/5118430-09,08/5017337-65/1986690-01/3259972-01/3257048-013243121-01/5010829-58/1986690-02/5010829-595118430-115118430-07 these task are on-going but effect the CSEP overall completion percentage
P-2017-27250	ww47 CSEP scheduled completion inefficiencies	during ww 47 the following work was not completed due to resources diverted to higher priority station requirements (p1711/p1781/p1861/fukushima) wo 1123902-02/3102004-26-27/2689528-01-02/2990189-01/3249986-01/2437855-01/4866077-01/4916759-014832677-01/4916727-01/1699020-03/3065929-05/5055692-01/4845745-02/4825763-01-05/5010820-49-50/2464513-03-01/5245566-01
P-2017-27208	EPG3 SRST Not Completed as Scheduled	EPG3 SRST NK30-SRS-M-002, scheduled under WO 5016483 was not completed as scheduled in 2017WW45. The work order completion notes noted "COULD NOT PERFORM DUE TO EMISSION LIMITS WITH OTHER GENERATORS I/S." EPG3 was last run on 27 October 2017. DR 2017-04732 was entered to defer the test to next occurrence. M-02 SRST has a three week frequency, however EPG3 is planned to go into outage in 2017WW48 along with EPS 4KV 058-54320-BUC as past of the Fukushima Modifications. The next occurrence following the outage would be in 2017WW51, ~8 weeks since the last test. This would create a potential 8 week unavailability of EPG3 if it were to fail the SRST. In addition, EPG2 is in plane outage until the end of 2017WW47, leaving EPS in a partial loss of redundancy.
P-2017-26642	WW46 CSEP Scheduled Completion Inefficiencies	During WW46 the following work was not completed due resources diverted to higher priority station requirements (P-1711, P-1781, P-1861, Fukushima): WO#5159755-04, 4716997-01, 2304585-09, 2932509-11, 3126927-01, 1784243-02,10,11, 3202803-01.
P-2017-26457	Missed Scheduled IOP maintenance WW # 46; ; WO # 3202803 - 01	Could not perform schedule maintenance on 5-54250-RF20H, WO # 3202803 - 01. Resources with PPT qualification are diverted to outage and fukushima project work.
P-2017-26413	Delay to Fukushima; Manufacturing Error (WO#: 05265203)	While attempting to complete the load bank test as per NA44-WPL-54120-0608180. Step 11.1.15 required you to select 1-54120-BUF-HS1 to "ALT" which would switch the control power from normal plant supply(600:240/120) to alternate supply(4160/240/120) through the control power transformer, which would be fed from the diesel generators. Step 11.1.22 requires you to record the output control voltage. At this point we did not have any control voltage coming from the alternate supply and had to back out of the load test to investigate why control voltage wasn't being supplied. After further investigation it was discovered that the secondary side of the transformer wasn't mating with its stationary plug. After discussion with project coordinators and vendors it was understood that the plug should have been mounted of the front of the mounting bracket instead of the rear of the bracket to ensure proper fit.
P-2017-26239	Delay to Fukushima project due to RE123 not having the right usi	following the work plan in order to perform load teat of battery bank by1. found a discrepancy with the usi number on RE123. RE123 was labeled correctly in the field and referenced incorrectly in the work plan.

P-2017-26082	Fukushima: False Starts cause maintenance inefficiencies	At the start of shift control maintenance was tasked to work on the PT cubicle on 1-54120-BUF. Control maintenance was in the process of getting PPT on to troubleshoot the PT cubicle. Before control maintenance could get authorized they were re-directed to preform a megger and removal of GTD on 4-54120-CB8A. Next control maintenance submitted PC1 and PC14 to complete this task. Currently waiting for permitry to complete this task. Due to last minute change in priorities control maintenance has lost the resources of 3 control techs for 8 hours totaling 24hours of lost work.
P-2017-26066	Delays on Resolving Fukushima Phase II EME Storage Facility Building Action Tracking 28204629/33, Various Assignments	Contractor is attempting to use its due diligence to actively take the actions to mitigate the various Site Deficiencies and other Procedural Requirements, as per Action Assignments 28204629 and -33. This includes procurement of any required or replacement materials, coordination of work execution at site, QA/QC presence to verify conformance to design and standards, and administrative to provide closure and extension forms. Specific examples including the closure of AR 28204633-02 AFS Spare Parts, -18 Asphalt Road Painting marking, -21 Equipment Labels/Lamacoids, and the extension notes for AR 28204633-19 Auto Dialer Testing and Comm., and 28204633-04/05/06/07/09 Issue History Dockets, and 28204633-20 PMIDs. Moreover, memos used to document the closure of AR 28204633-13 240V Drop-Down Relocations (P-CORR-53410-0664485) and AR 28204633-14 Relocate EWS (P-CORR-53410-0664486) requires OPG Concurrence to document the design change, installation, and close out the 2 issues.
P-2017-25929	1350 False Start for work on EPG2 due to Fukushima Mod project and permitry delays w/o03083046-05	Fukushima Modification permitry related delays causing IOP scheduling churn and delays effecting multiple work groups work load and resource constraints.
P-2017-25547	battery breaker auxiliary contacts not wired in wo # 5118427-07 fukushima mods 1-76801-by1	while performing the work plan na44-wpl-76801-0632809 for commissioning the ups it was found that the battery breaker contacts are not wired back to the ups .Therefore a alarm is present that states a battery breaker is open and that is not the case. Jumpers have to be installed to clear the alarm.
P-2017-24942	Fukushima wo 5118427-10	Upon inspection of 1-76801-DS2, found the flash guard cover broken.
P-2017-24209	Project 41027: U1 Fukushima EPR: Delay caused by pending approval of permit	Activity 5010820-52 (to A&V WPP for 1-54120-CB9A & BUG) has been delayed since 10-Oct-17, because of technical and design clarity issues being brought up during the permit review process. Upon OPG PC1 approval, ESFL will proceed with the 4 kV cable work on CB9A and BUG.
P-2017-24117	058-54800-EPG2 Outage Delayed Due to Fukushima Modification Issues	Entered to document EPG2 planned outage delay due to Fukushima modification issues. See P-2017-23980, P-2017-23987, P-2017-23908. Approximate delay to this point is 1 week.
P-2017-24057	SG Cycleplan changes required creating planning & scheduling flux	Several factors have created the requirement to modify SG cycle plan for 2018. Discovered during SG system health meeting with work control, OPS, maintenance, and engineering present. The Fukushima project has impacted to need to move 056-SG2 to Q1 2018, The DOM commitment for all 6 1-4 side SNO Toe's to be complete by end of 2018 Q1, the delays to completion of 012-SG2 outage completion caused by OPS resources P-2017-23172, P-2017-23594 & Fuel over pressurization issue P-2017-22475, P-2017-20754, 034-SG2 outage was required to move to line up with P1841 BUC D work and the delay to start 034-SG1 outage P-2017-22424 coupled with AC fuel pump premature failure P-2017-23183 are the contributing factors related to the required change.
P-2017-23996	058-55400-BUA-64-R1 Alarm Position Incorrect	On a routine visual walkdown, noticed that on 058-55400-BUA-64-R1, SW1 for both the positive and negative bus is set to 25 kOhms. The switch should be at 100 kOhms. If the alarm is at a lower setpoint than required, the ground fault detector is less sensitive and therefore may not alarm as expected in a ground fault condition. Last maintenance performed on the GFD was during 058-55400-BY1 capacity test in August 2017. WO 05202571 work report indicated that the GFD was bench tested and all alarm set points were within specification. There is no walkdown history for the GFD between August and this date as the panel was covered for protection during Fukushima mod work in the EWPS building.

P-2017-23987	Fukushima Project 41027: Near Miss - Grounded Disconnected 4kV Cable Not Documented	As part of the Fukushima work, cable from 058-54320-DS2B to BUC was disconnected and grounded to allow subsequent connection to BUB. A TCR was not installed and subsequently connecting the 4kV supply to ground was possible, until the condition was identified and corrected.
P-2017-23980	Fukushima Project - Undocumented Grounds in place after permit surrendered (WER)	During execution of NK30-WPL-54320-0619967 for 058 Emergency Power Restoration (Fukushima) modifications under WO# 5017337 a work protection permit (PC2# PB0018745) was applied to isolate 058-54320-BUC for 4kV tie-ins from the new bus 058-54320-BUE. A step in the workplan (4.10.22) disconnected the 4kV cable that runs from 058-54320-DS2B to 058-54320-DS4C. The cable was left inside the DS4C cubicle but pulled away from the BUC bus bars, grounded and insulated. A DED record was initiated to document the grounded conductors. After all 4kV tie-ins were complete a PC14 was applied to megger the cables and BUE. A temporary lift of the grounds was performed to allow meggering. After meggering was completed the HoR inquired if grounds would be required to be reinstalled for further work. The HoR was informed that the grounds would not be required on BUC and the DEDs could be removed. The HoR removed the DED record on both BUC and DS4C. The HoR then recorded off the permit and informed the incoming HoR that the DEDs had been removed and that a TCR was required to document the grounds remaining on the cable from DS2B in the DS4C cubicle before the BUC permit was surrendered.. The TCR was never initiated to document the grounds on the cable from DS2B in the DS4C cubicle. The issue was discovered during OPS testing during the BUC return to service as documented in SCR# P-2017-23908.
P-2017-23738	Fukushima - Delay to Fukushima tasks	upon pre service inspection we found no breaker was installed in 4-54120-cb1f cubicle. In order to place 4-54120-buf into service and continue with na44-wpl-54120-0607018 step 4.3.8 we need that breaker in place to perform function checks. KINGW 2017/10/25 09:38 : This work was being performed under WO# 5010829-17 (Measure and record voltage on BUF HS1) and WO# 5010829-26 (Function check BUF-DS1, DS2 and DS3).
P-2017-23463	Delay to Fukushima Project	While working with workplan na44-wpl-76801-0632809 (section 4.4) attempting to complete commissioning of 1-53300-RE123 as per P-AB-CMP-53383.01, step 4.1.5 (a) with plug removed 1-53300-RE123 can be switched into the closed position, bypassing its interlock, which results in a failed RE.
P-2017-23221	058-54800-EPG1 PPT Authorization Rejected Due to Fukushima Project WO# 5254901-01	Authorization for 058-54800-EPG1-PS2018 calibration was rejected due to higher priority work occurring on the Fukushima project. EPG1 and EPG2 must remain available at this stage in the project.
P-2017-23190	Fukushima BDBE Installation/Testing delays	An approximate 10 hour delay was encountered for the testing of 058-54320-BUG and 058-54320-BUE (WO# 5017337-43). OPG Control Maintenance staff were brought in on overtime to support the testing of power supply and disconnect switches for BUG and BUE. At the beginning of the shift there was notification that the work to insulate the 4kV cables was not complete. A TCD of 13:00 was provided by the contractors performing the work. As 13:00 approached, CM was notified that the work would not be completed until 14:00 because one of the connections had been incorrectly taped and would not be complete until 16:00. At 16:00 CM was notified that the work was complete but one of the PPT workers assigned to the job had left the site for the day without removing his locks and tags. He was unable to be contacted. After discussion with the Shift Manager, the PPT Holder entered the procedure to cut off the PPT worker locks and disable his proxy card. All of this resulted in delays of approximately 10 hours to the CM scheduled work.
P-2017-23072	Installation of 1-53300-RE123 incomplete, delay to fukushima project. WO#5118427-18	upon visual inspection of 1-53300-RE123 is was noted that the fuses were missing from the disconnect. Reminded the contractor that the fuses were missing, contractor then supplied MC with fuses at 3:30pm but did not have supporting documentation to allow the installation of the fuses.

P-2017-22953	Unable to complete task as scheduled	Unable to obtain authorization for WO#4850299, a C scheduled task, at this time. Task requires 125VDC bus alignment which cannot be performed at this time due to both a required test run of EPG2, as well as the scheduled isolation of 058-54330-MCC033 for Fukushima upgrades.
P-2017-20564	fukushima mods missing parts wo#4716835-69 4-53300-mcc8-f1	placed all material at job site and noticed that there was no locking nut for the cable connector.
P-2017-20396	13-49299 PA FUKUSHIMA U1 MV Tool As Found Condition Water Pooling on new equipment 1-76801-PS1	During QS inspections; it was discovered that there is water pooling on top of 1-76801-PS1. The water seems to be coming from condensation from air duct running directly above UPS cabinet. I think that it may be possible for this water to enter cabinet and cause damage to UPS equipment.
P-2017-12519	Project 13-41027 Fukushima - U1 Electrical Power Restoration: Scissor Lift Damaged	(WO 5041252) Scissor Lift Operator had platform extended while performing welding activities on the 254' EL. When platform was retracted, part of the rail mechanism jammed and the platform did not retract properly; which resulted in bending of the handrail. Circle check was performed prior to use of scissor lift; no defects were observed or visible obstructions found. Scissor lift did not contact any equipment.
P-2017-08826	Fukushima Project 49158/49299/41027 - No attendance from ES MSA project staff to Bi-weekly project meeting	Participants for the Bi-weekly meeting failed to show up at the meeting without prior notice.
P-2017-06737	Project 13-49158 FUKUSHIMA BDBE U8 PIPE SUPPORT SEISMIC HARDENING U8 flex conduit connected to 8-64321-LT252 is broken & wires exposed.	While performing inspection of CADWELD on WO 3076728 69 EC 127712 FUKUSHIMA BDBE U8 PIPE SUPPORT and notice that flex conduit connected to 8-64321-LT252 Condensate System is broken & wires exposed.
P-2017-05000	Project 13-41027 Unit 4 Fukushima electrical power restoration. DELAY - a suspended load over top of the safe work area.	while workers where attempting to pull wire cable for fukeshima project wo#5041256 from 294 elevation down to 225 elevation the cab crane on 294 elevation had a suspended load over top of the safe work area for the cable reels preventing us from entering the area because there where having issues with the crane. This delay caused 10 men a three hour delay
P-2017-04895	Project 13 - 41027 Unit 4 Fukushima electrical power restoration. DELAY - not getting work authorization	employees executing work on unit 4 fukeshima-electrical power restoration wo#5041256 are experiencing delays getting there work authorization in the mornings which is causing delays of 10 men by 2 hours. This is not the first time they have encountered these delays
P-2017-04420	Project 13-49158 P1751 FUKUSHIMA BDBE U5 PIPE SUPPORT SEISMIC HARDENING DELAY - Welding machine disconnected by other work group.	(BFPP) Workers arrived at worksite to perform welding (WO 3217363), but discovered welding machine was disconnected from 600V RE. Cost impact: 2 workers x 5hrs. 1 Supervisor x 5hrs.
P-2017-04180	Project 13-41027 BDBE U4 ELEC POWER RESTORATION - Emergent SATM required at west end of the Island just east of the security fence.	SATM area required for staging new outdoor switchgear the gear is to be mounted just north of the unit 4 TAB on new concrete pad. SATM is required for March 2/17 GILLARDB 2017/02/24 06:49 : This SCR input to support an emergent Satm request to stage and store Fukushima project switch gear equipment temporary until installation later this year.

P-2017-02612	NO-2016-302: Fukushima Follow-up assessment - EME PMID not completed 29Nov2015	Nuclear Oversight assessment NO-2016-302, Fukushima Follow-up (N-REP-01070-0628015) identified that Pickering PMID 132846-01 for UPS Battery Replacements (in-station EME) has not been completed by its late date of 29Nov2015 due to a parts hold. No PM Deferral was initiated (since PM mode codes are 'P' and 'X'). It is unclear who is advocating for this PM to be completed and who is responsible for driving the parts hold. This concern was previously identified as an issue on February 12, 2016 under SCR N-2016-04870, "Nuclear Oversight Assessment NO-2016-302: Existing PM Program for EME equipment is not fully effective". See attachment (PDS-02) for more details.
P-2017-02590	Project 13-49158, PB Fukushima Phase 1 Beyond Design Basis Event - Quality Issues Found During ITP Close-Out	During final review of contractor work packages, various vendor production and QC personnel sign offs determined to be outstanding. Discrepancies noted in Visual Examination reports sign offs Customer sign off marked NA on one report and left blank on two others
P-2017-02481	Project 13-41027 058 Fukushima EWS building Power Restoration - Emergency SATM permit required (SATM # ID 17410)	The Fukushima 058 project for EWS building Power Restoration has been brought ahead. This prevents normal process for SATM permit to be reviewed and approved. This SCR to document requirement and rush approval for such. SATM ID # 17410 was initiated.
P-2017-02178	Project 13-41027 Fukushima ELEC POWER RESTORATION -PHASE 2 -U4 WO 3036325 DELAY - water on the floor 225 elevation.	while workers attempted to enter 225 elevation to continue on work for unit 4 Fukushima project for the cable pull ,workers found basement flooded with approximately 2 inches of water. Workers notified unit ano and he was suppose to commence clean up with operators in the basement immediately which did not happen. After 4 hours 8 workers were redirected to other work areas as the area was still not cleaned up.general foreman checked this area after another 4 hours and no clean up was made and the only thing performed was some of the drains had been opened up but still lots of water,all worked performed under wo#3036325 CAHILLS 2017/02/01 09:32 : Right behavior's from workers and supervision on not going into the area and contacting unit ANO and SM. As indicated workers were re-directed to other work and this SCR is to document delay no further action is required.
P-2016-27432	WW44: 078-33350-NV3 isolation and maintenance aborted.	Work Order 3270332 was scope changed into the week at T-1 to continue with another isolation strategy and proceed with the corrective maintenance on the passing NV to remove a long standing (>1450 days) Level 3 Partial Impairment of ECI. The WP was applied in WW38 and attempts were made in WW38 and 39 to achieve a leakage rate of <2.8 litres/hr. The required leakage was not achieved so additional strategies were developed and approved to attempt to perform this highly desirable work. Isolation, draining, and leak quantification was to start Wednesday #1 shift but CS was unable to receive the water so a tote was required and fill connections were fabricated and installed. Leak quantification was attempted on Thursday #1 but during the initial phase, it became apparent that this was not heading towards success. Subsequent actions would require AWPP39 suspension which was is a relatively involved process and Operations resources could not support. The completion/ removal of this isolation was required for a planned Fukushima mods in WW45. The decision was made to stop the maintenance and return the system to service.

P-2016-26697	Project 13-41027 IOP Fukushima Airlock Bottle Racks - DELAY - RP Tent and Equipment Interferences	Interference issues were discovered at the time bottle rack installation was to be completed, on October 22, 2016. Some of these interference issues have been present since September. Unit 6 254 el. near P 151.5 has D2o barrels and equipment in the bottle rack location. In addition, the tape on the floor to mark bottle rack installation location appears to have been removed. Bottle rack location Unit 6 254 el. near P 165 is in a RP tented area. The rack location is occupied by RP equipment and partial scaffold. Bottle rack location Unit 5 254 el. near P 171 and P 169.5 is also in an RP tented area. The scaffold tube of the tent interferes with the bottle rack installation location.
P-2016-24394	Project 13-41027 FUKUSHIMA AIRLOCK EMERGENCY BOTTLE RACKS DELAY - AS FOUND CONDITION.	Empty bottles were abandoned in a newly installed rack (WO 4930232) after returning from work group returned from break (U8 274'). Rack is not available for use at this time. Additionally, with regards to a different rack that was installed on U8 254' RAB, 4 carabineer hooks that were installed are now missing.
P-2016-24386	Project 13-41027 Fukushima BDBE Storage Pad for DG DELAY - work stopped due to Station Stand Down	Worked stopped day-lighting electrical trenches for new Diesel Generator Storage Pad, located East Side of station, outside of protected area. GEAR dry vacuum truck was ready to dig out trenches when supervisor stopped work due to a Stand-Down work order across the whole station. This stoppage will impact the work schedule for pouring concrete, but should not have an impact on overall cost at this time depending on resolving outstanding issues and commencing work.
P-2016-23499	Project 13-41027, IOP 078 FUKUSHIMA BDBE AIRLOCK EMERGENCY BOTTLE RACKS - Discomfort felt in left knee	W.O. # 4930232 Worker was transferring a fabricated bottle rack from a pallet skid to a 4 wheel cart with 2 other employees. After the work was complete, as the worker was walking away he felt a slight discomfort in his left knee. Report only, no medical attention required.
P-2016-22122	Project 13-41027 IOP Fukushima U1 EPR Pad installation- Work area as found condition.	During excavation of U1 EPR Pad, discovered 2 Electrical Cable 1' under ground in the Pad area. One cable was identified by FE prior to excavation, the other was discovered during excavation
P-2016-22098	Project 13-41027 IOP Fukushima U1 EPR Pad/ trench. Delay - Old Buried Concrete.	During excavation of U1 EPR trench and Pad discovered buried concrete and K-Crete from previous work in the area. will need FE to scan area prior to chipping old concrete out
P-2016-22090	Project 13-41027 IOP Fukushima U4 EPR Pad installation. DELAY - Work area as found condition.	During excavation of U4 EPR Pad and trench, discovered a wall penetration 8" in diameter open ended and through the foundation wall
P-2016-22089	Project 13-41027 IOP Fukushima U4 EPR Pad installation DELAY - Work area as found condition.	During Scanning of foundation wall on U4 for the Fukushima U4 Pad/ conduit installation, found that the foundation wall is 42" thick and not 21" as per drawing. 4 - 6" holes required for conduit to run from Switchgear Pad to 294 Breaker risk is hitting Rebar, as scanning can only locate rebar 12-16" from exterior wall.
P-2016-20013	Project 13-49158 IOP FUKUSHIMA BDBE U6/8 PIPE SUPPORT SEISMIC HARDENING EMERGENCY SATM PERMIT REQUIRED	Due to the expedited nature of this project (we just started receiving the work packages but we will need to begin ASAP) we will need to begin work before the 21 days it takes for the normal SATM process. We have contacted the CA and Fire Protection and are following the collective path to Compliance.

P-2016-17650	Project 13-49158 P1681 Fukushima BUA Critical Monitoring PO# 229562 Delay - due to Hydrazine Spill, Restricted Access WO#3037393	Unable to perform scheduled tasks due to Hydrazine Spill (see SCR# P-2016-17435/17436/17437). Permit not verified due to location in restricted TAB area. Delay/Impact to Critical Path 12 Hours. Cost impact 1 FM, 4 BFIP x 8 hours.
P-2016-16946	Project 13-41027 IOP BDBE U4 ELECT POWER RESTORATION DELAY - REQUIRE EMERGENCY SATM - PERMIT ID# 15961	Need emergent SATM for WO# 3218951-13 just north of A line wall outside of the power house for the U4 IOP Fukushima Electrical Power Restoration Switchgear and Tie-in
P-2016-16708	Project 13-49158 P1681 Fukushima MV Tool DELAY - execution schedule shifted/pushed.	W/O 3096963 June 23 and June 24 Fukushima MV Tool resources were unable to be re-allocated. In anticipation of execution of MV Tool modification, electrical resources were obtained from Darlington to support MV Tool; mitigating in-processing cost. However, with outage priority and system alignment conflicts, Fukushima execution schedule shifted/pushed. In an effort to defer cost impact to project and maintain readily resources for Fukushima MV Tool Project, resources (up until this point) have been reallocated to other work. Cost Impact as follows: June 23 - Workers 4+1 Foreman x 8 hours June 24 - 4 Workers x 8 hours No impact to schedule at this time.
P-2016-14269	Fukushima Mod provide suction Standpipes EC#126448, for AFS one of the drawing update was missed	For Project# 058-71100-Provide standpipe suction for HL160M AND HL260M pumps. Vendor did not provide only one of the 7 AFS drawings. ADL for EC Rev. 001 did not identify -10006 as part of the Rev. 001 package. NK30-DRAW-71100-10006, is new drawing for one of the support HG-2005. OPG design did not identify the missed drawing until closeout. SCR to document delay in closeout.
P-2016-13358	No Progress on PARS Testing Area - Fukushima Commitment	3 months after entering P-2016-04347 to document condition, no significant change has been made. Said SCR was set D-4 within days, and "addressed outside the SCR process", yet nothing substantial has been done. At present, the west annex is part of an on-going cleanup, but is still an alpha 3 rubber area, and quarantined by RP for said cleanup. There is also now a large quantity of material piled up in the area where the PARS equipment should be moved to. This equipment NEEDS a proper home, with controlled access, that won't end up buried in contractor junk again in a few months.
P-2016-12951	Project 13-49158 P1681 FUKUSHIMA BDBE U8 ESC HOSE CONNECTION - Delay due to no Permit	This SCR is to capture accumulative delays (Between May 12th to May 14th) of P1681 Fukushima BDBE ESC Hose Connection (W/O 3036472) project due to no permit. Cost Impact as follows: Thursday Day: (4 workers + 1 Foreman) x 10 hrs Thursday Night: (4 workers + 1 Foreman) x 10 hrs Friday Day: (4 workers) x 13.5 hrs & (1 Foreman) x 14 hrs Friday Night: (4 workers + 1 Foreman) x 8 hrs Saturday Day: (4 workers + 1 Foreman) x 6 hrs Saturday Night: (4 workers + 1 foreman) x 12.5 hrs
P-2016-12811	P1681- ESC Fukushima Mod (V5) ICE Plug formation delayed	ESC Fukushima Mod (V5) ICE Plug formation taking longer than planned. 12 inch plug has been formed. 10 inch plug meets temperature constraints on one side but not the other side. OCC informed and Engineering contacted for potential dispensation.

P-2016-11466	Project 13-49158 P1681 FUKUSHIMA BDBE U8 ESC HOSE CONNECTION DELAY - No Permit	End Shield Cooling BDBE Fukushima Modification (W/O 3036472) installation delay incurred due to no permit (Passing Isolation - Reference SCR P-2016-11242). Ice Plug thawed, permit could not be applied and Fukushima modification installation re-scheduled at a later date in the Outage. Cost Impact for 3 shifts as follows: April 28 (Day Shift) 5 Workers x 8 hours April 28 (Night Shift) 5 Workers x 8 hours April 29 (Day Shift) 5 Workers x 8 hours
P-2016-11036	Project 13-49158 P1681 Fukushima FUKUSHIMA BDBE U8 ESC HOSE CONNECTION Delay - No Permit	End Shield Cooling BDBE Fukushima Modification (W/O 3036472) installation delay incurred due to no permit. Cost Impact: April 27 Shift #2 (Day Shift) 5 Workers x 14 hours GILLARDB 2016/05/02 07:55 : Ice Plug established however there is passing isolation from another isolator.
P-2016-11032	Project 13-49158 P1681 FUKUSHIMA BDBE U8 ESC HOSE CONNECTION Delay - No Permit	End Shield Cooling BDBE Fukushima Modification (W/O 3036472) delay incurred due to no permit (Reference P-2016-10920). Cost Impact as follows: April 26 Shift #2 (Day Shift) 5 Workers x 10 hours April 27 Shift #1 (Night Shift) 5 Workers x 12 hours GILLARDB 2016/05/02 07:49 : Ice plug is established, however their is passing isolation coming from another isolator.
P-2016-09190	HPSW to Emergency Boiler Water Supply System failure to sign Human Factors N-FORM-10221 Part B (MEC 122895)	OPG was informed of CNSC inspection on the Beyond Design Basis projects at both Pickering and Darlington. The inspection is to focus on verification of Human Factors within the Fukushima projects. While reviewing the Human Factors forms, it was found that MEC 122895 had an incomplete HF form. N-FORM-10221 Part B was could not be located and was assumed to be incomplete. Part B of N-FORM-10221 needed to be completed prior to AFS. In this case the MEC 122895 is in Closed status and part B of the form is still not completed.
P-2016-05433	Loose connection and stripped screw found red phase of 4-54130-RE2 FUKUSHIMA MOD	While commissioning EC 127742 - FUKUSHIMA BDBE U4 POWERED MV TOOL MODIFICATION on 4-54130-MCC18 we were inspecting 4-54130-RE2 as per CMP, noticed red phase was loose and pulled out very easy from termination. Attempted to repair connection but noticed the terminal screw was stripped. See attached photos.
P-2016-04241	Project 49158: 056-54660-TK1/TK2 and 058-54860-TK1/TK2 inaccessible due to ice covered dyke and degrades EME fueling capability	Performed walkdown with FE to verify valve tags by 056-54660-TK1/TK2 and 058-54860-TK1/2 and encountered issues with accessing valves V32 & V2220 (056-TK1), V33 & V2330 (056-TK2), V103 (058-TK1), and V104 (058-TK2) due to the foot of partially melted ice and water. A dyke full of water will affect Fukushima response personnel. Without refuelling the EME pumps, there will be a lack of cooling containment to the core during a Beyond Design Basis Event (BDBE). A dyke full of water will have implications to the fuelling code and may result in a penalty. Flowsheets: 30-056-O-54660-FS-01 and 30-058-O-54860-FS-01 Previous SCR: P-2015-07059. Scaffold installation fix is WO# 04786244

P-2015-29753	Project 13-49158 P1561 - Fukushima Project - MCC11 MV Tool Installation Delay	This SCR is to document the delay encountered with 6-33350-MV41 / 61 MV Tool Fukushima project [W/O3033937]. RSA alignment of the EVEN side MVs, conflicted with the workplan Ops alignment procedure. After review by appropriate parties, it was determined that RSA Alignment of the EVEN side would be changed to comply with workplan. While this was ongoing, U6 had a transient as well as another station emergent issue. Day Shift Schedule impact of 10hrs. Project cost impact 1FM, 2 JP x 8.5 hrs. GF and HOR remained to perform turnover with afternoon shift. Afternoon shift [16:00-02:00] Schedule impact of 8 hours was incurred due to MV alignment not completed. Crew sign-on to permit at midnight.
P-2015-29729	Project 13-49158 P1561: - Fukushima Project - MCC11 Installation Delay - A&V Work Protection permit not complete.	Day Shift Predecessor tasks [Align MCC11 and A&V work protection permit] not complete. At 10:40, a decision was collectively made to send crew home as no work available. Electricians - 1FM, 2 JP x 4.5 hrs. GF and HOR remained to perform turnover with afternoon shift. Afternoon Shift Predecessor tasks [Align MCC11 and A&V work protection permit] not complete. At 21:00, a decision was collectively made to send crew home as no work available. Electricians - 1 GF, 1FM, 2 JP, 1HOR x 5hrs.
P-2015-27844	Project #13-49158 P1561 - MV Tool Fukushima Mod CNO Milestone at Risk	Due to MV Tool Fukushima mod [W/O 3033937] execution scheduled date pushing multiple from December 1st to December 10th and now to Decemeber 14th, CNO Milestone [December 20th] is at risk.
P-2015-27062	Project 13-49158 BDBE U6 Power to Critical Monitoring - DELAY - "Start of work due to permitry not ready"	WO# 3033936 EC 127706 Fukushima BDBE -U6 UECC Critical Monitoring. The six shift look ahead showed the permit for this task being applied at 16:00 and ready to accept at 20:00 for work to commence. The permit did not get applied and accepted to 03:40. This resulted in an 8 hr. delay to the start of work.
P-2015-25741	P1561 ESC Fukushima mod (ICE PLUG) Delay	While commencing ESC Fukushima MMOD (ICE PLUG), in attempting to form ice plug it was noticed temperatures were not decreasing as expected, as the Ice plug jacket requires venting...vent hoses are run...unlike U5,7,8 vent hoses are run directly out to the south yard and vented, normally this is a small run as the door to the outside is nearby... but on unit 6 there is no door outside close by which required much longer run of vent hoses this created high back pressure on the jacket which in turn limited the flow of nitrogen to the jacket..... Ops decided a higher supply pressure from the Nitrogen trailer was needed but by procedures limited to a lower supply pressure ops stopped and contacted the vendor. ops contacted the vendor about raising supply pressure to a sufficient amount to allow for flow to the jacket to form the ice plug. There was a delay in response from the vendor resulting in delay in the ice form progressing. After ensuring path forward with the vendor ice plug formation continued. after declaring the ice plug at 12:00, next step was to drain the pipe work and apply permit.....in attempting the drain it was found to be a much slower process then the assessment and has been noted and will be changed onto the next similar project. Ops found drain was progressively diminishing but at 18:00 declared a passing isolation. Isolation was backed up using other valves and ops confirmed isolation was holding, 6-34110-V5 was found to be the passing valve. Due to the passing of V5, the work permit no longer satisfies the work being done. A new permit will have to be written creating another delay. Ops to re-write permit and then apply permit SKREPNEE 2015/11/05 17:53 : The isolation was tested and found to be passing(V5)

P-2015-25660	Project 13-49158 P1561 Fukushima BDBE - Continuing delays to start of work due to P1561 Outage Window	Schedule Fukushima P1561 outage scope related to Power to Critical Monitoring UECC Main BUs Mod has moved in the schedule several times since the beginning of the outage. Latest change has moved the start of installation for (BUC G) from November 05 to November 10. (BUC H) is now scheduled for Nov 26. Mod must be installed in this outage to meet regulatory commitments and window is now close to end of outage. Further movement may impact ability to execute. Additionally moving of outage windows impacts resources which have been arranged to support and then have to be accommodated on other work if possible.
P-2015-17929	Fukushima HL5 pumps discovered not able to reach upper RPM limit as required by approved procedure	P-2015-14555 was originally initiated to document this condition in June 2015. Operations agreed to complete a C3 NFE corrective action plan on this item. During review of the assigned action tracking 28179199-01 it was determined that operations did not have the technical expertise to successfully complete the action. Operations reached out to System Engineering, Design Engineering and Project Engineering without receiving adequate support. As a result, operations have cancelled AR 28179199-01 and initiated this new SCR. The intent is to have this new SCR assigned to that the appropriate work group that has the technical expertise to develop an effective corrective action plan. The original SCR P-2015-14555 was taken as EO by operations. This was an incorrect decision. SCR co-ordinator (me) have internalized this decision When the inability for operations to complete the action tracking assignment came to light, the SCR co-ordinator (me) was not able to successfully negotiate a new owner for the action. The SCR co-ordinator has internalized this failure.
P-2015-17215	MS-P. scaffold blocking equipment, Fukushima flood barriers	Scaffold erected for 0-65466-F7-FZ556 is blocking Fukushima flood barriers, discovered during field walk downs MOHUNB 2015/08/05 08:12 : Ref. WO 1578368-01.
P-2015-14555	Fukushima HL5 pumps discovered not able to reach upper RPM limit	During hands on training with operations staff to build necessary situational awareness regarding BDBE equipment it was discovered that none of the allotted HL5 pumps were able to reach the higher RPM limit of 2400 RPM. As the diesel engines are directly connected to the pumps RPM is proportional to pressure being developed. We struggled to reach 100 psi (90 psi was the highest pressure achieved through one boiler feed hose) @ 2040-2060 RPM continuously over the course of the training rotating through all the individual unit HL5 pumps. Although we were using a recirculation tank that provided no back pressure, the RPM stated in NK30-EME-09013-OPS-00003 which use P-CALC-03490-00001 reference 2400 RPM as a speed needed to achieve effective cooling. NA44-EME-09013-OPS-00003 state RPM in the neighborhood of 1800-2000 RPM. The instructions, parameters and method of achieving them between both stations differ significantly which adds to confusion. The revision history is absent on NK30 procedure so the evolution of changes in that procedure is a mystery. Also of note is the P-Calc document focus on flow rates not pressure which would make more sense when dealing with constantly changing dynamics of a crippled station, i.e. the pressure being fed into a system isn't as important as the flow of inventory going into that system. Consistency is needed between procedures of both stations as human resources may be interchangeable between the stations. Clarification on the RPM matter is needed and the procedures need to be updated accordingly.
P-2015-14522	13-41027 – Fukushima Phase II BDBE – Delay in Additional Monitoring Capability CAT 4 Package	The Additional Monitoring Capability (AMC) CAT 4 Package has been delayed multiple times. The AMC CAT 4 package was originally supposed to be submitted to OPG for approval on 26MAR2015 as per the approved vendor schedule. The second date that the package was to be submitted was 17JUN2015, which has now also been missed. A new date has been established to submit the AMC CAT 4 package by 25JUN2015. This SCR has been generated to document lessons learned and an adverse project trend.

P-2015-12007	13-41027Fukushima Phase II - Procurement delay on Emergency Power P1641 outage Recovery Plan	Vendor missed two Critical deliverables(Vendor drawings and PO issuance) for P1641 outage Recovery Plan for U4 Emergency Power Restoration modification. Per the recovery plan issued by the vendor on April 28th,Vendor drawings and a PO to the manufacturer had to be in place by May 1st and May 18th respectively as a prerequisite to completion of Detail design by July 31st.(outage milestone 11) As of May 22nd the PO have not been issued to the manufacturer and all drawing are not received. This has a ripple effect on completion of detail design by July 31th (outage milestone 11) and subsequent preparation of outage activities such as support documentation(outage milestone 18), Work Plan Assessing (outage milestone 21) and material delivery (outage milestone 28)
P-2015-11143	Beyond Design Basis Seismic Event - Previous SCR Actions not Issued	Previous SCR P-2013-05015 was raised in response to BDB earthquake event analysis. Specifically the reports raised issues such as conveyor tunnel failure with respect to irradiated bay water level, as well as toppling of irradiated fuel baskets during a seismic event. The reports stopped short on providing conclusions and recommendations to the above scenarios. The previous SCR recommendation was to be C3 with follow on actions to address these shortcomings. The previous SCR was D4'd with the following comments, "Existing available design documents confirm that these FH components are seismically qualified". The reports listed are for Fukushima initiated Beyond Design Basis conditions which have not been covered in the past. This SCR must be C3 with the appropriate follow on actions Ref 1) NK30-REP-03611-0001 2) NK30-REP-03611-00001 3) NA44-REP-03611-00028 4) NA44-REP-03611-0029
P-2015-07387	P1551: Delay to Fukushima Elec. Interface Mod. due to poor plannig of 1-4 OPS support	While Pickering 5-8 Operations were conducting Level 4 PJB for 5-54340-BUA Outage, Section 5.0 (Reactor Safety/Operational Impacts of Evolution), Pickering 014 support was identified. The support tasks for 014 were not assess or scheduled. The support tasks required VB pressure to be reduced prior to BUA outage which requires 12-24 hrs to complete. The 014 Control Room staff were unaware of the requirements and tasks were not completed in time. PJB also references the need for rector safety review in the form a a Defense In Depth review (DID). This was not included in the DID package for March 29 #1 shift.
P-2015-06717	Project 13-49158 - Fukushima Projects - Schedule Issue - AFS Strategy Memo Not Prepared	An AFS strategy memo was not prepared by the EPC contractor to support re-pressurizing of the End Shield Cooling system following installation of the modification under Design EC 126337 and for the system to remain energized and operational prior to turnover, as identified in N-GUID-00700-10000 Section 1.7.1 This was discovered during OPG Projects oversight of EPC activities and review of installation readiness for installation in Unit 5 during the P1551 outage.
P-2015-04102	P1641 Milestone 18 Outage Support Documents for Operations is at risk	P1641 Milestone 18 Outage Support Documents for Operations is at risk. The documentation milestone is being challenged by 15 operations procedures for electrical outages. The most significant challenge being faced is qualified resource. Currently operations resource is focusing on the P1511 governor modification and Fukushima upgrade electrical procedures.
P-2015-02929	Project 13-49158 P1551 Fukushima (Tool to open MV's) - As Found Condition - FME Issue	WO# 2909405 As Found Condition during walkdown on Feb.05,2015 for the upcoming U5 MV Tool connection modification for 5-54230-MCC11. Work group noticed duct tape on the terminal blocks located in the control cubicle. 5-5423-MCC12 was also verified. No issues withthis MCC12

P-2014-34219	Fukushima BDBE Project (13-49299, 49158) - Design EC 126377 - Project delay due to rework	Vendor submitted Design EC 126377 to OPG for review and acceptance. During review, it was noted that Bill of Material NK30-BOM-71260-10000 change paper and Flow Diagram change paper specified a 3/4" valve for 058-71260-V33. However, Cat-ID in Asset Suite specifies a 1/2" valve. Vendor was confident that the valve in field per walkdown photos is 3/4". After performing another walkdown, vendor confirmed that V33 is in fact a 1/2" valve. Incorrect assumption was made during detailed that had not been validated.
P-2014-27108	P1471, Project 13-49158 Fukushima Beyond Design Basis Event - Delay to Seismic Hardening Project (MCC11/12)	WO#2910166 When workers attempted to obtain work authorization at the beginning of the Afternoon Shift they were told by the Issuing Authority that they would not be allowed to start as Operations had a planned E-26 test that would take the remainder of the shift
P-2014-25141	P1471, Project 13-49158 Fukushima, Seismic Hardening U7 BY1B - Delay to Seismic Anchorage Upgrades Project	WO#2910166 7-54230-BY1B floor scanning for the drill card was delayed due to Capacity Discharge Test WO#2886748 being performed. The work is not tied in the schedule and therefore assumes both tasks can proceed in parallel
P-2014-20827	EC 126265 " 7-34110-Design-Fukushima BDBE Phase 1 EME Project - submitted by HSL, rejected due to legibility of scan	EC 126265 " 7-34110-Design-Fukushima BDBE Phase 1 EME Project - Provide Water to end shield cooling system via L2005W2B and V2002" papers submitted by HSL ,were rejected by BUS Service due to legibility of Scan
P-2014-19000	EME Portable UPS Deficiencies - Audit Field Observations (NO-2014-027 Fukushima Audit)	Some field deficiencies were noted for the Emergency Mitigation Equipment Portable UPSs at Pickering. The most significant issues were noted to be missing restraints at one location, missing warning signs, and none of the power cords were tagged to prevent unplugging the devices. UPSs were observed at: CER1, CER4, SDSE1, SDSE4, UECC5, UECC6, UECC7, & UECC8. [Photo attachments] 1) The two UPS carts for CER 1&4 were not restrained with cables or straps to limit movement (SATM P13-0268). The carts at the other locations were all restrained either with cables or straps. (Column L-35) [Photo 0304] 2) None of the power cord plugs were labeled with tags to prevent disconnecting of the UPSs. The UPS plugs to the power bar and the power bar connection to the wall were not tagged. Note: One Rad Protection instrument plugged into one of the power bars supplying a pair of UPSs did have a yellow tag attached. [Photo 0307, 0300, 0302, 0294] 3) The UPS location for CER1&4 did not have any warning signs on the two carts warning of an electrical hazard with the EME equipment in service. [Photo 0305] All the other UPSs had unsecured signs warning of an electrical hazard with the EME equipment in service. [Photo 0297 & 0293] 4) The checksheet calls for a 4' ladder for each UPS location, but there did not appear to be any in the near vicinity of the UPSs. 5) One of the UPSs for UECC 7 & 8 at M-123 was difficult to access as it was located between a wall and a cage. The device could be accessed by stepping on a beam and a stored box had to be overstepped. (SATM P12-0178) 6) The Line also noted that the following SATMs have been terminated and need to be updated in the checksheet (P-FORM-22233 R000): P12-0233, -0181, -0182, and -0178. 7) The UPS carts for CER1&4 were located at column L-35, but the checksheet indicated J, K-32. 8) Some power bars were located on the cart and some were on the floor. The condition was identified during the Fukushima Audit NO-2014-027.

P-2014-18557	T-Alt memo for IFB-B Interim Water level Monitoring (Fukushima) is expired	T-Alt memo NK30-CORR-34400-0369593 was created by FH Design in november 2011, to be in effect 9 months from date of temporary water level indicator installation or until the permanent modification is installed, whichever is earlier. WO # 2679870 – for installation of a temporary water level indicator was completed in november 2011, but the permanent modification for Fukushima Beyond Design Basis Event project- Master EC# 124582 for remote level/temperature monitoring and installation of a hose anchor at IFB-A/IFB-B/AIFB, will have the Design package expected to be completed before the end of the year and installation in 2015. The current T-Alt memo is expired and is too old. A new T-Alt memo NK30-CORR-34400-0503228 is prepared to document the temporary alteration until the expected completion of the design and installation.
P-2014-18503	Proj# 13-49299 & 13-49158: MEC 125214 (Portable Tools for MVs, P1&4 and P5-8) package and subsequent Comments & Disposition Response submitted by HSL	While reviewing dispositions (May 15/16) for MEC 125214, HSL confirmed that the current design submitted is based on the deployment of Permanent DG sets inside the plant for the power supplies to MVs (P1&4 and P5-8) in place of previously agreed deployment of portable Generator sets outside the plant. OPG was not made aware of this scope change. OPG Projects/Design brought up this issue with the Fukushima Focus Group (FFG). Based on the FFG recommendation, Projects/Design has advised HSL the following: MEC 125214 package for MV Tool: a) Should include P1&4 and P5-8 modifications for controls. b) Should include P1&4 and P5-8 modifications for power utilizing a portable solution. HSL revised and re-submitted the updated MEC package. A review identified that the MEC package still does not incorporate portable generator option changes in all applicable sections. This has resulted in OPG to go for another review cycle (Minutes of Meeting, May 28, 2014) in order to facilitate HSL to incorporate the changes. The Design choice of deploying permanent diesel generators in place of portable diesel generators was taken by HSL alone without consulting OPG Design/projects for concurrence. Moreover, HSL have re-submitted an incomplete package for OPG review. This has caused: a. A delay in the OPG review process thus causing a further delay in sending the design documents for the Design review Board b. Involvement of HSL design team in preparing design documents based on a design approach which has not been concurred by OPG c. Use of OPG engineering man-hours for reviewing incorrect design documents submitted by HSL By not providing due attention in revising documents based on the discussions with OPG has caused: a. Another review cycle (Minutes of Meeting) and a re-submission of the MEC package b. Additional man-hours for the updates by HSL.
P-2014-18500	Proj# 13-49299, 13-41027, 13-49158: (N+1) Option for BDBE Modifications (Deployable Generator Sets, Associated Switchgears & Portable Tool for MVs)	It was discovered while reviewing Pick-'B' Battery Calculation for the Portable Tools for MVs after BDBE event with HSL. OPG Projects informed HSL that as per recent discussion with Fukushima Oversight group, the (N+1) requirement is not applicable for MV Tools. Instead, ODD/EVEN Power supplies will be used as Primary and Secondary Power source which is contradictory with the current (N+1) design approach. HSL has already prepared/submitted most of the design deliverables for the MEC packages to OPG. OPG is reviewing and is finalizing the MEC packages. By changing the (N+1) design approach at this stage will further delay the design activities.

P-2014-17393	Records & Control Documents Optimization Program results in lack of available up to date copies of Operational Documents.	During review of Impairments Abnormal Incident Manual, discovered that Unit ANO copy flagged as no longer being updated, due to Records & Control Documents Optimization Program. Further discussion identified the fact that no copies of any manuals are being maintained in field operator field offices as a result of this program. No prior notice of this program was rolled out to operations staff in MCR or Field. ANO no longer has maintained copy of Impairments Manual available to reference for required actions resulting from system impairments. Field ops no longer have maintained copies readily available to refer to for procedural actions. LOBES, and Fukushima events have resulted in total loss of electronic documentation. WANO has identified value in maintaining current revision paper copies of operating documentation. RCDO Project has ignored any lessons learned from these events, and is potentially challenging the safety of the personnel, station and public as a result. Concern that Alarm Response Manuals are not controlled copies and will be subject to this project, resulting in lack of ability to respond to emergent conditions in a timely manner.
P-2014-15029	FUKUSHIMA EME-Gravity fuelling issues for both PNGS and DNGS	As per Liquid Fuels Handling Code 2007 4.1.1 Product shall not be transferred from a storage tank except by means of pumping 4.1.2 Product from aboveground storage tanks shall not be allowed using bottom outlets located below the liquid level unless the tank is located in a dike 4.1.6 All piping, except for water drains, that is below the highest liquid level of the supplying tank shall be protected with an anti-siphon or normally closed fail safe automatic valve Gravity feeding as we are now in a non-emergency condition is not allowed as per this code.
P-2014-15025	FUKUSHIMA EME; Refuelling tote grounding issues for both Pickering and Darlington sites	During fuel training course it was discovered that upon visual inspection of fuelling tote grounding/bonding reel, it was attached to a painted surface, compromising the ability of the unit to do its intended function. this problem may or may not exist on other fuel totes or other EME equipment that needs to be grounded/bonded.
P-2014-10630	Project 13-49299/49158/41027: PO 229562 increased by greater than 20% for Fukushima Phase I and II Projects at PNGS	The newly proposed contract value for Projects 13-49299/49158/41027 (PO 229562) is in excess of the current contract value by more than 20%. Current contract value of $7,630K will be increased by $4,481K (including $2,110K contingency). This funding is required for the completion of all execution in 2014 for the Fukushima Phase I and Phase II Projects, and includes the associated procurement and pre-requisite activities to occur for this execution work. Additionally, this release includes funding for approved PCAs/CTPs, and includes contingency for PCAs/CTPs that are presently unapproved.

P-2014-09288	NLO - EME ARQ PEL# 70447 cancelled this May-June due to training equipment delayed.	In December 13 , 2012 we had gotten approval to move forward with a formal scope change to pursue the purchase of equipment for PNGS to allow for hands on training for operations staff. As of September of 2013 we were informed that the approval (2013 MFA budget) has been given by the Fukushima projects group to purchase an enclosed recirculation tank that would be used for operator and ERT training. Based upon that information we created STEs for 14x8hr day courses to deliver PEL# 70447 for PNGS Generating Unit (GU) OPS. Also in September DNGS asked what the status was in regards to their own enclosed recirculation tank and at that time their tank was part of the 2014 MFA budget. In October 2013 we were informed that the tank would be on site by Q1 2014. Between November and December of 2013 it was decided to put our approved purchase into the 2014 MFA budget(we were not informed of this decision), which in turn stalled our process in acquiring the tank for the April 1st window. We were informed March 06 2014 that the tank would not be on site no earlier than June. Which would be halfway through our already scheduled training window. Since we would need at least 3-4 weeks to validate our lesson plans and enabling and performance objectives with the operational equipment would delay our delivery window to beginning of July. Our training has been developed based upon the use of the enclosed recirculation tank, it comprises to around 70% of the course.
P-2014-08033	Low Quality of Modification Design Requirements P-MDR-33350-00001 per Design Review Board (DRB)	Description of condition: As part of the Fukushima Beyond Design Basis Mitigation Project (13-49158, 13-49229), OPG vendor prepared Modification Design Requirements P-MDR-33350-00001 which underwent Design Review Board (DRB) review on March 5, 2013. There were several errors noted in the MDR from a technical and procedural standpoint (Comments attached). The overall quality of the package is deemed poor by the DRB. The associated Master EC 124570 package also received several comments upon Design Review. Per DRB comments, the MDR is required to be vetted through the DRB again alongside the Modification Outline and Design Scoping Checklist prior to Design Authority sign-off. Similarly for Master EC 124572, there were several comments on the submission. Re-work is required to bring the package to satisfactory quality. Discovered While Performing: - Design Review Board (DRB) review of P-MDR-33350-00001 - Design Review of Master EC 124570 and Master EC 124572
P-2014-01784	EME - Emergency Mitigation Pump 863-007 (Unit 4) deficient block heater found while performing routine daily inspections.	Block heaters were connected and activated on January 16, for all EME equipment. On January 17th while performing EME daily inspections it was found that the unit 4 pump 863-007 was not operational. Power to the block heatrer was operational, but it was not heating the coolant. Back on November 11th, this block heater failed and corrective action was taken to get it repaired. Repairs were completed on December 6th by the TWE.
P-2014-00680	Project 13-49158: P1471 Milestone #18 Outage Support Documents/Revision Issued Missed	P1471 outage milestone 18 missed for Fukushima Phase 1 due to delayed issuance of PO 229562. The delayed PO issuance caused delays in design completion, which in turn affects work plan completion.

P-2013-23212	P1471, P1511 and P1551 Outages - Missed Design Complete Milestones for Fukushima Project	Missed P1471, P1511 and P1551 outage milestones for Fukushima phase 1 & phase 2 project due to delay in issuing Purchase orders to ES MSA contractor. MAXIMA 2013/12/06 12:21 : The contract includes the design activities which cannot be completed to meet the outage milestone due to the delay in issuing the purchase order.
P-2013-23003	Misinterpretation of the Sec 01.6 of NA44-OPP-03600 and Sec 001.5 of NK30-OPP-03600	For the MEC-122895, 122896 CNSC Notification was required as per N-FORM-10369. It was discovered during discussions with Regulatory Affairs that Sec 01.6 of NA44-OPP-03600 and Sec 001.5 of NK30-OPP-03600 was misinterpreted for the modifications subject to CNSC approval or notification.
P-2013-17227	078 EME Equipment hard to access/remove for use	During walkdowns for EME drill/practice noted that the UPS's staged for U7 and U8 UECCs were in a location that makes it extremely difficult to access/remove for use. UPSs have considerable weight to them and are connected via cable and stored on wheeled carts with additional toolboxes. In order to remove the carts from the staged area they would have to be lifted above local stairs, transported across the roof to the UECC (lifting on more stairs) to be utilized.
P-2012-16821	Project 49158, Fukushima EME building, Material Delay - rolling Doors	Rolling Doors were to be installed but are now delayed as the carrier for the shipment is unable to locate the doors. Covers both Pickering and Darlington. Contractor has been trying to locate through carrier but has not been successful.
P-2012-12516	13-49158: Lack of clean up of pipe fab shop leads to health/equipment concern, bird waste	Fukushima Phase 1 project 13-49158, 13-49299. Work order 2831918 was initiated for Facilities to remove bird droppings and guano from the pipe fab shop due to health concerns. Facilities re-assigned this work to contractor on 17JUL12. To date, no cleanup has been completed. Health concerns for workers working in the shop had the equipment staged in the shop to be moved outside. This equipment is part of the Station's emergency mitigation equipment (Fukushima project), and must be connected to electrical outlets and remain charged. Movement of the equipment to the east yard is non-ideal; not enough electrical outlets available to keep all equipment plugged in, as well as staging the equipment in a different location than what is called out in procedure.
P-2012-12185	Field issues around seismic equipment and routes (WER)	CNSC letter July 6, 2012 Pickering NGS A and B Field Inspection of seismic related issues, new Action Item 2012-4-3434 raises 3 new Action Notices to investigate the cause for findings in the field around seismic equipment and routes; provide the timeline to correct specific findings; and to identify any other actions taken or planned by OPG to prevent recurrence.
P-2012-11091	Fukushima EME Storage Building - burried Electrical Cable located in Construction Island	While excavating for the Fukushima EME Storage building the Contractor day lighted a small portion of an electrical cable from the ERT building to the shed at the west side of the site proper of the emergency storage building. This service did not appear on OPG supplied drawings, but was picked up during the scan performed by the Contractor. This will cause extra costs to the project as it was not on the OPG Drawing.
P-2012-09093	Preparer not fully qualified to sign Engineering Calculation	As a result of high air instrument air inleakage in Unit 8, test C-013 failed in three consecutive times. (ref. SCR P-2012-08476, P1281 Level 3 Impairment on Containment due to Failed C-013 Test). Thus, Engineering Calculation NK30-CALC-03500-00001, Assessment of Unit 8 Instrument Air Inleakage, was prepared in support of Technical Operability Evaluation NK30-TOE-34200-00001. The preparation of the calculation was assigned to the backup Containment Engineer. After completion of the verification and approval of the calculation, it was questioned whether it was in accordance with our QA program to allow the Preparer to sign, since his qualifications were still in progress. After a discussion, it was concluded that another fully qualified Engineer, who worked with the Preparer, should co-sign the calculation to ensure compliance with QA program.
P-2012-07910	Material issue: Material damaged during Fukushima "dry run"- project 13-49299	The hitch that is bolted on the HL5 pump broke off while it was towed with a forklift. The forklift was towing the pump during a "dry run" test of the Fukushima EME (Emergency mitigation equipment). The turning radius of the hitch did not allow the pump to turn around the corners thus putting force on the hitch that resulted in the shearing of one of the bolt.

P-2012-06475	Schedule Issue, WMI INJ: 13-49158 Fukushima dry run schedule change at T-1	Fukushima Phase 1 project 13-49158, 13-49299. Work orders 2698870 and 2697322. After reviewing the schedule for the proposed dry run, Shift Manager requested the project delay the exercise by one week, from WW16 to WW17. After review with work control, it was determined that the workload for WW17 is too high to support the change, so the project is delaying the work until WW18. Schedule delay of 2 weeks. Change to schedule at T-1. Work injection at T-3.
P-2012-04211	Pipe Fab Shop JHSC Inspection	JHSC reps performed an inspection on March 1 2012. The findings were reported to appropriate line management for followup. The JHSC recommended that a qualified person walk down the facility and requested that we be told when this was completed so we could finish our inspection. Please see attachment. We returned today after being told all issues were resolved. We found several other issues today, including extension cords run in wet locations with no GFCI, site manufactured extension cords with no ESA inspection, skids resting on edge such that they could topple, extension cords with potential to be pinched due to positioning in yellow jackets. Please see attachment.
P-2012-01217	Additional scope has been discovered while master EC 116157 mod outline routed for approval with Design Authority	As part of the Fukushima Oversight Project there is a requirement to protect critical equipment against Beyond Design Basis Events. The purpose of modification is to ensure that the fuel forwarding pumps are protected from flooding as a result of a probable maximum precipitation (PMP) event. The resolution is recommended to install flood barriers at all of the exterior doors of the SG Pump house as a precautionary measure to protect against ingress of water in the building during a Beyond Design Basis Event. Standby Generator Fuel Forwarding Pump house was walked down with MTL, DTL and Design Authority on Jan 16th 2012. During the walkdown it was identified that there is potential for water to ingress through the brick wall of the building. This needs to be addressed in the modification outline EC 116157, which was not part of original scope of work identified in Engineering Change Request, ECR#20240. Modification Outline and Design Technical Specifications for Doors will be revised to reflect above mentioned additional scope of work. This will impact the project cost and execution time line. However, MTL/ DTL will work closely and develop the recovery plan.
P-2011-25693	BREAK PLAN TRAINING REQUESTED	Break plan training requested for Orange Badge PEL 63220, Fall Protection PEL 7231, Work Protection Level 2 PEL 24163 & Half Mask Comfo PEL 66254. This training is required to support work activites for the Fukushima Flood Barriers modification project.
P-2011-23951	3381- greater than 20% increase is require for PO # 202660 re: SOER 2011-02	To allow our department to purchase the required materials / equipment to support the PND requirements due to the Fukushima accident WANO SOER 2011-02
P-2011-15621	Potential for SG Fuel Pump Power Cables to be submerged following a flooding event.	As part of the post Fukushima event review, questions were raised regarding potential flooding in the vicinity of the Standby Generator Pump House due to restricted overland runoff (Ref. SCR P-2011-14969). During the follow up review of SCR P-2011-14969, it was noted that most of the power and control cables of the SG Fuel Pumps pass through a 6' deep manhole located in the CO2 Storage room of the SG Pump House. Therefore, during a flooding event, there is the potential for these cables to be submerged. Concerns were raised regarding potential failure of the power cables following a flooding event due to insulation degradation.

P-2011-14969	Potential Flooding in SG Pump House due to perimeter security fence configuration	As part of the post Fukushima event review, an assessment is being conducted to determine the potential impacts to the site as a result of heavy precipitation rate which could be greater than the yard drainage design basis. As part of this assessment, a walk down was conducted by external contractors. During the walk down it was noted that the base of the perimeter security fence was reducing and in some cases blocking overland runoff into the lake and forebay area. Questions were raised regarding potential flooding as result of the fence configuration. One of the areas with increased flood risk is the Standby Generator Pump House. Operability concerns were raised and plant design was asked to assess the issue. A review of the Golder Reports (part of Environmental Assessment and included in Pickering A Bounded Document Set) and following correspondence was performed: P-CORR-00531-00864, P-CORR-00531-00973, P-CORR-00531-01024, P-CORR-00531-01040, P-CORR-00531-01205, P-CORR-00531-01215, P-CORR-00531-01251, NA44-CORR-00531-05098. Two separate walk downs were conducted by plant design and projects to assess the potential for flooding and possible impact to the equipment in the Standby Generator Pump House. In the walk down it was noted that the pumps are elevated 8 inches from the pump house finished floor elevation. It was also noted that there is a gap (varying from 1.5 inches to 4 inches) between the bottom of the fence structure and the ground floor. The gap is interrupted approximately every 9 feet by 10 inch plates. This causes a reduction of overland runoff in the area. This runoff reduction invalidates the assumptions made in the Golder Reports and as such it invalidates the design basis.

N-2018-16497	Paint mismatch for the Fukushima Water to PHT modification	Legacy pink paint used for the P&IC system was CATID 476941. However this CATID is shown as OBSOLETE in AS7, with notes indicating that the alternate CATID to be used is 669688. However, CATID 669688 is also shown as OBSOLETE in AS7. CATID 476941 (Legacy) ICI DEVOE COATINGS Model: ICI 50YR68/114 Part: 4216-0100-501 Unique Description: WATERBORNE, FOR PIPING-HEAVY WATER Description: PAINT, ACRYLIC ENAMEL, PINK, GLOSS, 3.7 LTR PAIL, WATERBORNE, FOR PIPING-HEAVY WATER CATID 669688 (Replacement) ICI PAINTS (CANADA) INC Model: _____ Part: 4216-0100L-501 Unique Description: WEB SITE PURCHASE Catalog Description: PAINT, ACRYLIC ENAMEL, D20 PINK., SEMI GLOSS, 3.7 LTR, WATERBORNE In the meanwhile, it seems like ICI Paints got purchased by Dulux and Dulux by Pittsburgh Plate Glass (www.ppg.com). For the Fukushima Water to PHT project, ESFox actually got the paint from the Whitby PPG store for CATID 669688 having the following specs: Model: ICI 50YR68/114 Part: 4216-0100-501 P/N 42160100LC/01 Description: PAINT, ACRYLIC ENAMEL, D20 PINK., SEMI GLOSS, 3.7 LTR, WATERBORNE For ES Fox, although the paint provided by the Whitby Store (Store# 8633) may have seemed equivalent on paper to the CATID 669688 description in AS7, when actually used on the modified/new piping seemed altogether different compared to the legacy paint. However, where ES Fox should have paused and exercised questioning attitued, continued to use the explcitly different pink shade (bubble gum pink) for the modified/new piping for at least 3 of the 4 units (U2 is pending to be painted, as operational leak check is outstanding) across the 4 Units. Hence, OPG DTL researched further by reaching out to various PPG stores in the GTA area, including Whitby, Oshawa, Oakville, Toronto and Mississauga. The Toronto Store (Store # 8609) suggested that since the original paint was discontinued, there might have been a tinting error by the Whitby Store, and proceeded to provide a paint
N-2018-10224	13-41027-Pickering BDBE Fukushima Mods - Unable to closeout Project EC142289 and Master EC12768 for Seismic Racks for Emergency Back up Air Bottles	During closeout of Master EC 127682 for Seismic Racks for Emergency Back up Air Bottles at Airlocks it was noted that Project EC 142289 cannot be closed since revised procedure NK30-EME-09013-OPS-00020 has not been issued yet
N-2018-06852	Pickering BDBE Fukushima Phase II EME Project 41027: Unable to Closeout Design EC in 6 moths window	During extension of action tracking assignments, it was noted that EC 14134870/134871/134872/134873/134874 cannot be closed within 6 months close out window, since field work related AFS open items including history doc could be completed for these EC. All design related closeout ARs are completed and that the only thing delaying closure of the ECS is the project related open ARS
N-2018-06017	13-49158/49299 - Pickering BDBE Fukushima Mods : Unable to closeout Project EC and Master EC for Power to Critical Safety Parameter Monitoring	During closeout of Master EC 124737 for the Critical Safety Parameter Monitoring Modification, it was noted that Project EC 129515 cannot be closed since the revised procedures listed under the ADL have not been issued.

N-2018-04007	Fukushima Project (49158) - EME tent # 2 - Warranty issues - Overhead doors installed incorrectly	S/W overhead door was not closing properly and other doors were jammed in EME tent # 2. AFS for this modification was completed in Sept 2017. Facilities inspected all four doors. All four doors were found installed incorrectly.
N-2018-03687	13-49299 FUKUSHIMA U4 POWERED MV TOOL MODS W/O 4716835 - Findings During ITP Closeout	During review for closeout of vendor ITP 5580-7046 R01 there were 16 issues noted in oversight report P-OR-49299-C-4-042. Received disposition from the vendor on all items however there were items that warrant an SCR as they were scored as 'unacceptable': 1) Lack of 2nd as-left FME work reports - As per N-PROC-MA-0018 section 1.3.5.10 when work is performed by contractor under their own QA program then contractor QC workers are responsible for performing 2nd as-left FME inspection and documenting in an AS7 work report.. There were only two work reports entered (1 on 18NOV2017 and 1 on 24SEP2017) under 04716835-07 for the duration of the entire job which dealt with multiple pieces of equipment 2) Step 310 and 390 had scope added via mark up to install a conduit supports which is acceptable as per statement provided by vendor quoting section of quality procedure section 5.8.1 Field Mark-up Revision (Minor) "The Inspector, in ink indicates the revision using a one-line strike through of the required deletion or by adding the required information. Once changed, the QC Inspector shall date and initial the mark-up, then consult with the Customer and AI/ANI (if required) to determine if their involvement is required. Customer and AI/ANI (if required) acceptance is required for minor changes where the scope has been modified, and the ITP remains at the current revision". The issue here is that OPG Field Engineering who represents the customer in this case was not consulted and the vendor was incompliant to their QA program because of this.
N-2018-03662	13-49299 FUKUSHIMA BDBE U4 POWERED MV TOOL MODIFICATION - Battery Shipment manifest signed by unqualified individual	- OPG CMO requested MSA Contractor to dispose of defective batteries (REF. SCR N-2017-21941) - MSA Contractor contracted qualified Vendor (GFL) to dispose of the batteries - GFL retrieved the batteries from site under OPG waste generator number (unbeknownst to ESFL) - MSA contractor employee signed waste manifest provided by GFL - OPG Waste discovered break through when they received a mailed copy of the waste manifest from GFL but did not have copies 1 and 2 of the original manifest BOYCEC 2018/02/12 14:36 : Waste batteries were generated as part of project "BDBE Phase 1a - MV Tool UPS" which is part of installing four UPS's for a Fukushima related project. GFL was contacted by contractor ES Fox. The shipment occurred on January 26th using OPG site waste registration number ON0490334, under Waste Manifest TF67200-7, by consignee GFL Environmental. Acid filled batteries with an estimated weight of 100 kg (and an actual weight of 159 kg), coded 112C, UN2794, were transported for disposal. The manifest was signed by an unqualified individual (TDG Qual 1051), hence P-INS-79000-00010 "Completion of Ministry of the Environment and Climate Change Waste Manifests" was not followed, P-FORM-20168 Checklist for Completing Ministry of the Environment and Climate Change Waste Manifests" was not completed, copy 1 (white) of the manifest was not mailed to the MOECC within 3 days (regulatory requirement), and copy 2 (green) was not stored within 1 business day for a period of two years. Furthermore, since the consignor is responsible for the contents of Part 'A' of the manifest, the individual signing did not have the capability to validate that the proper provincial shipping code, class, and UN number were correct and are also registered by OPG on the MOECC Hazardous Waste Information Network (HWIN).
N-2018-00779	13-49299 FUKUSHIMA BDBE U1 POWERED MV TOOL MODIFICATION wo#5250541 Delay - Issues with SATM	workers where stood down while executing work on wo#5250541 as ert inspected the area and where not happy with the satm area.ert then contacted the satm spoc to come look at the area and upon inspection released the area for workers to go back to work but this inspection delayed work for 1 foreman 3 hours and 2 workers 3 hours

N-2018-00721	Project Work not completed will create scaffold shortage for P1841 PRE-REQs	On completion of Fukushima Modifications throughout the station there are many scaffolds built for this project that have not been scheduled for removal. As we move towards pre-recs for the P1841 outage we will have a scaffold shortage if these scaffolds are not removed and the material made available. This is project work and cannot be given back to station to remove. Funding needs to be released from the projects group and work assigned to have all scaffolds for this work removed.
N-2017-29473	13-41027 – Pickering BDBE Fukushima Mods : Unable to closeout Project EC and Master EC for Airlocks Seal Integrity Mods.	During closeout of Master EC 127682 for the Airlocks Seal Integrity Modifications at the end of the 6 month closeout window, it was noted that Project EC 142289 cannot be closed since the revised procedures listed under the ADL have not been issued.
N-2017-27649	13-41027/49299/49158 FUKUSHIMA PROGRAM - Lessons Learned	This SCR captures lessons learned on the Fukushima program in the past 3 months whereby gross cost overrun and schedule delays incurred for several issues as noted: 1) Rework relating to replacement of 6 stairs for the EPR Switchgears, as they were not code compliant. Replacement stairs at U4 BUG had to be replaced again because it was damaged. 2) Late identification of field changes, and long turn-around time resulted in delays of critical work on the EPR field installation and commissioning activities 3) Low efficiency in executing field work in the field. Project observed several instances where field work were not progressed as planned on the EPR and MV Tool in an efficient manner. 4) Long turn-around time for materials as well as defective materials (ex. U1 PT & MV Tool RE123 receptacle polarity configuration) that are generated by field changes 5) Lack of critical resource, including but not limited to PPT holders and welders to progress cable support installation. 6) Lack of coordination and look ahead to prevent critical path delays. Late submission and request for work permit. 7) Poor management and update of the master work plan and ITPs with respect mark-ups and signs. Further to an estimated 5M$ overrun on the contract in April 2017, an incremental increase of approximately 1.3M due to missed obligations on the contractor. The AFS date was pushed from Oct 5th to Nov 30th. Change notices from the contractors are being processed as per the ES MSA contract and escalation process.
N-2017-27513	13- 41027 BDBE Electrical Power Restoration - U058 - delay due to EPG testing	Work Group asked to leave the EWPSB Bldg due to EPG testing and pumps in the EWPSB pump room, This caused a delay to work being continued for fukushima 058 EPR project. 9 workers for 3 hours
N-2017-26470	13-49299 - PA FUKUSHIMA Unit 4 MV Tool - As Found Condition - Unacceptable QS Inspections.	During QS inspection of conduit and cable installation; it was discovered that there was a missing ground bushing required by Design EC and OEC code. SALISBUR 2017/11/17 13:58 : Ground bushing was for power cable 4-7680-501 located at 4-76801-PS1.
N-2017-26287	13-49158 Fukushima Phase II EME Storage Facility Building Delays on Resolving Action Tracking 28204629/33, Various Assignments	Contractor is attempting to use its due diligence to actively take the actions to mitigate the various Site Deficiencies and other Procedural Requirements, as per Action Assignments 28204629 and -33. This includes procurement of any required or replacement materials, coordination of work execution at site, QA/QC presence to verify conformance to design and standards, and administrative to provide closure and extension forms. Specific examples including the closure of AR 28204633-02 AFS Spare Parts, -18 Asphalt Road Painting marking, -21 Equipment Labels/Lamacoids, and the extension notes for AR 28204633-19 Auto Dialer Testing and Comm., and 28204633-04/05/06/07/09 Issue History Dockets, and 28204633-20 PMIDs. Moreover, memos used to document the closure of AR 28204633-13 240V Drop-Down Relocations (P-CORR-53410-0664485) and AR 28204633-14 Relocate EWS (P-CORR-53410-0664486) requires OPG Concurrence to document the design change, installation, and close out the 2 issues.

N-2017-24503	Project 41027: PO#229562 058 Fukushima worker felt discomfort in lower back	WO# 3217326 worker reported to supervisor he felt some discomfort after moving some fast fence at the 058 deployment pad
N-2017-24338	Project 41027: U1 Fukushima EPR: Delay caused by pending approval of permit	Activity 5010820-52 (to A&V WPP for 1-54120-CB9A & BUG) has been delayed since 10-Oct-17, because of technical and design clarity issues being brought up during the permit review process. Upon OPG PC1 approval, ESFL will proceed with the 4 kV cable work on CB9A and BUG.
N-2017-24205	13-41027 Delay due to obstruction at Emergency mitigating equipment (Fukushima) painting locations	Effected location #21 Tie-in location (alternate) for U1/4 moderator system-scaffold in the way #32- HTS alternate tie-in location at 1/4-34960-Y17- unit 4 has a rubber area in the way impeding area to be painted. Unit 1 valves are wrapped in plastic and we cannot CCV #33-Pickering A Genset deployment (primary) generator 1 north of unit 1- has not been paved #35- Pickering B Genset deployment north of EWPS building- not paved #36 Primary deployment location for switchgear north of EWPS building-not paved #40 Tie-in location for Pickering B portable switchgear in the EWPS building- to be completed October?? #41 Deployment for telecom trolley unit 4 outfall- not ready #42 Telecom Generator deployment location- EWPS building not ready & Emergency operation center- location unknown.
N-2017-24003	Project 41027 - Stand Down - Review of Safety, Quality, Work Protection and Plant Status Control	E.S. Fox was directed to put all BDBE (Fukushima) project work on Hold as a result of SCR P-2017-23908. Investigation of the event is in progress and a roll out has bee given to E.S. Fox Construction Leadership Team, Holders of Record and Electricians. Work is on Hold until further notice.
N-2017-23981	Fukushima Project project (13-41027) – Quality issues associated with installation work in the field.	The following is a summary of recent quality issues identified with on going field work for this project. • Cable shields for 4 KV cables at switchgear 058-54320-BUC location in close proximity to 4 KV bus were not fully insulated. • Lockwashers were not installed on cable terminations at switchgear 058-54320-BUG • ITP did not provide guidance for switchgear configuration prior to Hi-Pot testing. • Design sketch produced at the last moment to support design change in the field.
N-2017-23953	13- 49299 BDBE U1 MV Tool UPS DELAY - MC was unable to Charge BY1 Battery due to Interlock issues	The Charging of the BY1 Battery is delayed due to an interlock issue encountered by MC on the targeted start date. Delay in schedule but no effect on the AFS TCD. DESOUZAC 2017/10/20 16:30 : Critical task delayed posting a threat to CNO milestone. Contractor is progressing with replacement and in parallel developing alternate design as a recovery.
N-2017-23210	13- 41027 Fukushima work delayed due to limited material and resource availibility	Delays on the EPR Critical Milestone activities due to Control Maintenance and Operations resource availability and vendor material issues. Vendor was unable to provide the required materials for the Termination of 4KV cables in a timely manner. The procurement of the materials caused delays and pushed other sequenced critical work onto the next work week.
N-2017-22372	13-49299 Fukushima BDBE U1 powered mv tool modification, AS Found Condition - Damaged equipment	While performing oversight inspections the electricians brought to me attention that there was some damage done to some of their equipment. Upon inspection I noticed that the roof of 1-76801-PS2 was bent in 2 spots and that the conduit for 1-7680-503 was moved causing a hard bend where the flex conduit comes out of the rigid conduit. No one at that the job site knew how this happened but the damage appears to be cause to both items by someone stepping on them
N-2017-22148	13-49299 FUKUSHIMA BDBE MV Tool Unit 1 WO#4716835 Report only - small cut to right index finger of worker	Worker was looking through a miscellaneous tool box, while sorting he removed his gloves to get better dexterity and received a small cut to his right index finger. He notified supervisor and did not require medical attention. Worker cleaned finger applied band-aid and returned to work. no ert or medical support needed or requested

N-2017-22126	13-49299 FUKUSHIMA BDBE MV Tool Unit 1 WO#4716835 Delays - new breaker not lockable	Work Group required PPT to progress work on Unit 1 Mv Tool BY1-BY2 & PS1-PS2. The vendor supplied breaker did not allow for a lockable means for work protection. Breaker locks needed to be found and approved by Work protection coordinator and approved worker locks. This action delayed the work group acquiring PPT to progress work in Unit 1.wo#4716835
N-2017-22022	13-49299 FUKUSHIMA BDBE U1/4 POWERED MV TOOL MODIFICATION Discrepancy between EC drawing and ITP/WP	ITP # 5580-7045-1 step 350 and 420 operation description does not match EC drawings'. On NA44-DRAW-67801-10003-0004; there shows only one cable connection from positive and negative battery poles to breaker Q005 (+ and - poles), although ITP description lists parallel feeds for both positive and negative feeds from batteries to breaker Q005. This was discovered during quality surveillance activities. SALISBUR 2017/09/26 14:16 : Work plan NA44-WPL-54130-0605775 also lists parallel feeds being used. Current state of the installation has only one cable installed for each the positive and negative.
N-2017-21941	13-49299 FUKUSHIMA BDBE U4 POWERED MV TOOL MODIFICATION WO 04716835 - Defective Battery	Work Group went to complete task to interconnect battery links on BY1 Cabinet U4, Liquid was discovered on the top of one of the batteries, work group backed out applied spill kit and notified supervisor. 6 batteries were removed and quarantined with spill kit. 1 of the 6 batteries was identified as defective.
N-2017-21508	13-49161 Fukushima Emergency Telecom Enhancement #16-5630 Delay - defective breaker handle	while workers where applying ppt they could not apply as breaker handle defective not allowing not allowing workers to install hasp, seems to be a problem with trip mechanism and tab when handle is in the open position and handle is very loose. Notified ano and received permission to back out and close breaker and surrendered ppt.this delay was 5 men 4 hours.workers where re-allocated
N-2017-21350	4.KV Diesel Generators (x5) Purchased for Fukushima Type Event - issues identified	5 New EME 4.KV Diesel Generators Purchased for Fukushima Type Event are being stored at Pickering. Work Protection (WP) SPOCs were request to view the equipment for up coming commissioning runs for required WP. It was identified to the first SPOC that the breaker proper could not be locked in the disconnected position. During a second review with 2 different WP SMEs the same concern was raised again, and since the initial meetings additional issues were identified to the Project MTL and documented in an email (Email attached to this SCR). During this review addition potential safety issues were raised and we reached out to Pickering Conventional Safety Department for support. The Safety department attended on site at the trailers and performed an inspection as best they could as no entry into the machine /breaker room was possible as it is protected by a CO2 Fire Protection system.
N-2017-20802	13-49299 BDBE PA FUKUSHIMA U1 MV Tool Unacceptable QS inspection.	During QS inspection for the connection of new battery banks 1-76801-BY1 and 1-76801-BY2; it was discovered that unapproved vendor drawing was used for the installation of new batteries. Although, there was an approved drawing NA44-DRAW-76801-10003 sht.0004 issued in Passport; which has been approved by HSL and OPG design . Note: 1) Both drawings' are for battery layout and battery connection wiring diagram, but are different from each other. 2) This issue was discovered before wiring connection were started.
N-2017-20471	13-49158 Fukushima EME Storage BLD - Design agency failed to issue AFS documentation with proper approval signatures	Commissioning report (CR) issued to OPG for review and comment which did not bear the approver signature. signature requirements have been communicated to Design Agency(DA), through face to face meetings a day prior to submission of document and agreement was obtained from Design Agency to submit the CR with all 3 (prepared by, verified by, approved by)signatures.

N-2017-20405	13-49299 BDBE PA FUKUSHIMA Unit 1 MV Tool Unacceptable QS Inspections	As per EC129272-FICREQUEST09; cable routing for cable 1-7680-508 was changed on drawing NAA-DRAW-54130-10057-U1. Although, FIC cover sheet indicates the OLW has not been affected. This not true as OLW cable routing needed to be updated to reflect change. As per FICREQUEST; the routing changed from only conduit to using cable tray 1-PC5788. The problem with using this cable tray is that now we have both ODD and EVEN power cable routed on same tray; which does not meet separation requirements. Under EC129272-FICREQUEST10 changes were made to NA44-DRAW-54130-10060-U1, but these changes were lost under EC129272-FICREQUEST11 when additional changes were made to same drawing. This an error likely situation as all other changes were tracked on drawing, so now I don't know if FIC10 changes are still applicable or not. Also, it is not fair to ask people to work from multiple copies of the same drawing to ensure that they have all required information. As per SGP-014.Q sec.5.4.2 and 5.5; "The ITP shall reference applicable Code, Standard, Customer and/or project specific requirements. Inspection activities shall reference specific Acceptance criteria: this may be accomplished by referencing drawings, specifications, procedures, and/or Code passages. In an effort to aid the QC inspector in performing his inspection, the ITP should provide detailed acceptance criteria". I do not believe that ITP 5580-7045-1 meets above expectation of contractor's own QA program. If proper acceptance criteria was included in above ITP steps; we would not have all of the above issues with the installation. Based on my review of Contractors ITP and conversations with their field personnel; I do not believe that they have a full understanding of OPG's Electrical Installation Specifications including our Divisional Channelized Separation Rules and Pickering A Cable Pan and Conduit Guide.
N-2017-20401	13-49299 BDBE PA FUKUSHIMA Unit 1 MV Tool - Unacceptable QS Inspections	During QS inspections for the installation of new portable tool for MV Actuation. The following issues were discovered. During initial QS inspection; it was found that cable 1-7680-506 was incorrectly routed on cable tray 1-PC5788. This did not match design drawings' or OLW cable routing. Since initial inspection; this cable has been routed in conduit. Although, new conduit installation does not match NAA-DRAW-54130-10057-U1. This change needs to be captured on design drawing and approved by them to insure that seismic requirements are still being met. As per NAA-DRAW-54130-10057-U1; there are two conduit supports to be installed for cable 1-7680-503 and there dimensions have been provided. Although, the field has installed an additional support not shown on the drawing. This change needs to be captured on design drawing and approved by them to insure that seismic requirements are still being met. As per P-INS-01983.4-00009 appendix E; there shall be a minimum of 24" separation between conduits of two different divisions (i.e. ODD, EVEN). Although, there is approximately 15" separation between cable 1-7680-506 (EVEN) and 1-7680-971 (ODD). This either needs to be corrected or exemption needs to be approved as per NA44-INS-57000-00001 sec.6.0. As per OEC 12-618 and 12-510; teck cables require a support to be installed within 300 mm of every box or fitting. Typically, for larger diameter cables we will follow the practice of "as close as practical" to accommodate larger bend radius. Although, there is only one support installed in middle of cable 1-7680-507 for entire 10' length and there is a 6' from last support to fitting at 1-76801-PS2 end for cable 1-7680-508. I do not feel that this meets the intent of the OEC and do not see how this meets any seismic requirements, if basic electrical code has not been met.
N-2017-19840	13 - 49299 Fukushima BDBE U1 MV Tools Plant observation - worker not wearing gloves while performing working.	During a plant observation , in unit 1 RAB 274 elv. observed a elec. working on Fukushima MV tool UPS project performing work without wearing gloves required to do the job . The Foreman was standing in the area was asked the to coach the elec. to wear his glove while performing work.

N-2017-19459	13-49299 FUKUSHIMA BDBE U1 POWERED MV TOOL MOD. - WO 04716813 DELAY - Missed Measured Tasks in WW34.	WO 0471681349 tasks 49 and 53 were not completed in WW34 as scheduled due to the result of a FIC requiring additional material. The material is now received and will be completed in WW35 with no impact to critical path. SCR documented for trending
N-2017-19457	13-49299 FUKUSHIMA BDBE U4 POWERED MV TOOL MOD. WO 04716835 DELAY - Missed Measure tasks WW34 - Equipment Failure	Work group had a task to complete meggering testing of cables for MV Tool. Testing equipment was acquired, 2 meggering meters were recieved broken and required servicing. Work group was able to acquire a 3rd meter to proceed with work. This caused a delay in progression of work. The following tasks to be carried over for next week: WO 04716835 tasks 20, 39, 48, 50, 52, 54, 71, 79, 80, 90
N-2017-19162	13-49299 FUKUSHIMA BDBE U4 POWERED MV TOOL MODIFICATION Employee retrieved wrong badge from the badge rack	while worker entered the asb he retrieved his badge and proceeded to unit 1 274 rab work location. Upon arrival worker observed his tld badge and noticed it was not his. Worker communicated with supervisor and rp and was told to proceed back to the asb.worker then grabbed the appropriate tld and proceeded back to his work location.at no time was the worker performing radioactive work or in zone 3
N-2017-18991	13-49299 FUKUSHIMA BDBE U1 POWERED MV TOOL MODIFICATION WO # 4716813 Damage battery cell.	While transferring battery from cart to cabinet one of the lifting personnel had the battery slip from his grip and come in contact with the battery shelf and damage the battery half way up the cell.The battery began to leak .All proper PPE being worn and no injuries to personnel.
N-2017-18877	Project 4127: OPS Turnover Delay - 13-5580 Repower Main Volume Vacuum Pump WO 4931337 - Fukushima Project	The schedule for the CAT 4 Main Volume Vacuum Pump modification has been delayed due to material issues. The Operations Turnover was scheduled to be completed August 17th, 2017. A revision to the Cat 4 Report was made August 11th, prompting the procurement of additional material. In addition, delivery of ground cable was outstanding as of August 17th, 2017. Meeting the scheduled Turnover date would have had an adverse effect on the quality of this turnover. In an effort to turnover all equipment required for deployment, the Operations Turnover date has been extended until the remaining two materials can be turned over.
N-2017-18766	13-49299 FUKUSHIMA BDBE U4 POWERED MV TOOL MODIFICATION project#13-5580 DELAY - Welding RE has been decomissioned.	while workers where attempting to plug in 600 volt welding machine into the receptacle to weld stand for unit 1 wo#4716835 mv tool project there was no current. Workers engaged station staff for help to try and identify the problem and after about 6 hours station staff figured out that this re had been decommissioned and no longer available. This caused a delay to the project of 4 workers 6 hours
N-2017-18414	13-41027 Fukushima - Electrical Power Restoration Unit 1 As Found Condition - 4KV Cable Subjected to Hot Water	4KV cable on the 225' elevation was subjected to very hot water while in the process of being pulled through a series of cable trays. Cable was temporarily staged on the floor in preparation for the next phase of the installation when it was subjected to hot water that was being dumped from an adjacent system.
N-2017-18155	13-41027 BDBE U1 ELEC POWER RESTORATION - CABLE INSTALLS. WO#5041252 Damage to Cable Tray Section While Pulling New Cable	Workers were engaged in Fukushima - EPR, Unit 1 cable pulling when an existing section of cable tray buckled and bent to one side.

N-2017-18153	Project 41027,49158,49299 - Fukushima meeting suspended due to lack of quorum	Fukushima weekly schedule meeting was suspended due to lack of quorum attendance. Required Quorum members include: * Project Managers * Construction Leads * MTL * DTL * CMO * FE Although full complement and steady attendance has been a challenge, only OPG Projects, CMO and 1 of 3 ES FOX Project Manager attended. This lack of attendance hinders our ability, as a team, to properly status and resolve any adverse schedule trends on the Fukushima project especially with the current slippage on the Emergency Power Restoration and the MV Tool UPS modifications.
N-2017-17835	Project 13-41027 BDBE U1 ELEC POWER RESTORATION - CABLE INSTALLS delays because of heat temperatures outside	multiple work orders for projects on fukeshima and seismic restraints wo#s 5041252,5165629 where delayed because of station temperatures. Employees needed more water breaks to keep hydrated delaying multiple projects.
N-2017-17714	Project 13-41027 BDBE U1 ELEC POWER RESTORATION PO#229562 Delay to trenching activities	WO# 3217821 Work authorization could not be obtained for any trenching activities at the unit 1 Fukushima pad and conduit trench. Delay to project 8hrs.
N-2017-17593	Project 13-41027 BDBE U1 ELEC POWER RESTORATION - CIVIL PO#229562 Delay to trenching activities unit 1	WO# 3217821 Work authorization could not be obtained for any trenching activities at the unit 1 Fukushima pad and conduit trench. Delay to 1 supervisor 4 men 8hrs and 2 contract vendors. Area around unit 1 MOT has been quarantined
N-2017-17210	Project 13-49299/49158 Fukushima BDBE Phase 1 - Project Cost Increase	This SCR is entered to document the cost increase during the installation of the Fukushima Project Phase 1. The additional cost is mainly caused by: - Contractor performance challenges. - The installation delays led to extended duration and cost for installation supporting activities such as MTL, Project Management and OPG oversight The adverse condition was identified upon revised cost estimate submitted by Contractor.
N-2017-17193	Project 13-41027 Fukushima BDBE Phase 2 - Project Cost Increase	This SCR is entered to document the cost increase during the installation of the Fukushima Project Phase 2. The additional cost is mainly caused by: - Contractor performance challenges. - Installation delays led to extended duration and cost for installation supporting activities such as MTL, HoR, QC, Project Management and OPG oversight; The adverse condition was identified upon revised cost estimate submitted by Contractor.
N-2017-16676	13- 41027 Fukushima work delayed due to limited resource availibility	Fukushima MOD field work for H2 Igniter and Main Volume Vacuum Pump delayed due to lack of electrician resource in the field. Vendor raised this issue to OPG and indicated that although field work maybe delayed by 2 to 3 days, the AFS will be done as per schedule and on time.
N-2017-15785	Project: 41027/49299 PNGS Fukushima Late IOP/Outage Scope Injection Delay	Station support tasks for Fukushima Tie-in and commissioning of the P14 MV Tool UPS, P14 and P58 Emergency Power Restoration modifications are scoped injected later than T-7. As a result and over allocation of CSEP (static crew) resources, existing station work on the plan had to be re-evaluated by engineering for deferral to accommodate this late injection and to meet CNO/CNSC commitment. Delay caused by ES MSA vendor unable to meet schedule commitments.

N-2017-15653	Project 41027: Fukushima Phase 2 - Design deficiency for U5/7/8 H2 igniter project	During the H2 igniter project AFS walk down, it was noticed that some of the cable clamps had rusted. This is a deficiency in design/material spec, since these clamps are installed outdoor and exposed to the element.
N-2017-15444	Project: 13-49158 Fukushima EME Storage building Contract AFS Milestone missed	Contract AFS date missed. ESMSA vendor issued a recovery schedule which tracks completion of construction activities by first week of September with no set date for AFS and close out activities. Contract AFS date is July 14th 2017.
N-2017-15373	Project 13-49158 (Owner Only Project) PNGS Fukushima EME Storage Facility Schedule Delay due to adverse weather conditions.	Project A00464 has experienced on going schedule delays due to rainy weather over the last week. All civil trades doing outdoor work affected. Friday June 23/17 - 8hrs Monday June 26/17 - 4hrs Thursday June 28/17 -4hrs
N-2017-15328	Project 13-49158 (Owner Only Project) PNGS Fukushima EME Storage Facility Project A00464 - Excavator made contact with culvert.	A subcontractor was operating a steel track excavator to prepare ground for paving on the south side of the EME structure. While removing the top layer of ground, the spotter noticed that the excavator uncovered and damaged an 8-inch perforated drainage culvert. The crew backed out and reported the event to their Supervisor. The GPR locates for the excavation activity were up to date and inside the cab of the Subcontractor's excavator. The locates did not identify the buried drainage culvert.
N-2017-15231	Project 13-49299/49158/41027-Fukushima BDBE Project - Additional cost	A Project Change Authorization (PCA) per the ES-MSA agreement is required to add new scope for Projects 13-49158/49299/41027. This addresses scope addition as a result of discovery work while preforming construction for a number of modifications under PO# 229562 Line 0001 (Project 13-49299), Line 0002 (Project 13-49158) and Line 0003 (Project 13-41027). This effort was discovered while performing Engineer-Procure-Construct (EPC) work under PO# 229562.
N-2017-15161	Project 13-41027 058 Fukushima EPR enhancement Delay - work permit not available.	permit for the work group executing work on 058 epr enhancement project wo#5077779 was not applied till Tuesday june 20 causing a delay to 6 men 5 hours for the project. Workers where re-allocated
N-2017-14269	41027-FUKUSHIMA MAIN VOLUME VACUUM PUMP (MVVP) MODIFICATION - design deficiency	Additional project scope was incurred on the Fukushima Phase 2 project due to a an outlier in the original design package (NA44-REP-34220-00015) requiring future development of a manual means to operate the air operated valves at the main volume vacuum pumps. This is because instrument air may not be available during a beyond design basis event. This manual method was developed and documented in P-CORR-09013-0645024; however, additional EPC efforts are required to implement. This late resolution has compromised the project BCS milestone of 29JUN2017 by 2 months.
N-2017-14254	41027 FUKUSHIMA MAIN VOLUME VACUUM PUMP (MVVP) MODIFICATION	An ES FOX (HSL) design shortfall was identified on the MVVP Category 4 design package (NA44-REP-34220-00015) whereby the proper alignment of the pump (0-34420-P1/P2) permissive to ensure operation during a Beyond Design Basis Event (BDBE) was not considered. In reference to NA44-CDDN-63422-00001-00001 logic drawing, HS2 needed to be set to "normal" position and HS1 to the "On" position with the terminal block #20 wire removed. This condition resulted in a delay to the project critical AFS milestone and additional effort is incurred to implement a resolution. SMAILIA 2017/06/15 16:42 : Cause Known: Less than adequate attention to detail by the Contract Partner (designer of record of the original cat 4 package) and OPG project oversight team. Path forward has been established to align the logic manually, the procedure will be revised to capture the steps required to align the logic. Path forward actions are being tracked at the project meetings outside the SCR process. Trend SCR

N-2017-14232	Project 13-41027 Fukushima - 058 Electrical Power Restoration Schedule Delay - Inclement Weather,	W.O. # 5077779 Inclement weather condition impacted outside aerial work for the duration of the morning. Also, due to close proximity work location to the security fence security officer is required to be posted at work location. Security could not support after weather cleared, Security requires 24 -48 hours notice. Schedule Delay, Work group reallocated to other work.
N-2017-14229	Project 13-41027 Fukushima - 058 Electrical Power Restoration Schedule Delay - No Access Due To Equipment Testing	W.O.# 5077779 MM work group testing Pump in the pump room of EWPSB Bldg 058 EPR Enhancement work group required to stop work and exit building for the duration of day. Schedule delay Work group re-allocated to other work
N-2017-14219	Project 13-41027 Fukushima - 058 Electrical Power Restoration Delay - worker was stuck in unit 1 elevator between 254 and 274 elevations	while worker entered the unit 1 elevator on 254 elevation and attemted to travel to 274 elevation the elevator got stuck between 254 and 274 elevation. Worker picked up phone and notified ano and ert got employee out of the elevator within 30 minutes. This caused a delay of 1 worker 30 minutes
N-2017-14183	Project 13-41027 Fukushima - U1 Electrical Power Restoration Missing material - taken from safe work area	while workers went to retrieve a 5 gallon pale of yellow 77 wire pulling lubricant from there satm area they noticed that the lube had been removed from the area over the weekend, discussed with other work groups involved with this work and they had not touched or moved this material. GILLARDB 2017/06/15 10:11 : This is a repeat finding of materials and or tools reported missing, contractor should be locking up materials and tools in future due to the repeat events.
N-2017-14167	Project 13- 41027 Fukeshima Electrical Power Enhancemen PO#229562-003 Questionable workmanship - Switch Gear Breaker I-beam stands not level	The Unit#1 Fukushima Switch Gear Breakers were installed onto I-beam stands the we're anchored and grouted to the floor, however this floor is sloped for draining purposes, once the Switch Gear Breakers were mounted onto the I-beam stands the breakers needs to be leveled with shims. Shimming of these breakers leveled them squarely to allow them to be aligned and bolted together as per design. The I-beam stands should have been leveled to the floor slope as normal trade practice and then grouted. The use of shims between the I-beam stands and the bottom of the Switch Gear Breakers was not part of the original design, it raises questions regarding quality and workmanship, pictures taken attached to this SCR .
N-2017-13711	Project 13-41027 Fukushima DELAY - Project Contractor inefficent use of resources during start of shift.	Contractor has pre-approval from OPG projects to allow the General Foreman & Foreman to start work (1hr & 1/2hr) earlier to allow supervision time for start of shift activities such as preparing PJBs, Work Authorizations, Work Report reviews, and coordinating staff resources, etc. OPG approved this overtime to create/improve project efficiencies, the situation now is supervision starts at the same time as the execution staff creating delays to starting work, supervision still needs to prepare PJBs, WAs, etc, with execution staff now waiting (20 plus staff members) for PJBs to be performed, followed by work authorization requests. This change in start of shift activities was not reviewed with the CMO or the Project Manager.

N-2017-13317	Project 13-49158 EME Storage Facility Resource Issues - Vendor cancelled OT Shift with no notification.	OPG staff was requested to support Overtime work at the East Facilities, a Controlling Authority, and CUSW BTU electricians to support Lan/Bell communication as stand by contingency in the event of damaging the lines during excavation work on the Fukushima EME Facility Project. The Vendor had requested to work Saturday June 3/2017, & Sunday June 4/2017, 10 hrs shift. The Vendor made a decision late Saturday June 3/2017 not to proceed with work on the next scheduled shift. OPG CMO was not informed of this change, nor the OPG project manager. OPG staff arrived to site to support Sunday June 4/2017, with no support onsite from vendor to commence work activity's.
N-2017-12787	Project: 13-49158 Fukushima EME Storage building Vendor did not issue recovery schedule	ES MSA vendor did not issue recovery schedule as per actions set and agreed to by vendor PM (due Friday May 26th) and documented in SCR#N-2017-10389 Vendor is missing 2 key critical milestones which will put meeting the final AFS milestone at high risk.
N-2017-11704	13-49158 - Fukushima EME Storage building - Vendor did not attend project meeting to present pathforward to recover at risk contract milestones	ES MSA partner delayed the issuance of recovery schedule for at risk milestones .Vendor was invited to attend a team meeting to discuss the issues at hand leading to current milestone slippage, however vendor did not attend the meeting. Please note the contributing SCR
N-2017-11186	Project 13-41027 Fukushima Unit 1 EPR electrical installation Work Delays due to asbestos hazard	Work on Unit 1 EPR electrical installation could not progress as scheduled due to need for clean up of asbestos containing dust on structural beams in electrical installation work locations on Unit 1 254 elevation, TAB. Bracket and Conduit installation was stopped pending clean up of areas with positive asbestos results, as was installation of the indoor switchgear due to worker concerns over dust accumulation on lighting fixtures in the immediate area which need to be tied back to support hoisting of iron work. Of additional worker safety concern are reports from other contractors of asbestos dust in adjacent work areas. GILLARDB 2017/05/10 07:13 : Project Manager has approved the clean up of the Asbestos dust as well fox is to sample the light fixtures around the unit#1 indoor switch gear installation location.
N-2017-11155	13-49158 - Fukushima EME Storage building - Vendor failed to provide recovery schedule	Aecon failed to present the recovery schedule by May 1st 2017 for missing Milestone #2 “Concrete Slabs Poured & Building Structure Erected and Covered” due May 1st 2017 and Milestone #3 “ Completion of Electrical Work”_ due Jun 9th 2017. Reason: resource unavailability
N-2017-10874	Project 13-41027 Fukushima U1 EPR pads - Weather delay to outdoor work	Scheduled work to progress EPR outdoor pad installation on Unit 1 (W/O 3217821), outdoor pad installation on Unit 058 (W/O 3217326) and commissioning of the outdoor DG Storage Pad (W/O 4918333) did not progress as expected this shift due to heavy rain.
N-2017-10870	Project 13-49158 Fukushima Seismic Cart Restraints Schedule delay	The EC does not identify grounding of the transformer carts. The installation crew has questioned if grounding is required. The engineer is unavailable to disposition the concern until other priority work is complete. Approximately 1 week delay. W/O# 4916746
N-2017-10757	Fukushima Project 41027 U1 EPR. Asbestos found on station structure impacting electrical mod installation.	While preparing for installation of 4Kv conduit/cable supports to existing station structure on Unit 1, workers noticed dust on the top surface of the I-Beams in the work location. Work was stopped and supervision notified. 22 samples were taken and subsequent analysis was positive for asbestos in approximately 25% of the samples. GILLARDB 2017/05/04 12:59 : ESFOX staff were informed by Black & Mac staff who were sampling for Asbestos and found some positive samples in close proximity to there work location, staff were backed out and ESFOX safety contacted, ESFOX have begun sampling of their work area.
N-2017-10624	Fukushima Project 41027 U8 H2 Igniters delay to scheduled work	Scheduled work to complete H2 Igniter modifications on Unit 8 Hydrogen Igniter PL3022, per W/O# 4918311, could not progress as scheduled due to Ops and CM predecessor tasks not completing as scheduled.

N-2017-10596	Project 13-49299 FUKUSHIMA U4 POWERED MV TOOL MODIFICATION W/O 4716835 Mark-ups and sign-offs were not transferred from R0 to R1 of ITP.	While reviewing for customer acceptance on revision 1 of ITP the following POP quality elements scored unacceptable when reviewing work package containing ITP 5580-7046-1 R01: - ITP Review During Execution Mark-ups and sign-offs were not transferred from R00 to R01
N-2017-10491	Project: 13-41027 Fukushima Emergency Power Restoration - H2 Igniters U58 BCS AFS dates Missed	The execution of H2 Igniters Modification has experienced delays due to unavailable station OPS and MTC resources and presence of Hydrazine in the work area. OPS and MTC resources are diverted to higher priority work on unit 5&7 outages. As a result the BCS milestones are compromised. Please note the referenced SCRs
N-2017-10401	Project 13-49299 FUKUSHIMA U4 POWERED MV TOOL MODIFICATION Deficiencies Noted in Design During Review for Concrete Drilling & Anchor Card	While preparing a Concrete Drilling & Anchor Card (CDAC) for the installation of 4-76801-BY1 & BY2 (refer to W/O# 4716835), it was discovered that the drawings contained in the EC 129273 change papers did not identify HILTI anchor spacing. This was identified to the ES-MSA vendor's Project Manager. It was determined that the anchor spacing was to be as per the manufacturer's drawing which was included as a reference document within the EC, but not with in the change papers, so it likely did not receive the appropriate review by the design engineer during the EC approval process. A response from the ES-MSA vendor's design engineer indicated that the anchor spacing was found to be less than the tolerances specified by HILTI. Vendor has initiated an RFI to engineering and will likely require a FICREQ to document a new strategy for anchoring the cabinets because the proper reviews were not performed during the initial approval of the EC.
N-2017-10389	Project: 13-49158 Fukushima EME Storage building Contract Milestone missed due to discovery issues	EME Building project was put into winter safe state and upon return to work on Mar 2017, ES MSA partner was required to address numerous as found issues unexpectedly at cost of 2 weeks of schedule delay under fixed price contract. Therefore, Milestone 2 and Milestone 3 will be delayed by 2 weeks. Contractual due date for both milestones are May 1st and Jun 9th 2017 respectively. This delay will delay completion of Milestone 1 on to May 23rd and Milestone 2 on to Jun 23rd respectively. Apparent Cause of Condition: Less than optimal performance by the ES MSA partner 1- Less than optimal look ahead and coordination 2- Un acceptable level of assumption were taken
N-2017-10136	Fukushima Project 41027. Unit 1 EPR schedule delay - Project 13-41027	Installation of the EPR Electrical mod on Unit 1 per W/O 5041252, requires excavation across the road north of the Unit 1 powerhouse in order to install and connect 4KV cabling from the new switchgear to the plant. Excavation, Installation of electrical equipment and restoration of the road requires 21 days to complete. Fuel Handling who use this route for fuel transfers are unable to provide a suitable window to support the excavation work until July 06 due to backlogs in moving fuel and the transfer schedule.

N-2017-09833	Project 13 -49158 EME Hoses Rated below Specifications	The BOM (NK30-BOM-09013-10000) for Beyond Design Basis Event hoses specified a working pressure of 300 psig for the 6" discharge hoses. It was discovered that: • The type of hose specified in the BOM was only available for a maximum of 250psig working pressure. • Hoses originally purchased were rated for 250 psig but labelled incorrectly for 150 psig. • Some other 6" hoses subsequently purchased had ratings of 225 psig. • Few hoses were found to be actually rated at 150 and 200 psig. This was discovered during EME walk-down and further inspection.
N-2017-09522	Fukushima Project 41027. U7 H2 Igniters. Unable to complete scheduled work in the work week. W/O 4918310-29,31	U7 H2 igniter modification installation tasks (W/O 4918310-29,31) were scheduled to start and complete in WW 16. Work was not completed as planned due to Ops and C/M predecessor tasks not being completed in time.
N-2017-08976	Fukushima Project # 41027. Unit 7 H2 Igniters delay to scheduled work	Scheduled work to install modification on Unit 7 H2 Igniter PL4022, per W/O 4918310 could not progress and complete as required in WW15 due to late support from Operations. PL4022 was to be made available for isolation and work on Monday April 10. It was not made available until Thursday April 13 which prevented the work from completing as scheduled in WW15. This has resulted in a number of missed measured tasks in the work week
N-2017-08397	Project 13-41027 BDBE U4 ELEC POWER RESTORATION - CABLE INSTALLS Delays due to inclement weather	Due to heavy rain on Thursday March 30 and again on Tuesday April 04, outdoor excavation work on the Fukushima EPR civil modification could not proceed. Work did not proceed on Unit 1 per W/O 3217821, Unit 4 per W/O 3218951 or Unit 058 per W/O 3217326.
N-2017-08333	Project 13-49158 FUKUSHIMA BDBE U8 PIPE SUPPORT SEISMIC HARDENING Delay - Hydrazine alarm	while workers where executing work on Fukeshima pipe supports wo#3076728 they encountered multiple delays as there was hazmat events keeping them away from their work area. First delay was apr 5 for 2 men 1 foreman for 4.5 hours and the second delay was 2 men plus a foreman for 10 hours on April 6.workers reported for accounting and stood down till they where able to go back to work.
N-2017-08270	Project 13-41027 Fukushima BDBE Unit 6 H2 Igniters Schedule delay - lack of Ops and CM support.	Unit 6 H2 igniter installation work tasks under W/O#4918309 could not be completed as scheduled in WW13 due to lack of Ops and Control Maintenance support.
N-2017-07520	Project 13-41027 Incorrect Oncore charges to Fukushima PO#229562-0003 delaying Oncore approvals.	Small Tools & Consumables being charged mark-up fees, this not allowed as per memo from Project Director, should be charged to Activity code 48121, further DG Storage)Owner Only) line 0004 has been flagged no further charges accepted in Oncore , however these charges are now being routed to Fukushima line 0003. Oncore charges can not be approved until clarification given on how to proceed.
N-2017-07353	Project 13-41027 Fukushima EME Storage Facility Procedure non-compliance - Field work Activities prior to Kick Off Meeting	Field Work initiated prior to Scheduled Kick Off Meeting March 30/2017, OPG Projects, and CMO were not made aware of any field activities started to support Project 13-41027 EME storage Facility. AS PER OPG-GUID-08965-0004 a Kick off meeting is to take place followed by site walk down to discuss Contractor Activities. After these steps Contract Mobilization, and Contract Execution can proceed. These steps were missed. Vendor has removed the safe state of the Project that was currently placed on Hold, and has commenced minor field activity such as removing tarps, dewatering, grounding, and general housekeeping.
N-2017-07313	Project 13-41027 Fukushima project u4 epr cable pull DELAY - Workers noticed scissor lift past inspection date	while workers where performing a circle check of scissor lift 369-175 for work being executed on fukeshima cable pull unit 4 wo#5041256 they noticed that the inspection tag on this piece of equipment had expired on 05 mar 2017. GILLARDB 2017/03/29 07:05 : During a Station conventional safety tour it was identified that the Scissor lift was out of date.

N-2017-07296	Project 13-41027 058 Fukushima EWS Power Restoration - WO# 5077779 - 13 Delay - Scaffold build	BFCP tasked to erect scaffold in the EWS building for seismic conduit support installation. Crew could not work on the scaffold build as HoR resources were not available due to sickness and other priority work with remaining HoR resources. Scaffold crew reassigned.
N-2017-07295	Project 13-41027 058 Fukushima EWS Power Restoration - WO# 5077779 - Delay - Conduit Support installs and Scaffold build	BFEP / BFCP tasked to install conduit supports and erect scaffold for EPR project in the EWS building. Crews could not work as there was testing being performed (EPG turbines and the remote backup pumps located in the pump house) by Operations and MC. Crews were asked to stop work and clean up do to CM needing the space crew was using to weld the US3 stands on the north wall, to access the 600v disconnects and pump panel located about half way down the north wall.
N-2017-07101	Project 13-41027 BDBE PHASE II U058 ELEC PWR RESTORE TIE-INPO 229562 Delay due to weather	WO# 3217326 delay to U fill pour due to rain. U-fill pour rescheduled for Monday
N-2017-06932	Project 13-41027 058 Fukushima EWS Power Restoration - WO# 5077779-26 Delay - step added to prevent Fire Panel Alarms	Project requires Conduit and cable supports to be welded in the EWS building. Each morning the Fire Panel needs to be isolated to prevent alarms caused by the welding activities. Delay to getting the Panel isolated will impact the schedule for completion of the support installations.
N-2017-06837	Project 13-41027 Fukushima project Late reporting of personall injury	WO 5041252. While worker was executing work on Unit 4 Project cable pull on Friday March 17 worker believes that he hurt his wrist while performing work. Worker did not report any injury or soreness to his supervisor on Friday and completed a full shift of work. Worker reported for work on Monday March 20 and worked a full shift without reporting any soreness or injury to his wrist. Worker informed supervisor at end of shift about discomfort in his wrist. The employee did not show up for his next scheduled shift on March 21 due to the fact he was seeking medical attention from his doctor. Employee phoned his supervisor later in the shift and stated that his hand was swollen and painful and he has seen his doctor. Employee believes that he had hurt his wrist at work on Friday March 17. Employee is on site on March 22 and is being interviewed by supervision and contractor Safety rep.
N-2017-06559	Project 13-49158 Fukushima Water to Moderator 078-71380-NV18 DELAY - missed scheduled task	WO 3036466 task 43, to perform an in service leak check on 078-71380-NV18 was scheduled to complete in WW11 as a measured task. Task could not be performed due to lack of Ops support required to return the equipment to be checked into service.
N-2017-06476	Project 13-41027 058 Fukushima EWS Power Restoration Late submission of OT requests for project results in timesheet rejections	several timesheet have been rejected due OT requests not being submitted in a timely fashion GILLARDB 2017/03/17 07:43 : Overtime required 0.5hrs Project 13-41027 058 Fukushima EWS Power Restoration - Employee Contaminated.

N-2017-06460	Project #491-585 - Fukushima Project Incorrect attendance sheets conflicting with ONCORE charges	During ONCORE reviews of the Pickering Fukushima Project PO# 229562 discrepancies were noted between what is documented in ESFOX attendance sheets and the ONCORE charges. These attendance sheet are used along with Mitre Finch and CM logs to help verify ONCORE charges. These discrepancies document employees attendance sheets charging time to the Pickering FIRELINE project but actually charging time to the Fukushima project in ONCORE resulting in ONCORE rejections . In some cases the attendance sheets do not document employees working or time charged to any project work, however charges show in ONCORE charged to the Fukushima project resulting in ONCORE rejections . ESFOX rationale for these charges are attendance sheets are submitted at the beginning of shifts and sometimes unplanned events require movement of staff creating undocumented or incorrect attendance sheets. It should also be noted that the Pickering Fireline PO# 259801-0001 is in dispute with ONCORE charges being rejected as per Project Manager. The Fukushima charges remain rejected in ONCORE due to the inaccuracies of the attendance sheets.
N-2017-06428	Project 13-41027 058 Fukushima EWS Power Restoration Delay due to inclement weather	the concrete Pour for the conduit form was delayed 2 days due to inclement weather. Work to be rescheduled for Thursday GILLARDB 2017/03/20 13:04 : Wind conditions and temperatures of -20c wind chill prevented the pouring of concrete, these temperatures effect flow and curing, under these conditions it is not recommend to be using concrete.
N-2017-06233	Project 41027 - 058 EPR, DG storage - Fukushima project delays caused by missed critical tasks	This SCR is to document lessons learned due to delayed completion of critical tasks during week ending Feb 26th, namely the form installation on Fukushima U058 EPR Pad and completion of the Diesel Generator (DG) Pad Detailed Commission Specification (DCS). The project team is striving to commit and deliver the critical tasks on time in order to maintain planned completion date and slippage of critical tasks is documented to account for issues that threaten this objective. - U058 EPR PAD Form installation planned date of 24FEB2017 has been delayed to 28FEB2017. The requirement for a field change added 4 days of delay to already pre-existing delays of 5 days. Additional 3 days of delays attributed to contractor resource issues accounts for total 12 days of slippage on AFS date. - DG Storage Pad DCS was rejected by design upon submission due to less than adequate quality control during the comment and disposition process. (Refer to SCR# N-2017-05053). This delay has pushed the AFS by at least 15 days. Missing critical tasks within the planned week is a noted trend and must be rectified. If the project execution team is unable to recover slippage with improved productivity, the project may see an increase in cost (est. 6FTE). This was discovered through weekly status updates and oversight .
N-2017-06127	Project 13-49158 Fukushima BDBE - MAKE UP WATER TO HTS/MOD 078-71380-NV18 Scheduled task delay	Work scheduled in WW10, to perform a leak check on 078-71380-NV18 per W.O 3036466-43 could not be performed as scheduled due to lack of Ops support. Ops resources were challenged in WW 10 due to Unit 7 forced outage.
N-2017-05531	Project 13-41027 058 Fukushima EWS Power Restoration Delay - As found condition / Buried Conduit supports missing/broken.	During excavation on the EWS BDBE Power Restoration Project, Buried Conduit was found that had been supported by Plastic Spacers which kept the conduits (9) separated and in line. It was noted that a considerable amount of them were broken or missing. New material needed to be ordered to reposition and support these buried conduits prior to refilling excavation. This delayed the 058 Pad work 2 days while new material was procured and brought to site.
N-2017-05097	Project 13-41027 058 Fukushima EWS Power Restoration - Delay of employee leaving work at end of shift - possible Radon contamination.	Employee found to be contaminated when trying to exit Operating Island at end of shift (Monitor in ASB). Employee was working on the 058 BDBE EWS building Power Restoration. - building Switchgear outdoor Pad forms. No work performed in Zone 3 - This caused Employee to be late leaving Island and caused additional overtime charge. Employee had to wait for Reading to dissipate (possible Radon).

N-2017-05012	Project 41027 Fukushima_ U4 EPR - Uncontrolled Reassignment of Resource to Other Projects	Field oversight conducted by OPG CMO and project staff discovered that work on EPR U4 Cable pulling had not progressed to schedule due to inadequate resources. This cable pulling work required 10 electricians who have been trained and oriented. However, on multiple occasions experienced staff were pulled from the work and deployed to outage work (such as battery replacement). This leaves the cable pull work short of staff and new workers had to be oriented. This contributed to an estimated 2 days of delays while incurring additional costs to orient new staff with the work.
N-2017-04344	Project 49299: Missed IFB-A, IFB-B and AIFB BCS milestone	24FEB2017 Missed BCS milestone for IFB-A, IFB-B and AIFB Fukushima projects. Discovered during execution of field work - Late start of the work, led to late discovery of needed field initiated changes - Inadequate planning and coordination towards meeting the BCS milestone - Less than adequate assessment of the work package, leading to late identification of galvanizing treatment on fabrications
N-2017-03692	Project 13-49299 FUKUSHIMA U4 POWERED MV TOOL MODIFICATION W/O 4716835 Unacceptable Findings During Package Review	Initial Review: The following POP quality elements scored unacceptable when reviewing work package containing ITP 5580-7046-1 R00: - Work Plan Review prior to execution. - FME Assessment Review Prior to Execution - ITP Review Prior to Execution Second Review: Package was returned and corrections made. When the package was received a second time, it was found that most but not all previously highlighted corrections were made.
N-2017-02615	NO-2016-302: Fukushima Follow-up assessment - EME related document issues for NSATD	Nuclear Oversight assessment NO-2016-302, Fukushima Follow-up (N-REP-01070-0628015) identified that: 1) Three out of three Beyond Design Basis Functional Safety Requirements (BFSR) documents are not up to date with actual PM program status. This includes updates to show changes made to EME connection points that have been modified. 2) Lack of clear intent for deferral requirements in N-INS-03600-10002 R000. Section 1.2.3 states: “Deferrals to any test or maintenance activities performed on equipment with BDBA code must be referred to station Reactor Safety for review and approval", however document owner feedback is that N-INS-03600-10002 is not a governance document and BDBA equipment are not required to have PM mode codes for formal deferral and approval by Reactor Safety. See attachment (PDS-02) for more details.
N-2017-02607	NO-2016-302: Fukushima Follow-up assessment - EME equipment tags are not consistently used in Asset Suite	Nuclear Oversight assessment NO-2016-302, Fukushima Follow-up (N-REP-01070-0628015) identified that EME equipment tags are not consistently used in Asset Suite and therefore the appropriate identification flag of Equipment Important to Emergency Response (EITER) or BDBA, have not been captured. EME equipment lists are found in P-INS-03491-00050 (Section B.8.0) and D-INS-03491-10000 (Section B.8.0). N-CORR-09013-0569416, “Beyond Design Basis Nuclear Safety Enhancement Project – Turnover to Emergency Response Team” included a recommendation for the use of Asset Suite for EME equipment. See attachment (PDS-02) for more details.
N-2017-02598	Project 13-49158 P1751 Fukushima BDBE U5 Seismic Scope injection into outage	Installation of Seismic Reinforcement upgrade in U5 is in progress, however schedule delays were occurred due to field discovery issues (such as rebar interferences/field changes) that could not have been identified in an earlier stage. The U5 work will fall into the 1751 outage window. This SCR is to document U5, WO 3217363 scope injection into the 1751 outage window

N-2017-02568	Project 13-49158 Fukushima U8 Seismic Structural Delay - discovered a electrical cable in the excavation area	During excavation of the concrete area at the Unit 8 D/A storage tank, to facilitate installation of the new seismic bracket, an electrical cable was discovered in the excavation area. The cable appeared to be ground wire. Workers stopped and notified the Shift Manager who instructed the workers to stop work.
N-2017-02488	Project #13-49158 EC Fukushima BDBE U5 Job #13-5580-7028 - Broken Calibrated Tool- Torque Wrench	WO#03217363, while workers were performing torque on Hilti M16 190/40 Undercut Anchors (during installation of Boiler Feed Water HX Seismic Restraints) the torque wrench internals popped out from the head of the wrench. Workers stopped work and notified their supervisor, the torque wrench was taken out of service and a new torque wrench was obtained from stores. QC was notified to ensure that all anchors that were torqued with Tool# PMM 53490-00001 UTC# 1411014 are re-verified with the new wrench. There were no FME issue as there were no open pipes in the area and all parts of the wrench were retrieved.
N-2017-02114	Project 13-41027 U6 Fukushima BDBE H2 Igniter MCC 15 tie in Delay - Work to be rescheduled	the work on U6 MCC 15 was delayed as the Scheduled U5 MCC 15 tie work pushed into WW 04 which impacted U6 work. This prevented OPS to isolate and Off load the U6 MCC 15, install temporary heaters and lighting,
N-2017-01621	Project 13-49158 Unit 8 FUKUSHIMA BDBE U8 ELECTRIC ROOM SEISMIC ROBUSTNESS Anchorage Upgrades DELAY - Required Drill Card Not Available,	WO# 3037392 Could not start task for unit 8 anchorage upgrades of class 2 electrical equipment delay due to no drills cards were available Jan 12, Delay: 1 Forman 3 workers 8 hours Jan 13, Delay: 1 Forman 3 workers 8 hours
N-2017-01616	Project 13-49158 Unit 5 FUKUSHIMA BDBE BATTERY ROOM SEISMIC ROBUSTNESS Anchorage Upgrades DELAY - Required Drill Card Not Available,	WO# 5045753 Could not start task for unit 5 anchorage upgrades of class 2 electrical equipment Delay, due to, no drills cards were available Delay: 1 Forman 3 workers 8 hours
N-2017-01523	Project 13-49158, EC 127709 FUKUSHIMA BDBE U5 WO#03217363 Worker Pinched Finger, Report Only- No Medical Attention Required	Employee injured his Left Middle finger tip while grinding at unit 5, 254' TAB HX6B - Seismic support installations. Finger was pinched between grinder and HX support, no contact with grinding wheel. Employee was wearing gloves and all other required PPE at the time. On site first aid performed, worker was offered medical attention and declined. Report only. Worker completed his scheduled shift and will be reporting for his next scheduled shift.

N-2017-00805	Project: 13-49158 Fukushima EME Storage building II cost escalation and work stoppage	Work stoppage resulted from higher than anticipated cost, and inefficient work progression Late Nov 2016, OPG approved series of project changes (through CTPs) to increase the PO value by 38% to account for vendor's over all under estimation of the project as documented in SCR N-2016-20564. This change assumed to take the project to close out under accelerated approach and working 6x10 through AFS (including all additional materials). In early Dec vendor indicated cost increases beyond newly approved PO. OPG PM requested the vendor to assess and bring the cost within the approved PO. Escalation meeting took place on December 19, and the ES MSA partner communicated to OPG management that the project cost to complete will be within approved value as the estimate provided previously included unrealistic contingencies and there were inefficiencies that have been fixed in the schedule, a new schedule was provided to OPG as a result. In the second week of Jan 2017 vendor approached OPG with forecast to complete with additional cost increase of 10% above latest approved PO. Vendor suggested that they can finish the work with current budget if scope is cut. Subsequently, vendor made a decision to stop the project and demobilize all the equipment and crew on Jan 9h to reassess the cost and schedule. Original budget for completing the project has increased by minimum 51%. Apparent Causes: Less than optimal performance by the ES MSA partner in the following areas: 1- Resource management. 2- Project management and cost control. 3- Less than optimal look ahead and coordination
N-2017-00645	Project 13-49158 FUKUSHIMA BDBE U7 PIPE SUPPORT SEISMIC HARDENING PO# 229562 WO# 3076727 Worker suffered minor injury Report Only	While putting tools away in job box, tool box lid closed on workers hand. Minor injury, report only and no medical attention required.
N-2016-31797	Project 13-41027, Fukushima Phase 2, Excessive material expediting fees	To meet final AFS dates vendor approached OPG Projects to get concurrence on expediting material delivery. OPG projects requested for the cost impact of this activity but was never made aware of the cost impact. Vendor expedited the delivery which cost additional $17k without OPG knowledge
N-2016-31773	Project # 13-49299, 13-41027, 16-32202 - 3 MONTHS DELAY TO POPULATE BDBE/BDBA FUKUSHIMA EMERGENCY MITIGATING EQUIPMENT TAGS (N-CORR-76801-05589806)	Previous an SCR, N-2016-01874, was raised to populate BDBE EME TAGS outside the ECC PROCESS. As per the N-PROC-MP-0077, sub-section 1.2.2.b.1, for a large number of MEL records, requestor may contact the appropriate Design Section Manager to determine if the information can be transmitted in an attachment to N-FORM-10492.The direction memo: N-CORR-76801-0561864 does not contain the N-FORM-10492. A memo, N-CORR-76801-05589806, was generated to perform MEL population of BDBE EME TAGS. Subsequently an IT request was completed by procurement/codes & standards department. However, there were human performance issues occurred and caused 3 months of delay; and the IT request solution was not followed up properly and was not adequately verified prior to submitting to projects design department.

N-2016-31213	Project 13 - 41027, Fukushima Elect. D.G. Storage Pad, DELAY - with Additional Material Compatibility Concerns	W.O.# 4918333 EC 132002, While reviewing materials for installation, Additional compatibility issues were identified 1. Flex conduit could not be use due to radius limitation for installation of RE 607 2. The 300 MCM cable will not fit in receptacles sockets for soldering and is not flexible enough install inside Cover box, to the receptacle 3. The cover box and backing plate will require to be re configured to support the new installation orientation. 4. Additional schedule delay of one week due to Christmas break.. This has created approximately a 4 week delay as of Dec 5th, to incorporate the changes purchase additional materials. etc All materials are still pending delivery.
N-2016-31212	Project 13 - 41027, Fukushima Elect. D.G. Storage Pad, DELAY - Additional Material Compatibility And Electrical Code Compliance Concerns	W.O.# 4918333 EC 132002, While reviewing materials for installation, several compatibility issues were identified 1. Items missing from BOM conduit connectors to boxes, locknuts bushings etc. 2. Flex conduit could not be use due to radius limitation 1”, 1-1/2”, and 3” 3. Concrete embedded conduit configuration conflicts with conduit extension and hub connectors to PL601 4. West side conduit run and conduits to T18 transformer were on Hold due to, Cable #6, #8# 10 and #4 AWG were all purchased as black cables this does not comply with Electrical Code, cables under 2 AWG should have a color code jacket e.g. Blue, Red, White and Green for ground, etc. This has created approximately a 3 week delay as of Nov 28th to incorporate the changes purchase additional materials Some materials are still pending delivery.
N-2016-31102	Project 13-49158 FUKUSHIMA BDBE U7 WO#3076727-50 REMOVE SOUTH DST CONCRETE INTERFERENCES-AS FOUND DISCOVERY	Work group (BFLP) was tasked with removing concrete interferences (WO#3076727-50) @ U7 DST, While performing assigned task as per procedure and with all proper authorization & scan card in hand, work group discovered what appears to be a ground wire. Ground wire was not disturbed.
N-2016-30823	Project 13-49158 IOP FUKUSHIMA U8 PIPE SUPPORT SEISMIC HARDENING DELAY - CDAC / markings removed from location.	A critical component of a Concrete Drilling & Anchor Card (CDAC) is the scanning for embedded services, where the interferences are marked directly on the concrete. There have been occasions where re-scanning has been requested by the installation crew because the markings had been removed by cleaning, chipping, etc. This is creating a burden on FE resources to perform unnecessary rework (scanning).
N-2016-30587	49158/41027 Fukushima_Delays From Inadequate Resource Management	Progress of the Seismic Robustness and the Emergency Power Restoration modifications have been limited by inadequate resource level and efficiency, causing negative project cost and schedule trends: 1) The U6 DA tank North and South support were identified as critical task for 2016WW048, but was delayed due to lack of welding resources. There is a high level of schedule instability due to this condition of limited resources to maintain compliance of the critical path tasks. Contractor noted that they have placed requisitions for resource and acknowledged a need for higher vigilance to gain more productive work in the field. 2) Same condition observed on the U1 and U4 Electrical Power Restoration (EPR) Cable Pulling work. Overall these modification schedules are forecasted to slip more than 30 days and cost overrun more than 20%.

N-2016-30423	Inadequate Quality Issue of NCR from EPC Vendor ES Fox - Tetra Tech Joint Venture	For the MEC 124570, DEC 126377 for Pickering Units 1, 4, 5 to 8 Design-Fukushima BDBE Phase I EME Project- "Provide Water to Heat Transport System Upstream of Nuclear Valve V16-Add Isolation Valve and Quick Connect for Fire Hose modification", NCR No. 2016-1884-17984 dated November 30, 2016 prepared by EPC Vendor ES Fox - Tetra Tech Joint Venture was sent to OPG for oversight review and acceptance. While performing the general review of the NCR few errors and omissions were noted. The following are some of the noted deficiencies communicated to the vendor: 1. Description of Non-conformance missing the identification of the affected system component such as Valve support Number. 2. Disposition of the NCR appear missing: a. Qualification of the anchor installer b. Experience of the installer preferably with the Hilti HSL-3 anchors of any size. c. What additional QA steps were observed in anchor installation to ensure high quality workmanship? 3. As built anchor spacings, installation torque, drilled hole depth, drill bit type, diameter etc were missing. 4. TT rational to waive the pull test appear based on future actions such as "...upon verification of full adherence to ..."; "TT believes that .....";"if installation instructions were strictly followed ..." etc are not accepted. OPG review Comments clearly indicating the OPG concerns and clarifications to help resolve the issues were provided to the Vendor on December 5, 2016 and the NCR was not accepted.
N-2016-30405	Project 13 - 41027 Fukushima BDBE Job#13-5580-7063 Smoke Detector Set Off in Machine Shop PNGS	Work group located in an obsolete area of machine shop (former lunch room/wash room). Pneumatic testing of the Airlock Integrity Seal Rig (WO#4930331-05) proceeding. Work area was chosen specifically due to low personnel traffic and ability to safely pressure test away from other personnel. Upon completion of testing (for the shift), test rig was being disassembled for cleaning. Due to difficulty in disassembling of test rig a grinder was used to break the corner seals, odor set off smoke detector.
N-2016-30179	Project 13-41027 IOP Fukushima Electrical Restroration Failure to Maintain Safe Work Area Prior to Drilling	WO 2910155. Work group tasked to drill pilot holes through powerhouse wall at approximately 250' elevation. Drilling direction was from exterior of powerhouse wall into interior of basement. Scanning was previously completed and approved Drill Card issued. WA issued for work task. Scaffolding in place in basement at proposed penetration location. Prior to starting work, work group walked down basement location and observed no other workers or activity in the area. Work group did not set up a safe work area at scaffold location or remain in the area. Drilling from outside location commenced. During drilling activity, work group informed that a separate work group on a separate job was on the scaffold and heard the drilling activity, then a drill bit penetrated through the wall while separate work group was at the area. Work ceased immediately. SCR P-2016-30157 submitted by Civil work group.

N-2016-29314	41027 FUKUSHIMA EPR SCHEDULE DELAYS	During project oversight it was observed that the Fukushima Emergency Power Restoration (EPR) electrical installation on U1 and U4 has been delayed significantly. The baseline contemplated that 90% of the cable installation would be completed in 2016. There are several contributing factors noted as short comings from the contractor: 1) Lack of coordination and planning to keep the critical path compliant to baseline. The long-lead cable delivery for Oct 13th was identified by the contractor as the critical step to start installation of the cable. Later is was uncovered that comprehensive packages were not issued to the field and the pre-requisites/fabrication to begin cable pulling were not completed as planned. 2) Inadequate resource management lead to resources being deployed to the outage by the contractor. Notification was not given to the project and was only discovered during a field oversight walk-down Nov 15th. It was expected that sufficient cable supports would be fabricated for installation to move in parallel. Full complement of resource was expected to return the week of Nov 21st but still only about 50% complement is available at time of this SCR. 3) Failure to establish and comply with a detail recovery schedule. Contractor continues to fabricate material in excess of what is required to start installation (i.e. the critical path) and often times do not follow the plan that has been communicated. This uncontrolled fashion of performing work is compromising the project's effectiveness in delivering committed work. Attributed to the aforementioned, the project is running at least 30 days behind schedule.
N-2016-29279	Project 13-49158 Fukushima BDBE Water Supply to HTS 058-7160-V16 As found Condition - Slow Leak Detected on Plant Equipment.	REF EC 126377 during the installation of new fabricated spool assembly 058-71260-L12-4A, workers were performing compression torque on the non- pressure side of V16 (Guaranteed item) . They noticed the flange on the pressure side leaking at 90% compression at a rate of 1 drop per 10 seconds. Workers stopped and contacted Supervisor and HOR. HOR informed the ANO and Shift Manager. Shift Manager recommended we continue with the modification and report if the leak rate increases.
N-2016-29129	13-491518 Fukushima EME Facility - delay of critical material, which impacts the critical path of this weather sensitive project.	This SCR is to document delay of critical material, which impacts the critical path of this weather sensitive project. On Nov 22nd during weekly project meeting, Aecon PM informed OPG project of 3 issues which are hampering their ability to progress the critical path work plates 1- Unavailability of galvanized plates a. These were identified as long lead items for the first time to OPG projects b. This has pushed the concrete pour time further into winter months 2- Design deficiencies in grounding top and bottom rebar layers which is causing unforeseen work and delaying the pour a. This specific issue was raised to design agency during Detailed Design phase by OPG Design personnel on Wed Aug 17 during design meeting, Design Agency issued memo# P-CORR-76801-0609963 on Aug 23rd indicating JV construction has reviewed the design and concluded that design is fully constructible. 3- Design deficiencies in providing provisions for snow cleaning pathway (COMS requirement). Current design if constructed as is, will be burying the security fence at east side of the tent. Apparent Cause of Condition: 1- Lack of properly identifying long lead material and less than adequate oversight to ensure delivery to meet schedule milestones! 2- Deficiency in design Related SCR# N-2016-20564

N-2016-28682	Project, 13-41027, FUKUSHIMA BDBE AIRLOCK EMERGENCY BOTTLE RACKS DELAY - Obstruction In Concrete Slab.	W.O.# 04930232 Workers started drilling the required holes for the Hilti anchors that anchor Bottle racks To the RAB 317 elevation floor. The concrete slab was verified by Field Engineering as 4" and Free of interference as per CDAC and floor markings. The hole drilling was stopped at a depth of approx 1&3/4 inches at Unit 1 and hole depth approx 1 inch at Unit 4. Workers found an obstruction between the drill depth and the bottom decking. The obstruction appears to be of a steel plate construction. Affected racks are as listed: 1-21459-RACK2048, 4- 21459-Rack2046, 4- 21459-Rack2047 and 4- 21459-Rack2049 Workers stopped work and contacted supervision.
N-2016-28664	Project 13-41027, FUKUSHIMA D.G. Storage Pad, As Found Condition (Part Of Legacy Road Way Missing From EC Drawing).	W.O.# 4918336 EC 128806, As found condition, part of the road way along east side of new DG storage pad is missing The original design considered a full width road way with a crown in middle The apron slope on the east side of pad will now need to incorporate the as found condition Update --- NK 30-DRAW 15220-10007
N-2016-28571	Project 13-41027 Fukushima Airlock Bottle rack installation-WO 4930232 DELAY - Obstruction In Concrete Slab.	workers started drilling the required holes for the Hilti anchors that will secure the bottle racks. The Scan by FE indicated the area was free of interferences as per CDAC and floor markings. The hole drilling was stopped at a depth of approx. 1 3/4" at unit 1 and a depth of approx. 1" at Unit 4. Workers found obstruction between drill depth and bottom of decking. The obstruction appears to be steel plate. 4 bottle racks affected
N-2016-28298	49158 Fukushima_NV18 Execution Delays	Fukushima NV18 milestone is at risk due to discovery station issues. 1) Flanges on EWS Pump Spool was found defective when system was opened for installation of the modification. engineering provided path forward under ES FOX non-conformance report (NCR 1826-17926) that defect were acceptable within code. 2) installation delayed due to unavailability of station equipment (078-71310-STR1). Leaking strainer is to be repaired by station before the modification installation can progress 3) conflict with emergent station maintenance work on ECI NV3 (refer SCR N-2016-26432) AFS milestone of 21DEC2016 is at risk (both 056 and 078, ECs 127096 & 127099)
N-2016-28224	Project 13-49158 IOP Fukushima IFB A&B anchoring monitoring Project. DELAY / AS FOUND CONDITION - Bolt circle incorrect	when the level monitoring equipment was delivered to site, the bolt circle did not match the drawing. Pre fabrication will not be completed until Engineering resolves RFI
N-2016-28162	Project #13-49158 Fukushima Phase 1 BDBE L2029 and V2027 - Delay due to CWP and ITP deficiencies.	TSSA and Field Engineering Oversight Technician to witness two Hydrostatic Pressure Tests as part of ITP 5580-7038-1 step 310 & 320. During review of ITP prior to pressure testing, Field Engineering Oversight Technician found the following deficiencies: - Step 30 – QC Verify Welder's Qualifications was not performed and signed off. - Step 280 – Perform NDE (Magnetic Particle Inspection) Deficiencies and inconsistencies found in the NDE reports. - Deficiencies found on the weld map drawings referencing incorrect line numbers. - Deficiencies found in the ITP referencing incorrect line numbers. - Weld inspection log was incomplete and not signed. Please see attached Oversight Report.

N-2016-28152	Project # 49158 Fukushima EME - Worker suffered a cut to his left hand at the bottom of his thumb. (Pickering "Owner Only" Project Site)	AECON worker working on the FUKUSHIMA EME was cutting a piece of Styrofoam along the horizontal side of the pad with a safety knife in his right hand. Worker over exerted himself applying to much pressure which caused the knife to move faster than expected and it made contact with the left hand with which he was applying pressure to hold the Styrofoam down. Worker received a cut on his left hand at the base of the thumb. Worker was not using appropriate gloves for the task at the time of the incident.
N-2016-27811	13-41027 Fukushima EPR U1 Pad Delay on Field Initiated Change	During installation of the U1 EC 127562 for Fukushima Emergency Power Restoration (EPR) switchgear pad, several buried cables were discovered upon start of excavation. Some cables were related to security systems. The design agency were engaged to assess a path forward on or about 13Sep2016. Since then much efforts have been made collaboratively to prepare a FIC against the said EC, considering to shift the location of the pad slightly. The field change is taking more than 45 days to prepare. Furthermore, the electrical component of the field change in particular had less than adequate involvement with OPG electrical engineering for an effective collaborative review process, resulting in further delays.
N-2016-27662	Project 49158 - PB Fukushima Phase 1B (BDBE) - Vendor underestimated effort to complete Seismic Margin Assessment reports	Vendor expended more than planned effort to complete seismic margin assessment reports, resulting in addition cost.
N-2016-27507	13-41027 FUKUSHIMA DG STORAGE PAD-DELAY ON CONCRETE POUR (4NOV2016)	Due to late identification of a non-conformance report (ES FOX NCR 2016-1803-17903), scheduled concrete pad pour had to be cancelled. The NCR was submitted to OPG for acceptance 2NOV2016 but was actually initiated 26OCT2016. OPG civil engineering was not offered sufficient time to evaluate and respond to the NCR concerning a design deviation of using U-fill instead of concrete in a section of the pad construction. The vendor had to postpone the concrete delivery, a critical task required to be done on this weather sensitive modification. This is a similar event to the one captured under N-2016-26745 (056 NV18 delay due to late id of NCR)
N-2016-27376	Project,13-41027, FUKUSHIMA BDBE AIRLOCK EMERGENCY BOTTLE RACKS. DELAY - Void In Concrete	W.O. # 4930232 Workers drilled 1 of 6 required holes for the Hilti anchors (KB-TZ 3/8"x3") that secure 4-21459-RACK2049 (ref: NA44-DRAW-21459-10009-U4) to the RAB 317 elevation floor. The minimum embedment is 2-5/8" The hole depth required was 2-5/8" to install the anchors. The concrete slab was verified by Field Engineering as 4". The First anchor hole was stopped at a depth of 2 inches. Workers found an air gap between the 2" drill depth and the bottom decking. The Void measures approximately 3 inches deep. Workers stopped work and contacted supervision.
N-2016-27245	Phantom voltages on EME PLUGS for Fukushima 120V BDBE	the unexpected 40Vac L-G voltage was discovered on the new EME plug E2-65000-PL2388F-R2 installed as per EC122752. Normally if the transfer Switch is in normal power supply position and no portable UPS connected to the EME plug, we should not see any voltage on this EME plug. the following is what was noted: L-G: 40.4V, N-G: 12.2V, N-L: 20.1V between pins of EME plug. After countless discussions, long time thinking and research, OPG design made conclusion (backed by the bulletin#88 from NEMA) that these voltages are phantom voltages caused by capacitive coupling between wires and improper use of high impedance mutimeter. It is recommended by NEMA that low impedance multimeter shall be used on open wires. When measuring voltages on open wires which no power source connected to, if you see some abnormal voltages like 30 to 50V, then use the low impendence meter to check to confirm if these voltages are phantom voltages. it was also validated from the field that low impedance mutimeter was used and voltage reading on EME plug was zero, which was expected. The installation schedule was delayed for morte than one month because of troubleshooting. it also affected U4 & U3 installations. the U3 & U4 installation will be rescheduled to next year.

N-2016-26807	Project 13-49158 IOP FUKUSHIMA U8 PIPE SUPPORT SEISMIC HARDENING DELAY - CDAC / markings from electrical scanning removed from location	On the 25th of October E&C Tech performed electrical scanning to support CDAC-2923 (WO#03076728) for U8 HP Feed water heater supports. Interferences were found in the general area and Tech used red duct tape to mark where interferences were located then took pictures and signed his portion of the drill card. Today Tech was walking by the area and noticed that some of his interferences markings were removed from area. These markings were in the area the contractor had marked for drilling. Unable to re-mark area because area is roped off for waxing
N-2016-26745	49158 PNGS Fukushima NV18 (U056) Delay	NV18 rejected from WW41 on IOP schedule as contractor issues affecting pre-requisites were not completed. A non-conformance report (NCR) to address weld bead variation was discovered unresolved the day prior to execution. The customer's (OPG) engineering did not agree with proceeding with the deviation "as-is". Further information and field inspection was performed enabling the OPG engineer and TSSA to accept the NCR. A recovery plan was put forth to re-inject at WW43 but this work conflicted with another critical station work (NV3 per N-2016-26432).
N-2016-26614	Project 13-49158. IOP Fukushima Water to Moderator 056NV18 DELAY - lack of Ops resources at WW32.	Installation of water to moderator modification at 05-NV18 was initially planned for installation and NIMD into the station schedule in WW32. Due to lack of Ops resources available to support the work in WW32 the work was rejected from the schedule and was re-injected into WW41.
N-2016-26443	Project 13-41027 IOP Fukushima, Diesel Generator Storage Pad. DELAY	Second pour of concrete related to the Diesel Generator Storage pad was arranged for 08:00 Tuesday Oct 25, and is now delayed due to an emergent issue with the location of the Seismic Tie-Down locations. (W/O#4918336). Review of design identified that the locations of embedded rods, as specified in the design drawings is not consistent with the actual locations of the lugs installed on the Diesel Generators. This will result in an offset tie down arrangement which has been confirmed with design to be unacceptable, and will not be correctable after concrete pour.
N-2016-26440	Project 13-41027 IOP Fukushima Airlock Bottle Racks. DELAY	Installation of Fukushima Mod, Airlock Bottle racks per the IOP schedule is being delayed due to late issuance of CDAC drill cards, required for anchoring of the racks with Hilti Anchors. (W/O# 4930232). Work is currently on hold pending issuance of drill cards associated with installation of the last 13 racks. Areas are marked out and require F/E scanning and issuance of cards.
N-2016-26436	Project 13-49158 IOP FUkushima Water to Moderator at 078-NV18 Potential Delay - AS FOUND CONDITION	Installation of Fukushima Water to Moderator mod at 078-NV18 is schedule in the IOP plan for WW45. (W/O# 3036446-3217788). Pre-requisite scanning of the area specified in design for the modification piping support has identified a number of re-bar interferences which will prevent the support being installed per design.
N-2016-26432	Project 13-49158 IOP Fukushima MAKE UP WATER TO HTS/MOD 056-71380-NV18 DELAY - injected schedule re-scheduled.	Installation of the Fukushima Mod to provide water to the moderator at 056 NV18 (W/O 3036447-3217791) was tentatively accepted to be scope injected into the IOP schedule in WW 43. Due to higher priority work on ECI NV3 the work was subsequently not accepted into scope and will now need to be injected after completion of a similar Fukushima Mod on 078-NV18, which is scheduled in WW45.
N-2016-26206	Project 13-41027 Fukushima U4 ELECT POWER RESTORATION PO 229562 Worker struck by 2'x4' at home depot	WO# 3218951 while picking up 2'x4's at home depot our worker was accidently struck by a 2'x4' while loading cart by the home depot worker. Material is for Fukushima unit 4 EPR pad. Worker is not seeking medical attention and has returned to regular duties, report only
N-2016-26101	Project 13-41027 IOP Fukushima projects Unit 4 EPR and unit 7 hydrogen igniters PO# 229562 Rain delay.	WO#3218951 unit 4 pad and 4918310 U7 igniters rain delay to projects only crews allocated to other work.
N-2016-26083	Project 13-41027 IOP Fukushima Bottle Racks TLD, Sent Through X-Ray Machine	W.O. # 04930232 Worker placed TLD into security tote with other personal items and sent tote through the X-Ray machine. Worker immediately notified FLM of event.

N-2016-25277	Project 13-41027 IOP 058 Fukashima pad work. PO# 229562 Emergency SATM required.	WO# 3217326 Emergency SATM required for 058 Fukushima pad work north side of EPG building. Need SATM put into emergent status to start setting up hazardous work area. SATM#16704 Permit # P-16-0963
N-2016-25126	Project 13-41027 Fukushima Emergency Mitigation Equipment Facility Rain Delay	Due to excessive rain on project 13-41027 failed compaction test results on west excavation due to heavy rain causing unstable soil conditions, dewatering and further excavation required to meet test requirements. 2 workers 8hr to dewater and complete satisfactory test results.
N-2016-25123	Project 13-41027 Fukushima Emergency Mitigation Equipment Facility/ Delay - Power Failure	Upon arrival at work employees discovered no power in trailers and work location. Project 13-41027 was unable to dewater excavated areas for footings till following day. Workers had only battery operated tools limiting production throughout the day due to power failure and unavailable power. Work activities limited to what working available tools were on site.
N-2016-25122	Project 13-41027 Fukushima Emergency Mitigation Equipment Facility Rain Delay	Heavy rain this morning delayed project 13-41027 for approx. 2hr. 21 employees affected. Due to the amount of rain 2 workers pumping and removing water from footing forms for the rest of day 7 hr.
N-2016-24970	Project 13-41027 U4 Fukushima EPR Pad Emergency SATM required	During excavation of EPR U4 Pad, discovered excessive amount of ground water. Power pack required to run pumps to remove water from area
N-2016-24672	Project 13-41027 | MEC121427 EPR for PA Detailed Commissioning Specifications submitted by ES-MSA Design Service Provider rejected by OPG design	The Design Service Provider to ES-MSA prime contractor provided OPG design for review and acceptance with the Detailed Commissioning Specification NA44-DCS-54120-00002 Beyond Design Basis Event project for Emergency Power Restoration, Pickering Units 1 and 4. On initial review of this DCS document, OPG design identified a number a key technical errors that are contrary to the detailed design requirements per the Modification Design Requirement, Commissioning Requirements as documented in Asset Suites for DEC125973 and DEC125975 as well as Reactor Safety Memorandum that renders this submission unacceptable. Two key errors that led to the rejection are as follows: 1. Direct connection of the portable diesel generators to Class III busses 1,4-54120-BUA, -BUB during commissioning contrary to earlier guidance provided by Fukushima Oversight Group P-CORR-09013-0544290 that no direct connection of the portable generators to station buses is to be undertaken. 2. Commissioning and testing for phase rotational checks have not been captured. It appears that the Design Service Provider is not fully aware of design constraints and requirements associated with this modification. ES-MSA vendor must ensure that a proper turnover of design information does occur during the change in Design Service Provider contractor strategies [SCR N-2016-06043]
N-2016-24260	Project 13-49158 U6 EC 133231 FUKUSHIMA BDBE AIRLOCK EMERGENCY BOTTLE RACK INSTALLATION Drilled Hole Through the Slab/Q Deck	Workers drilled 2 of 6 required holes for the Hilti anchors (HSL-G M12/25) that secure 6-21459-RACK2030 (ref: NK30-DRAW-21459-10074) to the RAB 317 elevation floor. The minimum embedment is 3 1/8". The hole depth required was 4 5/8" to install the anchors. The concrete slab is 5 1/2" (Q deck -1 ½ "). The Q decking was at the required anchor depth. 2 anchor holes were drilled. First anchor hole stopped against deck. Workers did not notice this until they removed anchor from the drilled hole. Drilling the second hole the bit went through the slab. Workers stopped work and contacted supervision.

N-2016-23637	Project 13-49158 Fukushima BDBE Seismic Structural. Delay - work area inaccessible / steam leak.	During a field walk down to review scanning results associated with installation of new seismic brackets, per W/O's 3076727, 3217363, 3076728 and 3076725 on all Pick B HP Feed Heaters, adverse conditions were noted on both Units 6 and 7. On Unit 6 a steam leak has occurred on HX 5b which has resulted in the area being roped off and currently inaccessible. This will impact the ability to install approx. 25% of the brackets on Unit 6. On Unit 7, scaffolds have been installed on all 4 HP Feed Heaters directly in the locations of the brackets and are currently in use to perform shell thickness measurements of the HX's
N-2016-23346	Project 13- 49158 IOP Fukushima Storage Facility. P.O 258340 Soil debris outside the Owner Only Island protruding fencing.	It was discovered by CMO that soil was protruding the Owner Only fencing, for P.O 258340 Project Code 49158 Fukushima Storage Facility. Any soil debris outside the Owner Only fencing is at risk with AECON Doc A00464-EMP-001 Rev 00 Environmental Management plan. This is the responsibility of the Contract Owner to correct.
N-2016-23295	Inadequate Quality Issue of EPC Vendor AECON-SNC Joint Venture LAN Cable Protection Details	Part of the MEC 121427, DEC 134870, EME Storage Facility at Pickering, Protection of the existing Fiber Optic LAN Cable Buried Under the foot print of the proposed new EME Storage Facility versus Relocation Option Study memorandum submitted by the EPC Vendor AECON-SNC Joint Venture was reviewed by OPG Civil Structural Analysis section on July 28, 2016. While performing the general review of the memorandum N-CORR-53410-0599262 few errors and omissions were noted. the following are some the noted deficiencies communicated to the vendor: -Construction of wooden cages around the existing Optical Fiber LAN cables involved activities such as placing concrete blocks and wood framing members under the existing cables would disturb and may compromise the integrity of the existing LAN cables. The proposed protection detail appeared inadequate. -The memorandum did not provide pros and cons for the options and Was missing the information with respect to construction time, material and cost for the alternatives. OPG review Comments clearly indicating the OPG concerns and clarifications to help resolve the issues were provided to the Vendor on July 28, 2016. My section manager, OPG DTL and Project Manager were informed. On Thursday July 28, 2016 in the face to face meeting, OPG civil concerns were communicated and discussed with AECON construction representatives, OPG DTL, Project Manager, and Fukushima Portfolio Manager Design Projects. This SCR is being initiated to document the quality of the Vendor memorandum.
N-2016-23139	Project 13-40127 IOP U1 EPR Pad- Fukushima Phase 2 DELAY - AS FOUND CONDITION OF WORK AREA.	with assistance from FE, SRE, Engineering, Security, Control Mtce, and Contractor it was determined that the conduit found in the concrete is under the Electrical Security Jurisdiction. Ref Drawing 8690-DRAW-14100-10077
N-2016-23136	Project 13-40127 IOP Fukushima Phase 2 U4 EPR Pad. DELAY - AS FOUND CONDITION OF WORK AREA.	During initial fill of A-Gravel, workers noticed that the North East section of the Pad was very wet after back and forth movements with the Bobcat loader.
N-2016-22799	Project 13-40127 IOP Fukushima BDBE Phase 2 U1 EPR Pad installation, DELAY - As Found Condition in work area.	During excavation of the U1 EPR Pad a large piece of concrete was uncovered. It appeared to be legacy concrete spill. FE were called and the area was scanned. Drill card issued to chip and remove concrete. Almost immediately on removal we ran into what appeared to be 6" conduit encased in the concrete and stopped.

N-2016-22207	Project 13-41027 IOP Fukushima BDBE Phase 2, EPR Unit 4 DELAY - Legacy design thickness discrepancy.	Post excavation of the Unit 4 EPR switchgear pad location per W/O 3218951, scanning of the building basement wall from both sides was conducted to determine re-bar locations prior to core drilling for 4 4kv cable penetrations. Scan can only penetrate 12-16" which was anticipated to be acceptable as design thickness of the wall is shown to be 21" However actual measurement of the wall thickness through an adjacent penetration identified that the wall is in fact 42" thick and not consistent with design drawings. This precluded the ability to scan the entire thickness of the wall to determine re-bar locations.
N-2016-22188	Project 13-41027 IOP Fukushima BDBE Phase 2 Unit 4 EPR pad excavation, as found conditions.	During Vac Truck excavation of the area for Unit 4 EPR pad installation, per W/O 3218951, a through wall open penetration was found through the basement wall approximately 4 feet below grade. The penetration is approximately 8" in diameter and is open ended through the concrete wall.
N-2016-22186	Project 13-41027 IOP Fukushima Phase 2. Unit 1 EPR pad. DELAY - as found conditions.	During Vac Truck excavation of the area for Unit 1 EPR pad installation, per W/O 3217821, what appears to be buried concrete and or K-Crete from previous work was discovered.
N-2016-22183	Project 13-41027 IOP Fukushima Phase 2. U1 EPR Pad installation As Found Conditions	During excavation of the area for Unit 1 EPR pad, per W/O 3217821, electrical cables were discovered at 12" below grade. One of the cables had been identified by FE prior to excavation, the second was discovered during excavation
N-2016-20810	Project 13-49158 Design Plan DP-65430-0001 revision to R02 not accepted by OPG design. AFS delay.	An AFS Meeting for Fukushima Critical Monitoring design DEC 127041 was rescheduled from Aug 16 to Aug 18 due to incomplete design documentation (N-2016-20599 and N-2016-20471). The design plan was to be accepted by OPG design prior to the AFS meeting on Aug 18. OPG design again did not accept the design plan from the DSP as there were errors/omissions. This prevented OPG design from accepting the Commissioning report for DEC 127041, and not approving a revision to DEC 127041 required for AFS.
N-2016-20564	Project: 13-49158 Fukushima EME Storage building cost overrun and schedule non-compliance	Extended delays and cost overruns are incurred for the Fukushima EME Storage facility project design, procurement and start of construction deliverables discovered while performing oversight on design quality and project management . This SCR documents several factors that contribute to these adverse project results: 1) Delay in preparing Owners-Only contract (OSHA) related documents to take possession of the construction island. This delayed gathering of soil sample and site survey data for design inputs. 2) Several iterations to correct quality issues on the design packages, including incomplete calculations and failure to accurately incorporate agreed upon comments. More details provided in SCR N-2016-16151. Original TCD for design complete was 9Jun2016; and several recovery plans have been dishonored (29Jul2016 & 12Aug2016) to date. Key resource to progress design to completion is noted to be on vacation and as such creating further delays. Original budget for completing design was exceeded as attributed to the above noted delays.
N-2016-19439	Project 13-49158 IOP BDBE Fukushima-Water to Heat Transport V16. Scheduled Work Rejected in NIMS.	Project work per W/O 3036455, to add an BDBE Fukushima related injection point for water to Heat Transport at V16, scheduled for installation in NIMS for WW32 was rejected by Work Control at WW30. Reasons provided are lack of Operator resources and a potential issue with an O Ring which might be required for a Mechanical Maintenance contingency task to replace filters. Task in question is 3036455-44, which is at "ready" status.
N-2016-19135	Project 13-41027 IOP PN FUKUSHIMA PHASE II EME DG storage Pad, Worker stung by Bee.	W.O. # 4918336-03 Employee was gathering scaffold material at west end area 51 scaffold lay down and was stung by a bee on left check.

N-2016-18628	Project 13-49299 IOP Fukushima- Make up Water to Moderator V478, DELAY - incorrect material (Flanges for strainer) impacting schdeule.	Vendor supplied flanges required for the 4 strainer carts associated with the Unit 1 and Unit 4 Water to Moderator V478 Fukushima work (W/O 3036316) were found to be incorrect. The flanges to be fitted to the strainer carts, as received from the vendor (TRC), should have been 4" raised face and were found to be 4" flat faced on receipt inspection in the field. Post follow up with the vendor resulted in a second shipment of flanges which were raised face but were 5" and not the required 4". Measured tasks (3036316-16 and 3036316-17 to pre-fabricate and test the 4 strainer carts will not be completed as scheduled in WW39
N-2016-18625	Project 13-49158 Fukushima - Hydrogen Igniters. DELAY - Unit 7 not meeting milestones	Due to the late acceptance of the detailed commissioning spec (DCS) for the H2 Igniter work on Unit 7 (W/O# 4918310), the Work Plan and Assessing milestones for this work will not meet T-16 MA0022 requirements. The DCS is now accepted and the Detailed Work Plans which had been prepared and were waiting for DCS acceptance have been completed and were accepted on July 18. The Assessing will now be completed on July 29, (WW30) with all tasks set to ready. Installation of this mod is scheduled in WW44 so the T-16 assessing milestone will be missed by 2 weeks and be completed at T-14.
N-2016-15562	Stress report issues for Fukushima ESW Tie Ins requires extension to DECs 123890/123891/123923/123924 closeout.	Closeout of Design ECs 123890/123891/123923/123924 under MEC 120954 requires extension to August 26, 2016 from the original DEC closeout date of April 29, 2016. The associated piping stress report requires more time to resolve (SCR N-2016-10956).
N-2016-11260	Project 13-49158 IOP Fukushima - Provide Water to Moderator at NV18. DELAY - Schedule push due to material delivery delay.	Delays with acceptance of vendor related drawings and vendor manufacturing timelines have resulted in scheduled work being moved to future work weeks. Valves to be supplied by Velan related to the install of 056 and 078 NV18, have moved from a delivery date of May 27 2016 to August 31, 2016. 056-NV18 was scheduled for installation in WW26 and has now been moved to WW41. 078-NV18 was scheduled in WW30 has been moved to WW45.
N-2016-11254	Project 13-41027 - Fukushima Phase II - Scope addition	Ground connection of large Diesel Generators to the storage pad per preliminary design was through use of lugs, however during detailed design COMS, it was identified by stakeholders that disconnecting the lugs are time consuming and quick connects have to be implemented to help minimize the deployment timelines during a Beyond Design Basis Event (BDBE).
N-2016-10135	Project 13-49158, Fukushima BDBE MEC 124570 - Material Delay for Manual Valves	Whiteboard milestone of May 20th for Material on Site will be missed for both 056 (WOs 3036447/3217791) & 078 (WOs 3036466/3217788) Installations. Valves 056-71380-V2026 & 078-71380-V2027 which are to be procured from Manufacturer Velan, are class 3 valves. Due to this, procurement activities took longer than anticipated. Therefore delays in procurement activities resulted in Velan being unable to deliver these valves by the whiteboard milestone of May 20th. These valves are the only components holding up completing procurement activities for DECs 127096, 127098, 127099 & 127100. Original date for valve delivery: WW19. Estimated delivery has been adjusted to WW26. This will have an adverse impact on the SOI for 056 Installations under WOs 3036447/3217791 which are currently scheduled in WW26. There is no adverse impact on the SOI for 078 Installations under WOs 3036466/3217788 which are currently scheduled in WW30. GILLARDB 2016/04/21 09:14 : The two valves in question are new installations and not yet updated in ESM, TCR's # TB48885 & TB48887 document the installation of these valves.

N-2016-09640	Configuration of Unit 2 Boiler Chemical Feed piping at 2-74400-V5 & 2-74400-NV6 Fukushima BDBE Mods. Project#31508	Unit 2 Boiler Chemical Feed Piping, L11-3/4C (at 2-74400-V5 & 2-74400-NV6), is not configured correctly. The current routing of the Pipe does not match the ISO piping drawing NK38-D1H-74409-2006-U2. This configuration Management condition is impacting the installation of U2 Seismic reinforcement modification on Deaerator Storage Tank (Project 16-31508). This condition is limited to Unit 2 only. All other units are configured correctly.
N-2016-08315	Fukushima Project 13-49299 BDBE 4-54130-DSGN-PORTABLE TOOL FOR MV ACTUATION Online Wiring not statussed prior to AFS meeting	AFS meeting for 4-54130-DSGN-PORTABLE TOOL FOR MV ACTUATION was scheduled and held on April 1, 2016, without having Online Wiring statussed. Per N-GUID-00700-10000 section 1.9.7.7 (b) “The following deliverables should be presented at the AFS meeting: (vi) On-Line Wiring updated and statussed as “currently built”, and OLW STATUSSED milestone updated.” Both of these activities were not completed prior to the AFS meeting.
N-2016-06127	Project 13-41027 BDBE (Fukushima) - CAT ID not set to READY, DEC 130188 EPR-PA	Unit 4 PA, CAT ID 991637 for 4-54120-CB14B was not set to "READY" status prior to installation activities which is contrary to the procedure: N-GUID-00700-10000 (Sec 1.5.9). It appears that the Vendor missed to initiate the Cat ID creation process totally and OPG PE was not provided enough time to work for the completion. According to the Vendor, OPG PE is currently working on this and the Cat ID is expected to be in "READY" status by 18 March, 2016. The AFS for DEC 130188 is scheduled for 09 March, 2016. This was discovered just ahead of the scheduled AFS meeting.
N-2016-06049	Project 13-41027 BDBE (Fukushima) - CAT ID not set to ready; DEC 130188	The purpose of this SCR is to document that CAT ID 991637 was not set to ready status, prior to installation activities, as per N-GUID-00700-10000, Section 1.5.9. Modification was installed prior to CAT ID's being set to ready, This was discovered during completion of corresponding AFS documentation. Reason for CAT ID 991637 not set to ready status: DSP / MTL missed setting CAT ID 991637 to ready status. AFS Meeting will remain scheduled for March 09, although corresponding AFS documentation will not be signed off until CAT ID 991637 is set to ready status.
N-2016-06043	Fukushima Project 13-49299 | 13-49158 | 13-41027 | BDBE Engineering Support Activities Placed on Hold by ES-MSA vendor	Informed by ES-MSA vendor that all Engineering Support work associated with the Beyond Design Basis Event (BDBE) projects except those directly related to P1641 and P1681 have been placed on hold. Completions of design close out activities associated with already installed modification are most likely to be missed due to this work stoppage.
N-2016-05697	Project 13-41207 Beyond design Basis Event (Fukushima) - DELAY to AFS Meetings for DEC 130188 & DEC 127409	The purpose of this SCR is to document the delay to the AFS meetings for: DEC 130188 - Unit 4 Emergency Power Restoration; BuB Extension DEC 127049 - Unit 4 Power to Critical Monitoring AFS meetings have been originally scheduled for Monday March 7th (U4 BuB Extension) & Friday March 4th (U4 PCM). Purpose for rescheduling: outstanding actions not complete from DSP. Immediate action was taken to reschedule the meeting to March 9th which is within the allowable timeframe dictated as per the ECC process.

N-2016-05352	Fukushima Project 13-49299 | BDBE Critical Safety Parameters Monitoring unit 4 wiring color code discrepancy	Beyond Design Basis Event modification for Critical Safety Parameters Monitoring on Unit 4 was installed as per Online Wiring under DEC127049 using wiring color codes contrary to existing Electrical Installation Specifications P-INS-01983.4-00009 section 4.12.3 - WHITE wire was installed as Line and BLACK wire was installed as Neutral rather than BLACK wire for Line and WHITE wire for Neutral. ES-MSA vendor reported during design review meetings on the resolution of these issues previously identified under SCRs N-2016-02623 and P-2016-02260 has been resolved to the satisfaction of all stakeholders. When questioned further about the resolution it was reported that the design was implemented in the field as per Online Wiring. But the Online Wiring is contrary to the OPG and OESC requirements as the ES-MSA vendor attempted to match the wire colors to existing field installation, not following the OPG procedures.
N-2016-05168	Project 13-49158 Beyond Design Basis Event (Fukushima) - Design Quality issues impacting schedule dates.	During a field walkdown to determine detail required to support work plan writing related to Seismic Structural Support work on units 5,6,7 and 8, a number of equipment interferences were noted that are not addressed in design. This has led to a need to revise the design and delayed writing of the associated work plan to the point that it is affecting contractual AFS dates.
N-2016-04266	Project 49158: Fukushima Phase 1 - 15 kw generator delivered in unacceptable state and not adequately repaired	The N+1 15kW Generator was sent to OEM early January for touch ups as it was received in an unacceptable state. It was discovered that the paint was in patches, uneven, inconsistent, and there was rust on the inside and outside. An inspection of the unit repairs done on 04-Feb-2016 at the OEM site. Despite being sent for repairs, the overall unit did not look like a brand new unit and it was unacceptable. OPG requested OEM to restore the unit to a new state. This impacts the completion date of AR 28168461 (P-2014-15029) which is due 29-June-2016. The N+1 (spare) must be available to site before we can send the N 15 kw generators (6 in total) to fix the fuel tank.
N-2016-02407	Project 13-49158, 13-49299 and 13-41027. Fukushima Project - Overtime inputs to Oncore not pre-approved and rejected by OPG project reviewers	From July 25, 2014 to October 13, 2014, 48 hrs total of overtime was charged to the BDBE project by various ES Fox staff, for which there are no overtime approvals from OPG project.
N-2016-01874	Project # 13-49299, 13-41027, 16-32202 - POPULATING BDBE/BDBA FUKUSHIMA EMERGENCY MITIGATING EQUIPMENT TAGS AS PER DIRECTION MEMO N-CORR-76801-0561864	N-CORR-76801-0561864, a memorandum for Emergency Mitigating Equipment Labelling prepared, verified and approved by the Fukushima Oversight Group. This direction memorandum is considered as request for MEL/ tag updates. As per the N-PROC-MP-0077, sub-section 1.2.2.b.1, for a large number of MEL records, requestor may contact the appropriate Design Section Manager to determine if the information can be transmitted in an attachment to N-FORM-10492. N-CORR-76801-0561864 does not contain the N-FORM-10492. An initiation is taken to complete the N-FORM-10492 and update the existing Emergency Mitigating Equipment Tags by Projects Design Electrical and Mechanical Section.

N-2016-00673	Project 13-49299/49158/41027 - Fukushima BDBE Project PCA and CTP Contract Changes Required	A Project Change Authorization (PCA) per the ES-MSA agreement is required to add new scope for Projects 13-49158/49299/41027. This addresses scope addition for a number of modifications under PO# 229562 Line 0001 (Project 13-49299), Line 0002 (Project 13-49158) and Line 0003 (Project 13-41027). A Consent to Proceed (CTP) per the ES-MSA agreement is required to complete existing performance fee scope under Project 13-41027. This affects PO# 229562 Line 0003. This effort was discovered while performing Engineer-Procure-Construct (EPC) work under PO# 229562.
N-2016-00317	Procurement Oversight (report ESMSA-FUK-SCO-ESFOX-003) ESMSA Project - Fukushima BDBE project	This oversight activity was performed on December 14, 2015 at ABB Brampton facility. This oversight activity was performed on ESFOX surveillance of 4.16kV Switchgear Extension Inspection and Factory Acceptance Test per SO#P150528 Rev 04 to determine functionality of the unit. Receipt inspection of breakers and site assembly inspection were also Included in the ESFOX surveillance plan. Observaions from the oversight are identified on oversight report ESMSA-FUC-SCO-ESFOX-003. An observation was noted with ABB failing to comply with requirements to have "100% QC witnessing and application of acceptance stamp" per the switchgear panel testing production checklist PD-F-003. Production Checklist Item #10 states Bus Bare connections (Main bus & GND bus) are to be tightened as per standard PD-WI-001 2.0 and Witnessed and Stamped by ABB QC. The Checklist Item #10 is signed off, however Quality Control has not witnessed or stamped the bolts to complete this step. ABB has taken the action to initiate corrective action (NCR 2015-1132-17232). CAR 2015-460 was initiated by ESFOX on ABB for inadequate instruction PD-WI-001 2.0 and associated checklist PD-F-003. The adverse condition is ABB's quality assurance procedure lacks adequate documentation of tools, components, personnel requirements and acceptance criteria for the activity and production personnel appear to be unfamiliar with ABB's procedural requirements.
N-2016-00126	Project 13-41027 P1641 Beyond Design Basis Event - Fukushima Phase II. DELAY - lack of OE support.	WO# 3218944-13 BEL:(PRE-REQ) PERFORM INTEGRITY TEST OF 4-54120-CB14B could not be completed today due to lack of OE support from other vendor. Breaker is located in east complex and needs to be loaded by forklift and delivered to loading bay A
N-2015-30156	Proj 49158 - Fukushima 15 KW gen found to be in poor shape during PDI inspections	During Per Delivery Inpsection it was found that the newly purchased 'spare' N+1 15 kw generator has a poor paint job and slight rust, and possibility that the generator is not new. Vendor has been called in and will be fixing the unit. Without the spare N+1 available, the remaining 15 kw generator which needs a fuel tank replacement to meet code cannot be done, impacting the completion date of AR 28168461 (P-2014-15029) which is due Jun 29, 2016. The fuel tank replacement will be done by the same manufacturer and a recovery plan will be provided.
N-2015-29869	Project13-49158 P1561 - Fukushima Project Phase 1B. Delay in permit application related to MV Tool installation	Permit application required to support P1561 Fukushima modification work related to MV Tool, was delayed impacting project cost and schedule. Permit application for MCC11, per the ouatge six shift, was to take place on the evening of Friday December 18. Trades were arranged to be on site to support the work which was expected to finish on MCC11 on Saturday dayshift December 19. Permit was not applied until Sunday December 19 with work completing on MCC11 later that day. This has additionally pushed downstream work required on MCC 12, which is now expected to start at 14:00 Tuesday December 22.

N-2015-28487	Fukushima Project 13-41027 | Electrical Power Restoration MEC121427 Design Activities Placed on Hold by ES-MSA vendor	Informed by ES-MSA vendor that all work associated with the Emergency Power Restoration project under MEC121427 have been placed on hold due to lack of funding. Completion of all design activities that are currently to be completed by the vendor for submission to OPG design for review and comments by the end of this year and ultimately the overall design acceptance by the end of February 2016, are in jeopardy.
N-2015-27118	Project 13-49158 BDBE 058 Stand Pipe - Contractor vacuum truck incident.	After vacuuming out bollards on wo# 3076715-23 Fukushima beyond design basis the vac truck was heading west toward UPP berm along road just south of powerhouse under PRD duct. At the waste management service wing the boom on the vac truck came in contact with the building causing minor damage to the sheetmetal cladding. No injuries reported.
N-2015-25728	Project 13-49158 BDBE (058 Stand Pipe)bollard install DELAY - as found condition " Concrete Obstructions "	WO# 3076715-23 fukushima draw water from lake bollard excavation and install, we discovered existing concrete obstructions in 2 bollard locations. This will interfere with the bollard install.
N-2015-25582	Project#41027 Fukushima Phase 2 (Storage Pad)- Vendor request to create CATIDs without providing correct information on AS7	On Wednesday Oct 28th Vendor requested OPG project's support in expediting the CATID creation to avoid impacting on the schedule for meeting the design milestone. the CATIDs were needed by OCT 30Th per the vendor. OPG Project responded by coordinated with Supply chain to provide the support over the weekend on high priority basis. Initial assessment of OPG supply chain on Sat Nov 1st on the information provided by the vendor in AS7 indicated that the information provided by the vendor is not adequate to create the CATIDs.
N-2015-25290	Project 13-49158 Beyond Design Basis - Oncore submittal for contractor travel rejected due to lack of pre-approval	During Oncore review it was noted that travel incurred by the ES Fox engineering provider (HSL) in support of the Beyond Design Basis Fukushima Mods had been rejected in Oncore. Investigation into rejection resulted in the determination that the travel had not been pre-approved by OPG Project so was consequently rejected. Travel was pre-approved by ES Fox. ESMSA Business Expense Schedule, currently available on the ESMSA Web, does not require OPG pre-approval of travel. A more recent version, not available on the web, requires pre-approval for Air, rail or Bus travel per section 3.1. Revision is dated December 10, 2014. Document is silent on how pre-approval is to be obtained and there does not appear to be a standard travel request form.
N-2015-22927	Project 13-49158 Beyond Design Basis Event (058 Stand Pipe) - Worker not wearing required PPE while in confined space (self report)	Worker was modifying scaffold on fukushima draw water from lake project WO# 3076715 south of power house. The scaffold is erected in the pits located south of unit 6/7 and is a confined space. The worker entered the scaffold/confined space and neglected to don the harness contrary to the safe work plan and rescue plan. As part of the safe work plan and rescue plan a full body harness is required to be worn for rescue purposes.
N-2015-22013	Project 13-49158, Beyond Design Baasis Event (P58 Provide Water to Intake Channel) - Rain Delay	W.O. # 3076715 Crew attempted to erect scaffold rescue beams for the Fukushima Draw Water from lake project. Due to the inclement weather the crew could not progress the job as normal. This may, push the schedule. 4men x 4hrs and 1 foreman 2hrs Total 18 hrs delay.

N-2015-20750	Design Quality issue of EPC VendorBDBE Modifications	Memorandum P-CORR-09013-0560310 Technical Justification of Seismic Restraints for Pickering Unit 1 and Unit 4 Portable UPS carts for BDBE (Fukushima) Modification submitted by the Vendor Hatch-Sargent & Lundy was reviewed by OPG Civil Design and Analysis section on September 18, 2015. While performing the oversight review of the Assessment Memorandum errors and omissions were discovered. Some of the noted technical errors and omissions are listed below: • Missing design details for protection of EME equipments stored on the carts. • Cart specification, cable specification, stored EME equipments information (size, weight, location etc) were missing. • Assessment of the carts to demonstrate adequacy to support EME equipment loads considering BDBE design conditions is missing. • Assessment (seismic interaction, sliding, overturning, fall from the carts) of untied stored equipments is missing. • Handrail capacity was based on unverified assumptions. • Overturning assessment of carts appears missing. • Details of recommended solutions are missing. OPG review Comments summarized in an e-mail indicating the OPG concerns were provided to the Vendor on September 18, 2015 and the Memorandum was not accepted.
N-2015-20668	Project 13-41027 P1641 Fukushima BDBE Phase II Bus Extension Work Plan delay in approval due to lack of Operator resources	P1641 Project # 13-41027 Fukushima BDBE Phase II Work Plan (NA44-WPL-54120-0550091) for 4-53290-BUB, DEC 130188 Bus Extension, Installation and Commissioning, delay in approval processed for Stakeholders signatures due to resource issues. Work Plan NA44-WPL-54120-0550091 for DEC 130188 was prepared and sent out for stakeholder approval signatures on 18-Aug-2015. Final signatures of Work Plan were not received per the outage recovery plan milestone of August 28, 2015 due to resource constraints within the final stakeholder work group.
N-2015-20263	Fukushima Projects 49158/41027/49299 - PCA for Completion of SMA for Water to Moderator Flowpath and for BDBE Power to Critical Safety Parameters	A Project Change Authorization (PCA) per the ES-MSA agreement is required to add new scope for the Seismic Margin Assessments (SMAs) for Water to Moderator flowpath and for the BDBE Power to Critical Safety Parameters. These efforts were not anticipated in the original project estimate, and therefore a PCA is being processed. This is related to PO 229562.
N-2015-19007	Fukushima Projects - PCA required for implementation of manifolds on EME Pumps, Project 13-41028	A Project Change Authorization (PCA) per the ES-MSA agreement is required to add new scope for implementation of 5 manifold assemblies on Emergency Mitigating Equipment (EME) pumps. During the design phase of the project, it was determined that additional manifolds would be required to allow for connection of smaller, lighter hoses to EME pumps (HL160M and HL260M) as initially requested by ERT. Additional manifolds are required for a larger number of EME pumps (5 manifolds in total are required - 2 manifolds for 2 HL160M pumps and 3 manifolds for 3 HL160M pumps). This effort was not anticipated in the original project estimate, and therefore a PCA is being processed to add a new line item under the Minor Fixed Assets PO# 247775.
N-2015-14748	BDBE Phase II: Portable Instrument Project Schedule Risk	One action for HSL from Comment and Disposition Review Meeting with HSL, Fukushima Oversight team and Design for this project is to perform walkdown for constructability verification of the proposed solution. The review meeting was held on May 8th, 2015. Design was told on occasion when following up with the project progress that walkdown was requested and would complete by Ex-Fox. On June 24, Design was informed by HSL that they had difficulties to get the walkdown complete due to the schedule issue, and would like to submit the desgin package with the performance of walkdown in Issue Tracking File. It is not acceptable for design to accept the package without the walkdown verification being carried out. Therefore, potentially the scheduled due day of the project (Jun 30, 2015) could be slipped. This is the risk to the project schedule.

N-2015-14523	13-41027 - Fukushima Phase II BDBE - Delay in Additional Monitoring Capability CAT 4 Package	The Additional Monitoring Capability (AMC) CAT 4 Package has been delayed multiple times. The AMC CAT 4 package was originally supposed to be submitted to OPG for approval on 26MAR2015 as per the approved vendor schedule. The second date that the package was to be submitted was 17JUN2015, which has now also been missed. A new date has been established to submit the AMC CAT 4 package by 25JUN2015. This SCR has been generated to document lessons learned and an adverse project trend.
N-2015-13348	Fukushima Phase II EPS Equipment Costs Project 32202 PO 229988-2 MEC 122207	Contract change request received form ES-MSA Vendor for materials (Switchgear) for the BDBE Phase II EPS Restoration modifications. Provisionally designated PCA-229988-2-1015-0007 until PCA/CTP assignment complete. This request increases the original vendor capital materials estimate for this work by a factor of approx 20X.
N-2015-12268	Project 13-41028: ES MSA Vendor schedule non compliance on Fukushima Phase 2 Diesel generator Procurement	ES MSA Vendor has missed issuance of drawings per contract schedule , Schedule delivery date of all drawings per schedule was May 13th 2015, however this date was missed without clear indication on delivery of balance of the drawings. Receipt of these drawings are prerequisite to multiple activities in the schedule and could put delivery of the equipment at risk. it also serves as an input to Emergency Power Restoration (EPR) project under Fukushima phase 2 modifications these equipment are funded by Minor Fixed Asset hence delivery has to happen within 2015.
N-2015-12079	13-41027 Fukushima Phase II - Procurement delay on Emergency Power P1641 outage Recovery Plan	ES MSA Vendor missed two Critical deliverables(Vendor drawings and PO issuance) for P1641 outage Recovery Plan for U4 Emergency Power Restoration modification. Per the recovery plan issued by the vendor on April 28th,Vendor drawings and a PO to the manufacturer had to be in place by May 1st and May 18th respectively as a prerequisite to completion of Detail design by July 31st.(outage milestone 11) PO was issued May 25 to the manufacturer and not all drawing are received. This has a ripple effect on completion of detail design by July 31th (outage milestone 11) and subsequent preparation of outage activities such as support documentation(outage milestone 18), Work Plan Assessing (outage milestone 21) and material delivery (outage milestone 28)
N-2015-11852	BDBE Action Request Extension	Action Requests 28172644-02, 28172797-13,18 are in place to initiate a DCR for BDB Functional Safety Requirements update for PNGS A (NA44-GUID-03600-00001), PNGS B (NK30-GUID-03600-00001), and Emergency Mitigating Equipment (EME) layout drawings. Currently, the EME pump deployment strategy is being revised via P-CORR-09013-0527371 to incorporate changes suggested by the Fukushima oversight team and ERT. These changes are required to be reflected in the DCRs under the subject ARs. Therefore, the AR assignment will be completed upon revision of the deployment strategy memo update.
N-2015-11619	PO 236249 (PN)/236279 (DN) - PO Increase over 20% of Original Value - Proj. 16-31508 (DN)/ 13-49158/13-49299 (PN)	Increases to PO 236249 (PN)/236279 (DN) are required exceeding 20% of the original contract value. Additional scope is to be completed by an external fuel safety specialist to support the Fukushima project fuelling strategies at PN and DN. This is the result of actions stemming from the conclusions of a report generated as part of the original contract scope.

N-2015-11535	Design Quality issue of EME Godwin HL160M and HL260M Trailer modifications	Report NK30-REP-71100-00005 R000 dated May 8, 2015 for EME Godwin HL160M and HL260M pump suction manifold for use during BDBE (Fukushima) modification was submitted by the Vendor Hatch-Sargent & Lundy for oversight acceptance review by OPG. This report provides the design for two Category 4 pump suction manifolds (16 inch manifold with four 6 inch suction ports for HL260M EME pump and 12 inch manifold with three 6 inch suction ports for HL160M EME pump). The manifolds and their supports are to be custom fabricated and permanently installed on the EME HL160M and HL260M pump trailers. Civil Design and Analysis section was required to review part of the report i.e. Section 3.1 Structural Qualification and Appendix-E related to design and connections of the manifold supports to pump trailers. While performing the oversight review of the Structural qualification section 3.1 technical errors and omissions were discovered. Some of the noted technical errors and omissions are listed below: - Effect of wind loads was not considered in design - Effect of seismic loads was not considered in design - Effects of transportation loads i.e. vibration environment during transportation was not considered in design OPG review Comments summarized in an e-mail clearly indicating the OPG concerns with clarifications to help resolve the issues were provided to the Vendor on May 12, 2015 and subsequently discussed in details in the teleconference of May 14, 2015. The structural design of the manifold supports was deficient and the report was not accepted.
N-2015-10172	PNGS & DNGS - A number of BDBE (Fukushima) Projects are on “HOLD”	During weekly video conference meeting on April 30, 2015, Design Agency informed OPG Projects Design that a number of Fukushima BDBE Projects currently on “HOLD” including MV Tools for Pickering A & B. On May 04, 2015 Design Agency re-confirmed that 17 Projects are still on “HOLD” including: a) MV Tools (Unit 1,4), Pickering b) Storage Area activities of Diesel Generators (PNGS/DNGS) c) Emergency Power Restorations (DNGS) OPG Projects Design team was not aware of any “HOLDS” on these projects. These “HOLDs” are expected to have negative impacts in meeting the current milestones of Design deliverables.
N-2015-09663	13-41027 Phase 2 Fukushima: P1641 Outage Milestones Missed	Due to changes identified during the detail design and material availability for U4 Bus extension as part of Emergency Power restoration project, new design approach is imminent. Due to this change, the outage schedule for P1641 milestone# 18- Outage Support Documents Issued- (31-Oct-2015) is at risk to meet N-PROC-MA-0013 requirements.
N-2015-09012	Fukushima Project 13-41027 | Electrical Power Restoration DEC125975 Disconnect Switch Procurement	A revised technical specification P-TSE-09013-10002 was prepared by ES-MSA vendor for a bus extension to 4-54120-BUB using a disconnect switch. This revision was necessary to address issues identified by ABB during bid evaluation clarification process that bus extension via cables was not feasible and shall be accomplished by adding a new switchgear section to the end of the existing switchgear lineup. [SCR: N-20155-05757]. During the revision to the technical specification, OPG Projects Design suggested that the draft revision to the technical specification be discussed in detail with ABB personnel to ensure that all of the requirements are being properly captured and any issues to be identified upfront. During the clarification meeting with ABB, it was identified that the disconnect switch cannot be seismically qualified in its proposed normally operating configuration.

N-2015-08028	ESMSA Project 13-5580 PNGS Fukushima BDBE: Procurement Oversight	Procurement Oversight was conducted by Supply Chain on the Pre-award PO file to procure Electrical Equipment - Switchgear and Disconnect Switches for PNGS. Observations from the oversight are identified in oversight report ESMSA-FUK-SCO-ESFOX-002: FUK-002-1.1 Seismic Qualification: Review of the ESFOX QSL determined that the seismic qualification/testing is not covered in the scope of NLI. Review of OPG ASL scope determined that the seismic testing is covered. Gap in the QSL confirmed. ESFOX to updated their QSL and make request to SCQS for update for the scope of qualification. FUK-002-1.2 Commercial Bid Evaluation: Not dated or signed. The evaluation was primarily based on price resulting in NLI as the recommended vendor. Lead time for delivery of SG4 and bus extension has recently become an issue, however ESFOX has determined that the evaluation criteria will not be updated to factor in the delivery schedule. ESFOX plans to negotiate with NLI to meet delivery schedule. FUK-002-1.3 Risk 1: NLI Current schedule for delivery of SG4 is Dec 29, 2015, however SG4 is needed by Nov 2015 to meet outage window. Risk 2: Bus extension spec is not approved and the equipment is required by Nov 2015 to meet outage. At present, the delivery timeline of bus extension is unknown. Risk 3: Phase 2 PO to procure material not awarded to ESFOX, therefore ESFOX cannot proceed with order of SG4 or bus extension unless PO is issued. FUK-002-1.4 Procurement Plan: Accepted copy not available. Draft copy routed for OPG review and comments. FUK-002-1.5 Software: Section 5.7 of spec P-TSE-09013-10002 R00 covers software QA requirements. Proposal from NLI Section B.16 indicates software QA is not required. The technical evaluation says NLI proposal meets software QA requirements. It is also noted that a completed copy of Appendix C of the tech spec was not provided by NLI but was provided by Curtis Wright. Require clarification whether the NLI product is supplied with no software or has
N-2015-07499	“Accepted as noted” deliverables for DEC#129300 were not issued in Asset Suite.	For the Fukushima Stand pipe project the Design (DEC#129299 & DEC#129300) was approved on 19/12/2014. In the month of January 2015 it was noticed that only deliverables associated with EC#129299 was issued in Asset Suite, deliverables associated with EC129300 and some other deliverables were not issued. Design Agency was informed and it was noticed that the deliverables were issued in asset Suite in 2nd of Feb2015. While referring to the flow diagrams from both the EC’s it was noticed that the change papers for EC # 129300 does not have “Acceptance Stamp” on any of the issued change papers hence all the notes are missing.
N-2015-06616	Fukushima Projects (49158/49299/41027) - Overexpenditure in 2014	The actual year end cost was greater than the yearly budget for the following Fukushima Projects: Phase I Pickering 1,4 - Project 49299: 2014 budget $1,300k, actual cost $1,650k Phase I Pickering 5-8 - Project 49158: 2014 budget $6,500k, actual cost $7,630k Phase II Pickering - Project 41027: 2014 budget $2,300k, actual cost $2,654k The main reasons for the 2014 cost increase were the better understanding of scope during the detail design and the accelerated design effort to meet the end of year milesotones.
N-2015-06117	Fukushima Project # 13-41027, Electrical Power Restoration DEC 125976	DEC 125976 R00, Electrical Power Restoration for Pickering B, Units 058 was accepted by OPG Design on Dec 24, 2014. As per ECC process, ES-MSA Vendor requested OPG Controlled Document to issue the approved DEC into the OPG Asset Suite. While processing for uploading, OPG Controlled Docs identified an error in DWG: NK30-DDS-54323-9003, Sht. 0001 (previously accepted stamp missed being cross-out) and the upload request was rejected.

N-2015-05757	Fukushima Project 13-41027 | Electrical Power Restoration DEC125975 Disconnect Switch Procurement	As part of the modification to address Beyond Design Basis Event, a Bus extension to 4-54120-BUB was proposed to be connected using a disconnect switch via cables. A technical specification P-TSE-09013-10002 was prepared by ES-MSA vendor and for procurement of the disconnect switch which was accepted by OPG Projects Design. Design EC was also prepared by the ES-MSA vendor to reflect the bus extension via cable NA44-ES-65400-04001. The usage of a cable arrangement between the existing bus -BUB and the new disconnect switch was based upon discussions between EPC contractor and switchgear manufacturer ABB. Procurement of the associated equipment has progressed to the stage where bid are being evaluated to place a purchase order. During this bid evaluation clarification process, ABB personnel have stated that bus extension via cables is not feasible and shall be by adding a new switchgear section to the end of the existing switchgear lineup.
N-2015-04015	13-49158 - Fukushima Fueling AR 28168461-01 completion at risk due to code change	Safety Safety Consultant is hired to complete Fukushima fueling report. CSA code pertaining to fueling is changed from CSA B139-09 to B139.1.0-15 and B139.1.1-15
N-2015-02974	Fukushima BDBE Phase II (13-41027) - EPC Vendor Late delivery of Diesel Generator & Switch Gear Proposal	EPC Vendor Late delivery of Diesel Generator & Switch Gear Recommendation EPC Vendor was tasked to provide OPG with a recommendation to identify a suitable vendor for procurement for a set of emergency diesel generators and portable/permanent switchgears per approved Technical Specifications. Original commitment was to deliver the recommendation package by 10 Oct 14. With some new environmental requirement and less than adequate quality of the proposal submitted on Oct 24, 2014 (3 wks late), new committed dates were successively made for Jan 23rd and Jan 28th. Again these dates were missed with vendor submitting on Feb 4th (2 wks). The project requires these long lead items to be delivered within 2015 and with this 5 weeks delay threatens our ability to succeed.
N-2015-02475	Project 49161 - fukushima telecom Power Trunk final design delay	Power Trunk Final design for fukushima telecom was originally Feb 9th delayed. A draft design has been sent Jan-26 but is not of OPG expectations as details are missing. New completed design is expected to be completed on 28-Feb with all details included.
N-2015-01380	ESMSA Project 16-31508, 13-41027 PNGS, DNGS Fukushima BDBE - Procurement Oversight	Procurement Oversight was conducted by Supply Chain on the ESMSA ESFox Fukushima BDBE Project Pre-award process - bid package and draft PO file to procure Diesel Generators & Load Banks for PNGS and DNGS stations. Several issues were identified as recorded in ESMSA-FUK-SCO-ESFOX-001.
N-2015-00443	Project 13-49158 Fukushima Beyond Design Basis Event - Lost Visitor Pass,	W.O.# 3033932 While performing NDE inspections worker lost his visitors pass and noticed it missing on the way out, through security. In the location where worker was working, no open systems in the area, not an FME issue.
N-2015-00275	ESMSA Project 13-5580 PNGS,DNGS Fukushima BDBE: Procurement Oversight	Procurement Oversight was conducted by Supply Chain on the Pre-award PO file to procure Diesel Generators & Load Banks for PNGS and DNGS station. Observations from the oversight are identified in oversight report ESMSA-FUK-SCO-ESFOX-001

N-2014-34280	EPC Vendor Sargent & Lundi and HatchDesign Quality Issue	Civil design EC126317 R001 incorporated eight Field initiated changes FICREQ01 to 08 and Engineering Calculation NK30-DC-22259-00001 R001 for Fukushima beyond design basis modification Seismic Robustness improvement for Pickering-B Unit 7 was submitted by the Vendor Hatch-Sargent & Lundy (S&L) on October 7, 2014. The EC package and design calculation were reviewed by OPG Civil Design and Analysis Section. On October 10, 2014 C&D summarizing the 14 oversight review comments was provided to S&L for their disposition, while performing the oversight review errors and omissions were discovered. For one of the comments OPG civil expressed their concern several times through OPG C&D process and in conference calls to the Vendor's civil engineering team (Preparer, Verifier and Approver) of S&L part of Hatch was not able to technically demonstrate code compliance of as built configuration. The OPG concern was regarding the code compliance of installed anchor bolts in close proximity of existing construction joint on the South side of UPS cabinets. The Vendor's Civil Design requested to have anchor static pull tests which were done. However static anchor pullout test (carried out as part of examination and installation testing) cannot simulate seismic effect. OPG concern(s) about the applicability of the static pullout test was already discussed and communicated to the design engineers of S&L on October 16, 2014. Further Hatch-Sargent & Lundy (HSL) requested that ARES Corporation evaluate the adequacy of concrete expansion anchors installed as part of external anchorage modifications on the south side of the Pickering Nuclear Generating Station B Class II UPSA and UPSB (7-54230-UPSA and -UPSB) electrical equipment. The anchors are located close to a construction joint in the Turbine Auxiliary Bay El. 316'-6" floor on column line G. ARES has reviewed anchorage design calculations and documentation provided by HSL. OPG civil design including an independent Civil Reviewer did not accept ARES assessment and provided rationale by explaining the following: a. Installed anchorages are in the close proximity of a formed construction joint with existing crack width exceeds 0.02" at construction joint hence the anchors are outliers as per SQUG GIP. b. EPRI does not have recommended approach for resolving anchorage outliers identified for concrete crack width exceeding 0.02". c. It is concluded that the installed anchorages in close proximity to the existing construction joint do not meet the code and cannot be vetted with SMA or similar assessment. In conclusion the design package EC# 126317 U7 associated with "seismic anchorage Upgrades of Class I and Class II battery racks and electrical equipment" submitted to us for review and acceptance which reflects as build configuration was not accepted. The reasoning was already communicated to the Vendor and project. UPS is back up and running with unacceptable anchor installation. Unaccepted anchorages are installed in the field that cannot modify right now because the UPS is back up and running. Knowing that the installation of additional new unaccepted anchors do not meet the code and BDBE design requirements but will not adversely impact load carrying capacity of the existing anchors. Therefore the Design Basis Seismic qualification and operation of existing UPS cabinets in Pickering-B Unit 7 are not adversely impacted from the installed unaccepted anchorages.
N-2014-32045	Project 13-49299 Fukushima BDBE - Employee slipped on debris indoors	W.O. 2917091 Employee was en route to job face on U7 TAB 254 elevation when his left foot slipped on a granular substance on the floor causing him to fall onto his right knee. No medical attention required. Report Only.
N-2014-32043	Project 13-49299 Fukushima BDBE - EBWS piping installation (Pressure test gauges out of tolerance post teat)	The pressure gauges used on the EBWS Unit 2 hydrostatic test were found to be out of the required 2.5% tolerance during the post test check. These gauges were calibrated before the test and were found to be within 2.5% tolerance. With the worst case scenario (gauge most out of tolerance) the hydrostatic test pressure would have been performed at 231 PSI (gauge) as opposed to the required 245 PSI (gauge). An operational pressure test was subsequently performed at system pressure 145 (gauge) with pressure held for 10 minutes and all joints checked.

N-2014-32021	Fukushima Projects (41027/41028/49158/49159) - P1511 Outage Recovery Plan Milestone Missed	P1511 outage recovery plan was approved in May, 2014. Recovery plan milestones were delayed due to a delay in completion of detailed design, as well as a change in priority and resource allocation from P1511 related design work to P1551 due to a change in outage plan/dates.
N-2014-31669	Project 13-49299 Fukushima Beyond Design Basis Event - As found condition on CCW Intake Cover Plates	W.O.# 3232040 As found condition During the removal of existing CCW Plates and Installation of new CCW plates as found condition were raised. Unit 2 Plate #1 was removed and 1 hole in the embedded EP angle, out of 6 hole locations was stripped. This hole is also offset and did not line up with the existing plate hole, pattern. Unit 2 Plate # 2 was removed and 2 holes in the embedded EP angle, out of 6 holes, location were stripped. Unit 4 Plate # 2 was removed and 1 out of the 8 holes in the embedded EP angle did not line up, with the existing plate hole, pattern.
N-2014-30343	Used (Referenced) of document not issued in Asset Suite	While reviewing the vendor document 076202.13.07-S-001, Fukushima Project, found out that one documment referenced is not issued in Asset Suite and not available. Comments were sent back to the Vendor.
N-2014-29536	EPC Vendor Quality Issue	Civil design EC126317 R001 incorporated eight Field initiated changes FICREQ01 to 08 and Engineering Calculation NK30-DC-22259-00001 R001 for Fukushima beyond design basis modification Seismic Robustness improvement for Pickering-B Unit 7 was submitted by the Vendor Hatch-Sargent & Lundy (S&L) on October 7, 2014. The EC package and design calculation were reviewed by OPG Civil Design and Analysis Section. On October 10, 2014 C&D summarizing the 14 oversight review comments was provided to S&L for their disposition, while performing the oversight review errors and omissions were discovered. For one of the comments OPG civil expressed their concern more than four times through OPG C&D process and more than four times in conference calls to the civil engineering team (Preparer, Verifier and Approver) of S&L part of Hatch was not able to technically demonstrate acceptance of as built configuration.
N-2014-28276	Fukushima BDBE Project - U5 Power to CPM Design package incomplete	As part of the Fukushima BDBE Project, the Design package for U5 Power to critical parameter monitoring was expected to be received on October 6th, 2014 for OPG Design review. However, the package was delivered in the evening of October 7th, 2014. The design binder that was delivered to the OPG DE was incomplete -- OLW was not completed, Fire protection assessments were not completed, and the HFE Design review was also not completed.
N-2014-26509	Project 13-49158 P5-8 Fukushima BDBE (EWS V22/V23) - Test of a - 3" Storz Assembly Failed	W.O. # 3041007 Pressure test was request by quality control on three Storz Assembly parts prior to shipping to site, one of the three failed pressure test.

N-2014-24646	Quality issue of Pipe Supports Calculation	Design calculations P-CALC-71260-00001 dated July 16, 2014 for Mechanical Pipe Supports for Adding Valve and quick connect Upstream of V16 for use during BDBE (Fukushima) Modification submitted by the Vendor Hatch-Sargent & Lundy was reviewed by OPG Civil Design and Analysis section on August 25, 2014. While performing the oversight review of the calculation it was concluded that the calculation does not meet specified requirements of the MDR (P-MDR-33350-00001 R00) and the calculation was not accepted. Some of the observations noted are listed below: a. A methodology and acceptance criteria not stated. b. Design inputs are not listed with appropriate references and design method, design input loads, load factors etc not provided. c. Assumptions are not listed and validated. d. Conclusion and Results are not summarised to satisfy the proposed modification. OPG review Comments/observations summarized in an e-mail clearly indicating the OPG concerns with clarifications to help resolve the issues were provided to the Vendor on August 25, 2014.
N-2014-24113	Quality issue of HSL Seismic Assessment Memorandum	Technical Justification Memorandum P-CORR-65430-0507998 dated August 13, 2014 for Seismic Mounting of New Receptacles for Pickering B panels for Critical Monitoring BDBE (Fukushima) Modification submitted by the Vendor Hatch-Sargent & Lundy was reviewed by OPG Civil Design and Analysis section on August 21, 2014. While performing the oversight review of the Assessment Memorandum errors and omissions were discovered. Some of the noted errors and omissions are listed below: • Objective was not defined to match with the Technical Justification • Over reliance on unverified assumptions (mass of the installed components) • Missing retrievable references • Missing Conclusion OPG review Comments and Disposition sheets clearly indicating the OPG concerns with clarifications to help resolve the issues were provided to the Vendor on August 21, 2014 and the Memorandum was not accepted.
N-2014-13110	Project 13-49299/49158 - Project Changes for Fukushima Phase I Projects at PNGS	In the process of preliminary and detailed design, scope changes have been identified under the Fukushima Phase I Projects at PNGS (13-49299/49158). To account for these changes, Project Change Authorizations (PCAs) and Consent To Proceeds (CTPs) have been submitted under PO 229562 for Line 001 (Project 13-49299) and Line 002 (Project 13-49158). Summary of Changes for Line 001 (13-49299): Portable MV Tool (MEC 125214) – Scope of modification has changed from a portable solution with no field work to a solution that involves permanent installations. Power to Critical Monitoring (MEC 124737) – Scope of modification has changed from a completely permanent solution to a solution including both permanent and portable installations. Summary of Changes for Line 002 (13-49158): IFB Makeup and Monitoring (MEC 124582) – Recommended level transmitter from conceptual design was determined to be not suitable. As such, additional effort was required to investigate alternate level measurement options. Additionally, the design contractor has been asked to assess the feasibility of a wireless IFB monitoring instrumentation solution, which was not included in the original scope of the modification. Power to Critical Monitoring (MEC 124737) – Scope of modification has changed from a completely permanent solution to a solution including both permanent and portable installations. Portable MV Tool (MEC 125214) – Scope of modification has changed from a portable solution with no field work to a solution that involves permanent installations.

N-2014-11016	Fukushima Project 13-49158, 13-49299 and 13-41027 Missile / Tornado Requirements	Missile / Tornado requirements for all BDBE modification at Pickering are F4. Previous input from Fukushima oversight personnel has identified that the Pickering missile / tornado requirements are to be downgraded to F2. Official communication on the on the actual requirement for missile / tornado is needed. All electrical design deliverables are being prepared on the basis of F2 requirements for Pickering. Design requirements for F4 are stringent. Increase in cost and delay in schedule are associated with the implementation of F4 requirements.
N-2014-11015	Fukushima Project 13-49158 and 13-49299 Portable Tool for MV actuations	Finalization of a list of MVs that are to be actuated after a Beyond Design Basis Event is needed such that all of the design deliverables associated with MEC125214 can be progressed to completion. Process reviewed by Reactor Safety and Operations personnel has identified the list of MVs that are needed to be actuated subsequent to a Beyond Design Basis Event and now this list needs to be validated and approved by Fukushima Oversight group. A previously issued listing of MVs has been changed significantly based upon this review.
N-2014-11014	Fukushima Project 13-49158, 13-49299, 13-41027 and 16-32202 Load List / Load Sequencing	Load list for equipment to be repowered subsequent to a BDBE event at both Pickering and Darlington needs to finalized including load sequencing for Pickering A, Pickering B and Darlington. Design has been requesting this from various stakeholders since late 2012. In fact, the initial Modification Design Requirements was rejected at the DBR in May 15, 2013, due to not identifying the expected loads and sequencing properly. Finalization of the proposed design including completion of technical specification is on hold as the sizing of generators establishes the design for the rest of the distribution system. Load list determination and sequencing will allow for optimization of equipment procurement specification of generators, cables, accessories etc.. This shall lead to completion of load flow calculations, short circuit analysis and synchronization capabilities.
N-2014-10969	Project 13-49299/49158/41027: PO 229562 increased by greater than 20% for Fukushima Phase I and II Projects at PNGS	The newly proposed contract value for Projects 13-49299/49158/41027 (PO 229562) is in excess of the current contract value by more than 20%. Current contract value of $7,630K will be increased by $4,481K (including $2,110K contingency). This funding is required for the completion of all execution in 2014 for the Fukushima Phase I and Phase II Projects, and includes the associated procurement and pre-requisite activities to occur for this execution work. Additionally, this release includes funding for approved PCAs/CTPs, and includes contingency for PCAs/CTPs that are presently unapproved.
N-2014-10418	Fukushima Project 13-49158, 13-49299 MDR for Power to Critical Safety Parameters Monitoring Rejected by DRB	As part of the preliminary design deliverables on MEC124737 for Restore Power to Critical Safety Parameters, the Modification Design Requirements document was prepared, verified and submitted by the MS-ESA vendor to the Design Review Board for review / acceptance. The MDR was reviewed at the March 26, 2014, DRB and was rejected due to poor quality of work.

N-2014-06296	Fukushima Project Phase I and Phase II: lack of approved schedule for design deliverables	Projects Design received a draft schedule on Jan 17, 2013. As per the schedule, some completion dates of the preliminary design deliverables were already missed or at risk. Issues with the schedule were raised to Design Projects. However no official schedule has been received yet. This resulted in that Projects Design has no formal schedule to follow up for the progress of the projects and duly conduct design oversight. MATHEWA 2014/02/25 13:12 : HSL and OPG Projects were informed that a schedule with deliverables is required in order for Project Design to assign and plan resources for this project.. No further action is required; recommended as D4.
N-2013-02894	PN-Fukushima Beyond Design Basis Events, Phase II Missed Modification Planning Design Milestone	Pickering Fukushima Phase II, restoration of power supplies to EPS and Class III, modification planning Design Milestone was due on 31 May 2013. The milestone was missed. In the first DRB meeting held on 15 May 2013, the MDR was rejected. Path forward was to obtain more comments from the stakeholders. Last set of comments were received on 31 May 2013. The MDR is now with verifier. The COMS is still not signed. The related forms of the MODOUTLINE also need signatures of SMEs. This not being a typical MDR (for Beyond Design Basis Events) required the use of a new guide, N-GUID-01130-10000.
N-2013-00335	High Winds Cause Damage To Sliding Gate At Fukushima Building	High winds caused damage to large sliding gate at entrance to Fukushima Building. Gate was attached by one roller. Discovered while driving on site.
N-2012-02505	Poor Quality Facilities Commercial Modification Design Deliverables, Project 49158	During the 50% COMS Review Meeting for the PNGS Fukushima Emergency Equipment Storage Facility Project No. 49158, the modification team leader (MTL) provided one hard copy of 50% Design submission on April 5, 2012 and then a second copy (in electronic format) of 50% Design submission on April 11, 2012 to NEF Engineering. NEF Engineering provided Electrical and Architectural Comments and Dispositions Sheet (C&D) on April 25, 2012 to Projects. Projects MTL provided the 95% Design submission on May 1, 2012 and requested review completion by May 7, 2012. NEF Engineering review was completed on May 7 and discipline specific C&Ds were provided for the submitted drawings. NEF Engineering, however, noted significant gaps in technical details and procedural adherence with respect to Facilities Commercial Modification (FMOD) Control Instructions N-INS-0700-10004. Some of the major deficiencies are noted below: 1. The design agent (an ESMSA design agent for other projects)/ Project did not submit disposition of the 50% review comments C&D sheets for NEF Engineering acceptance. In reviewing the submitted drawings, it was discovered that numerous comments from the 50% C&D have not been addressed. 2. The design agent 95% submission did not include mark-up of the existing affected drawings as requested on the 50% C&D sheets. Each of these drawings merely has a note across the page indicating: "Change Paper To Be Modified by DCN117829 Under DCP 117575". 3. The design agent did not include design calculations, analysis, vendor documentation in the 95% design submission. 4. On the 50% C&D sheets, OPG controlled document numbers were requested to be put on the Electrical and Architectural drawings. The 95% design submission does not have OPG controlled document numbers for the new drawings. 5. The design agent failed to have FMOD DCN Cover Sheet N-FORM-10874 signed correctly. The same individual signed for Prepared by, Reviewed by and Approved by sections of the Form.
N-2012-01518	Engineering Issue, Fukushima, Proj 49299, PO 212513: 16-31508 :CON RWK : Rejected report leads to rework for contractor	Fukushima Phase 1 project 16-31508. Design Agency (DA) PO 212513. Design Agency submitted report which was rejected by OPG. Reason for rejection was technical, and documented in Comment Disposition Form. No calculations were performed to support conclusion of report, full scope of work requested by OPG was not addressed in report, and not all critical parameters were addressed in report.

3.3 OPEX Review Findings

See the **Recommendations** outlined under Section 3.1 of this LLR.

4.0 COMMUNICATIONS PLAN FOR THE LESSONS LEARNED REPORT

This LLR will be distributed to Projects, the Computer Design group, External Design Agency (Tetra Tech), CMO and Field Engineering.

5.0 CONCLUSIONS

Fukushima Phase I and II were implemented to mitigate the very low probability of fuel damage caused by a beyond design basis event. This report outlines key lesson learned from each phase of the project and provides recommended actions. The lessons learned summarized in this report should be taken into consideration for the benefit of other large scale modifications for a beyond design basis event such as Fukushima. The recommendations outlined are vital and will assist in increasing safety and mitigate deviation from the original schedule and budget.

ONTARIO POWER GENERATION

Lessons Learned Report

Internal Use Only	
Document Number: I-LLD-30744-00001	
Project Number: 28-66000	Project Execution Plan Number: N/A
Revision: R000	

Title:
CIRCUMFERENTIAL WET SCRAPE TOOL (CWEST) IMPLEMENTATION AT PNGSB LESSONS LEARNED REPORT

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CIRCUMFERENTIAL WET SCRAPE TOOL (CWEST) IMPLEMENTATION AT PNGSB LESSONS LEARNED REPORT

I-LLD-30744-00001-R000

Project Number: 28-66000
PEP Number: N/A

2019-02-22

Order Number: PO # 255755
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Revision Summary

Revision Number	Date	Comments
R000	2019-02-22	Initial Issue.

1.0 BACKGROUND

During the P1861 and P1881 Outage, Inspection and Reactor Innovation (IRI) performed scrape sampling operations of CANDU pressure tubes in PNGS Units 6 and 8 as part of establishing the fitness for service requirements. These fitness for service requirements are as per CSA N285.4-05, Periodic Inspection of CANDU Nuclear Power Plant Components, Clause 12.3, for hydrogen equivalent concentration determination and CSA N286.8-12, Management Requirements for Nuclear Facilities.

The scrape sampling operations included the use of the Circumferential West Scrape Tool (CWEST) to remove samples from 10 channels in P1861 (I-REF-30744-0686931) and 12 channels in P1881 (I-REF-30744-0725984). Manual scrape requires an operator to work from trolley platforms in front of the reactor face or via a fuelling machine which requires temporary modifications which is dose intensive. Conversely, the CWEST is delivered by the Universal Delivery Machine (UDM) to a flooded channel and takes both Body of Tube (BOT) and Rolled Joint (RJ) scrapes and completely eliminates the need for ice plugs and open channel work which have direct impact on both personnel and nuclear safety.

This tooling will continue to be used in upcoming campaigns in Pickering NGS, Units 5, 6, 7 and 8.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

This report is primarily focused on the project management and vendor oversight activities provided by the NDE Innovation department and the design and design oversight activities performed by Technical Services department.

The tool modification process was initiated by the CWEST Project Team which consisted of the IRI NDE Innovation Project Department and the Technical Services Department. Together the CWEST Project Team established design requirements and scope of work for the project, and approved and/or accepted these project and design deliverables upon completion.

The design and build of the CWEST tool is owned by the external design agency (Kinectrics Inc., Toronto) who also provided the assessments to ensure conformance of the tooling to the design requirements. Kinectrics owns the design and build of the CWEST tool and provided technical documents to confirm design requirements are met.

Please refer to the following for the project organization and/or design responsibilities:

1. Project Management Plan, I-PLAN-30744-00004, 28-66600 Machine Delivered Scrape Project Management Plan.

2. Quality Design Plan, I-DP-307444-10000, CWEST Implementation at PNGS5-8

3. Scope of Work, I-SOW-30744-50000, OPG CWEST Procurement

4. Deliverables and Activities Interface Agreement, I-DAI-30744-50000-R00, IMS – Deliverables and Activities Interface Agreement for the MDS Project

5. Work at Risk Release, I-CORR-30744-0508400, MDS WARR – Request for Authorization to Proceed at Risk with Circumferential Wet Scrape Tool (CWEST) Procurement

3.0 LESSONS LEARNED

A number of internal IRI CWEST Lessons Learned meetings were held on the following dates to capture the Operating Experience (OPEX) gained during the conceptual/detailed design, testing, installation, commissioning and execution phases of the project:

1. Internal Lessons Learned Meeting on September 15, 2016 (minutes documented in I-CORR-30744-0705337)

2. P1671 Machine Delivered Scrape Circumferential Wet Scrape Tooling Lessons Learned Meeting in November 2016

3. CWEST Wet Module Lessons Learned Meeting

4. CWEST-UDM Interface PL804 Lessons Learning Meeting on April 18, 2017

5. CWEST Lessons Learned Meeting on December 19, 2018

Attendees to the meetings included Managers, Engineers, Project Managers, Technical Officers, Control Technicians, FLMs, and FLMAs.

This report has been created using information gathered from these meetings, interviews with key personnel, OPEX during training and the SCRs entered that referenced the project.

3.1 Lesson Learned Summary

Various issues were encountered and documented by staff throughout all phases of the project. Issues have been organized into categories outlining the issue followed by recommendations on how the issue can be mitigated for future IRI projects. All issues within these categories will be listed in further detail in Section 4.

3.2 Background

The initial Business Case Summary, BCS (N-BCS-30740-10003) for the project was written and signed off by Project Sponsor in 2014, with an aim to have the commissioning run by P1561, and 1st usage by P1681. A Work at Risk Release, WARR (# I-CORR-30744-0508400-LOF) was approved in August 2014 to allow for procurement of the tooling prior to a purchase order being placed. This was done in

order to meet the timeline to validate the BCS for the remaining UDM outages in PNGS B.

However, due to unacceptable tool performance on a non-OPG CANDU facility in fall of 2014 (i.e. several cutter breakages and abandonment of the scope after 8 channels scraped), the project work was suspended in late fall 2014.

After the vendor managed to correct the tool performance through an independent root cause evaluation by both the non-OPG facility and the CWEST vendor, the OPG project resumed in June 2015. This was after a new BCS was approved with target commissioning run in P1671 and first formal usage in P1751.

Due to tight timelines of preparing the modifications for installation and commissioning in the field by the end of summer 2016, many issues were encountered during commissioning and the equipment did not function as expected. An organizational decision was made to delay the execution of CWEST into P1751.

After a successful partial AFS in January of 2017, the CWEST tool was deployed on reactor in the P1751 outage. The CWEST tool experienced a negative change in tool performance when used on-reactor versus off-reactor testing configurations (i.e. High No Load Running Current), which resulted in an inability to complete the campaign scope of work.

The vendor re-designed the tooling to be able to adjust to a fluctuating NLRC, included upgrades for work protection, and modified the tool motor harness to accept power cables from the umbilical. OPG also provided some updates to field run cabling in order to accept power cabling. The tool was then successfully deployed in P1861.

The target duration for the P1861 CWEST campaign was 330 hours, with target start and finish times/dates of 11-Feb-2018 at 01:00 and 24-Feb-2018 at 19:00 respectively. The P1861 CWEST campaign actually commenced on 16-Feb-2018 at 08:00 and finished on 01-Mar-2018 at 0:650, for an actual duration of 310.8 hours (77 hours in delays for Fuel Handling and IRI).

A total of 29 SCRs were created during the execution phase in P1861 that related to project delays and traceability issues.

The target duration for the P1881 CWEST campaign was 368 hours, with target start and finish times/dates of 12-Oct-2018 at 19:00 and 29-Oct-2018 at 21:00 respectively. The P1881 CWEST campaign actually commenced on 12-Oct-2018 at 01:05 and finished on 28-Oct-2018 at 00:38, for an actual duration of 248 hours (120 hours ahead).

A total of 14 SCRs were created during the execution phase in P1861 that related to project delays and traceability issues.

4.0 BREAKDOWN OF SPECIFIC ISSUES AND SUMMARIES

4.1 Project Management

The purpose of the Project Management Plan (PMP) is to provide a formal approved document to manage the project execution and project controls. It should document the actions necessary to define, prepare, integrate and coordinate the various planning activities and define how the project is executed, monitored and controlled, and closed.

For the CWEST Project, the Project Management Plan (I-PLAN-30744-00004) was not issued until after the Conceptual and Preliminary Engineering phases of design were completed (in the fall of 2016), and progress was underway on the Detailed Engineering and Procurement of Equipment phases. Since the initial Business Case Summary (BCS) was not supported by a PMP with a Work Breakdown Structure (WBS), schedule, scope and cost management were negatively affected.

There were important milestones which were not addressed in the PMP, such as regulatory approval for a new method of obtaining material samples from fuel channels for Periodic Inspection Plan as per CSA N285.4 (12.3.4.2 Procedures). This was also reflected in the seventeen (17) SCRs (as per Appendix A) that summarized the missed Campaign Work Management milestones.

Resourcing issues were experienced in which there was turnover of staff in all phases of the project. There were four (4) different Project Managers during the life of this project until close out, as well as three (3) different Project Leads and many Project Engineers. This caused discontinuity in knowledge and slowed progression of tasks. For example, during the Enhanced COMS process for the main CWEST system, there were SCRs raised which documented the changes in signatories leading up to Partial AFS for P1751.

Project planning was also sub optimal with regards to the Procurement phase, and resulted in delivery risks for critical equipment such as CWEST Sample Retrieval Cart, Umbilical, Electrical Panel and PL804.

SCRs related to Project Management are listed in Appendix A.

4.1.1 Schedule Management

A detailed project schedule was not created during the planning phase. The Primavera Portfolio 6 (P6) schedule was finally created in late 2016, after the issuance of the PMP and well into the Detailed Design stage of the project. This schedule however did not follow a standard Work Breakdown Structure.

There was a lack of overall coding in the schedule with regard to Major Milestones, Project Milestones and Gates. As a result, the schedule did not map properly to Financial Reporting Analytics (FRA) cost data, and did not reflect the current released amount of dollars for the project and did not clearly identify the Vendor POs and

milestone structure for payments. This also made it very difficult to report on the Schedule Performance Index (SPI) metric. During the project planning phase, staff resources should also be accountable for/allocated to Work Packages on the Level 2 schedule, and should be confirmed to be available throughout the project. If, for unforeseen circumstances, staff need to leave the project, a turnover plan should be created and introduced to the new employee.

The vendor completed a Cause Analysis after failure to execute in P1751, which resulted in them having to re-enter the Detailed Design stage. This extra scope was not assessed for impact or added to the baseline schedule which shifted all deliverables to a later date.

The schedule was also not updated on a regular basis since it did not properly reflect the Scope of Work of the project. Schedule adherence was challenging due to conflicting priorities within IRI, and missed commitments or late deliverables from the vendor.

Recommendations:

The OPG Project Manager/Team should follow the Nuclear Project Management Governance (N-MAN-00120-10001-SCH and N-GUID-00120-10131) to establish a quality WBS that addresses 100% of project work, down to Work Package level, at the Initiation stage of the project. This WBS should be included in the PMP and used to support the BCS.

Also, as per this governance, the project schedule must adhere to a standard Work Breakdown Structure (WBS) which includes all of the Milestones, Costs, Resource Loading and Activities (i.e. Project Management, Preliminary Engineering, Detailed Engineering, Procurement, Installation/Construction, Testing, Commissioning and Close Out). A quality review of the schedule against Appendix A in N-MAN-00120-10001-SCH should be carried out before it is baselined and then used for regular status updates.

The project schedule should be monitored and updated regularly by revising the activity status and actual progress (i.e. started, completed and % completed), as well as forecasting future performance and completion data. The project schedule must be updated and communicated on a regular basis, with variances controlled against the baseline.

A list of equipment to be received by the project should be compiled at the Material Request level and should be added as milestones on the project schedule so they are received prior to critical tasks in the field.

4.1.2 Scope Management

The Work Breakdown Structure (WBS) was provided in the PMP (Appendix A), however it did not follow the standard structure or nomenclature. Also, the WBS was neither deliverable oriented nor based on the project Scope of Work documents.

The original scope of the project was defined in the original BCS as:

1. Procurement/payment of the CWEST tooling system,
2. Detailed engineering and procurement of the UDM Umbilical,
3. UDM software modifications, and
4. CWEST mockup.

There was no actual Scope of Work document at this point, but only a Purchase Order 00237218 based on a proposal given by Kinectrics (K-402013-PROP-0001) for a build to print tool.

However, there was a significant scope change which was captured in the 3rd BCS (approved February 2016) as it described a realized risk that: “design changes may be required to adapt CWEST to Pickering 5-8 configuration”. The PO 00250345 R000 was released on June 24, 2016 and did not have a full scope as to what was required in order to adapt the CWEST system to function at PNGS-B.

This scope was then transferred to Line Item 003 of PO 255755 R001 which was issued in December 2016. It referenced the Scope of Work document, I-SOW-30744-50000 issued in late 2015. However, this Scope of Work document still did not include all the pertinent analysis and testing that was required to get the CWEST tooling system to function at PNGS B and underestimated the level of effort required for this. For example, Appendix B of the Scope of Work mentioned some of the additional analyses, such as an assessment of how the Pickering channel and UDM lock-on pressures could affect tool operation, yet failed to address the update required for seismic analysis at Pickering B. Furthermore, it seemed as though the vendor’s Project Manger had not communicated that the scope of the project had moved from a build-to-print tool to a customized tooling.

As a result of the incomplete scope definition, there were many Contract Change Requests (CCR’s) to this largest PO 255755 which appeared to the beyond the original scope of the project as stated in the latest version of the BCS. For example, one such CCR (K-402013-CCR-0018) had to do with additional scope for re-design of equipment for off-UDM testing setup (i.e. test umbilical harness, junction box and cabling changes). The off-UDM Setup was described in the PMP WBS (Appendix A), however, the scope was never fully defined in any of the documentation described above nor was it discussed with stakeholders. There was no Purchase Order to procure the setup itself.

Recommendations:

Ensure the PMP is written at the initiation stage of the project and references a complete scope via an appropriate WBS. It is a living document and should change as scope is further defined in the gated process for project. Scope definition documentation needs to be improved and/or revised once more details of the project are refined as it proceeds through the gated process.

When defining scope, ensure to validate with stakeholders the difference in needs versus wants. The off-UDM and training scope for testing and maintenance of the tooling was a good idea, as in theory it would reduce the amount of involvement with the vendor and the turnover time for tool qualification, troubleshooting, maintenance and testing. However, they were not a requirement for the Business Case justification which was savings on dose and critical path time for scrape execution activities. As a result, time and resources were spent unnecessarily pursuing these Off-UDM deliverables.

Scope for the project needs to be fully defined in the front-end planning stage. A superseding Business Case Summary should have been provided for when the scope drastically changed to incorporate Line Item 003 of PO 255755 R001 to install changes to the tooling to ensure it is usable at PNGS 058. At this point, the previous project lifecycle process should have been abandoned, costs sunk at this gate, and a new process and new BCS provided for a scope that was much more extensive than in the original BCS.

4.1.3 Contract Management

The original contracts (PO #'s 237218 and 249254) based on the Kinectrics proposal for "build to print", were used to purchase the 1st and 2nd cart sets, and design and testing for the first tool head. This was an ineffective strategy, as it did not consider the actual timeline and effort required to adapt the system to function at PNGS.

Later on, the main contract (PO # 255755) was set up to replace the original PO's as a service purchase order. This was used for procurement of the CWEST tooling systems for production and training, the retrieval system, the cartridge system, commissioning of both sets of carts as well as testing of tool head # 1.

Unfortunately, this service PO did not allow for the use of Catalog IDs, which made it difficult to trace the receipt and inspection of the equipment, and associated paperwork. Also, this PO did not specify a correct and complete scope of work. The PO was structured poorly, which was a cascading effect of not having proper scope and contract strategy defined. It did not define when the product needs to be delivered, milestones completed or service entirely performed. This did not allow for financial consequences to be enforced upon the vendor for failure to perform in a timely manner.

In addition, many revisions to this service PO were required to incorporate the full scope. There were also multiple other POs issued to the same vendor for deliverables related to the main contract which should have been defined up front and included in a single contract.

The only two contract models which were used by the project were Time and Material as well as Fixed Price. Since the scope was not well defined at the initial stages of the project after it was ascertained that the tooling system would have to be modified to adapt to PNGS B, a Time and Material contract was used to cover the gap in the design/assessments. However, as the project scope was further defined, this work was moved to a Fixed Price contract.

Recommendations:

It is prudent to use one PO to capture all deliverables in multiple line items at the start of the project. This will allow for a clear understanding of how the scope of the project is defined as well as payment milestones/phases.

There are several different other contract models that fall between the Fixed Price and Time and Material which can be used to suit the needs to the project better. For example, there many different types of cost reimbursable contracts which can be used when concern over quality and delivery time is higher than the cost. More education on this is required for the company, including Supply Chain who were involved in setting up the POs which were less than adequate.

As a general rule of thumb, Fixed Price contracts are better suited to smaller projects where there are clear requirements, and determined budget and deadlines. On the contrary, Time and Material contracts are better suited to larger projects with more dynamic requirements, where the full scope is not yet known at the time, and the contract owner would like the flexibility to modify scope or workloads.

4.1.4 Cost Management

Since the project did not have an established WBS in Primavera (P6) at the Work Package (WP) Level that related to Financial Reporting Analytics (FRA) costs, there was no accurate way to report on cost per WP.

The coding in the schedule did not map properly to the FRA cost accounts (WP) which made it difficult to manage or report on the costs in each of the WPs. As a result of the improper coding, it was difficult to gauge the money that was being spent based on the percentage complete of each of the WPs. Therefore, the accuracy of Cost Performance Index (CPI) metric was very low.

An Over Variance memo was written to request an extra $2.1M to cover an additional $1.0M in the engineering budget to adapt the tool to PNGs as well as $1.2M to cover the increased cost of procured materials from the original budget. This extra funding was not planned for.

Also, there was scope which was budgeted for, which was not in the BCS, such as the off-UDM training and setup for approximately $267, 000 including only about $100, 000 for materials. This budget was grossly under-estimated for the work required to build such a facility. In order to do any modifications to the IRI Training and Mockup Building, the FMOD process (BAS-INS-08965.4-00021) would have to be utilized and adjustments would have to be made to the building for electrical, hydraulic and air supply. Eventually, this scope was dropped from the project.

Recommendations:

As per Nuclear Project Cost Management governance (N-MAN-00120-10001-COST), the cost management planning should start early in the project life cycle, and the Project Manager and project staff should request help from the Nuclear PMO to establish a workable WBS and assign costs at the WP level.

Project teams should utilize the experience of the Nuclear PMO office as the new governance is set up so that projects do not over commit with cash flows and payments.

The Cost Breakdown Structure (CBS) should be established in the software Ecosys and should have the same structure and coding as the WBS.

4.1.5 Work at Risk Releases (WARR)

Work at Risk Releases (WARR) were approved for the Machine Delivered “build-to-print” system in 2014 and for the CWEST Sample Retrieval Cart in 2016 to allow procurement of equipment to begin prior to accepting the vendor’s final design.

In both cases the WARRs were used due to scheduling constraints in order to meet the business case for the MDS project with first usage in P1681.

Recommendations:

WARRs should be avoided through better front end project planning. The use of WARRs are undesirable since they pose a financial risk to OPG through additional procurement of items which may not be required if additional design changes are identified prior to EC approval, or through technical risks when key design inputs such as the Modification Design Requirements are not approved at the time of procurement.

4.2 Vendor Quality

During oversight of the vendor throughout detailed design, testing and commissioning of the CWEST tooling systems, OPG became aware of several quality issues with the tool and documentation.

The vendor discovered these issues during testing performed at the vendor site in preparation for both the P1751 and P1861 outages. Although the vendor proactively identified these issues to OPG as part of their daily status update e-mails, there was a trend of build quality problems experienced during design and commissioning documented in SCR N-2017-01341 and N-2017-24979 (P1751 outage).

4.2.1 Ultrasonic Transducer (UT) Probes

During a high-level meeting with the vendor in March 2015 (prior to procurement of the tooling), a probe reliability risk was identified in using UT, as opposed to the Fading Hard

Stop method for cutter actuation. This was because there was no OPEX on the new UT probes to be used on the OPG tooling at the time of usage.

As per the assessment report, CWEST UT Probe Assessment for Datum Finding Test Report (vendor document # K-402013-REPT-1001), the fore and aft probes on the tools needed to be changed for CWEST implementation at OPG. This is because more specialized focused probes are better suited for Rolled Joint groove detection/ datum find in OPG fuel channels was suggested by the vendor. However, other than the testing of these probes in the report, the vendor did not have OPEX on the performance of these more focused probes.

Throughout the project, many quality issues were experienced with UT probes, including failures that necessitated harness replacements and re-testing in the lab environment. As per the investigation report on UT Probe failures (i.e. degraded signal or non-response) that were experienced from the period between February 2016 (first usage of the focused-probe OPG UT harnesses) and prior to commissioning in P1861, a total of twelve UT harnesses were manufactured for the OPG project, of which a minimum of seven experienced a probe failure. Several SCRs speak to the issues with failure of the UT probes during testing. Examples of this include SCR No. N-2017-20024, N-2017-20028, and N-2017-28138.

It was later discovered that the most likely failure mechanism of the UT probes was the 140 psig pin-side nitrogen leak test pressure used during the manufacture of the harness. It has been postulated that exposing the pin side of the harness to these pressures can cause damage to the UT probe if there is a leak path through the wire insulation.

Recommendations:

Inspection and Testing equipment including sensors, harnesses and other small devices for measuring and testing can be highly sensitive to high pressures and temperatures. Ensure that the testing conditions on tooling for qualification purposes does not exceed the threshold for fatigue failure and is appropriate for the application.

4.2.2 Revision Control

There were several instances where the vendor provided sub-standard finalized documentation packages. For example, in one instance, for the main tool head drawing package, the Tech Services drawing review and acceptance process discovered many quality issues: missing drawings, incorrect revisions, and welding assembly drawings which were not P. Eng. Sealed. Even top level drawing listing the suite of drawings for specific equipment did not contain the correct revision numbers.

There also was an occasion where an uncontrolled version of the approved CWEST software had been installed onto the CWEST SCADA systems at both OPG and the vendor’s facility prior to P1861 commissioning activities.

Recommendations:

In instances where the vendor continually has problems with their quality program in a specific area (i.e. documentation control), it is prudent to issue a non-conformance action request (NCAR) through Supply Chain on a specific quality program element. The follow-up of the results of the corrective action taken would also be part of a Supply Chain responsibility, however, should aid the vendor in understanding the importance of adherence to the quality program.

4.2.3 Vendor Procedures

For the P1751 outage, management approved to use of Kinectrics procedures. Some of these procedures were not well suited for Pickering NGS's work environment. As an example, these procedures allowed the E-stop button to be depressed to de-energize the tool.

At PNGS, as opposed to non-OPG CANDU facilities, the E-stop circuit is tied to the UDM e-stop circuit, which means power to the UDM flow injection and FM Bridge will be terminated upon depression of the E-stop. Prior to accepting the use of Kinectrics procedures, table top reviews were performed between Projects and field personnel; however, this review did not catch all the discovery issues.

Recommendations:

It is recommended that the project should insist that the vendor provide site specific procedures that take into account differences in environment, type and length of field run cabling, embedded control systems, etc.

4.3 Engineering Design

4.3.1 In-House Builds

The PL804 serves as a communication interface panel between UDM Control Console and CWEST SCADA rack. At the time of preparation of this panel for P1671 UDM Integration, project decided to proceed down the parallel paths of both and in-house build (i.e. replicating legacy/previous design of PL801/802) and procurement of the panel from GE.

When the PO was placed with a vendor for the panel, the in-house build was abandoned as it proved to require much more work than originally anticipated. This rendered the delivery time of the panel from GE critical for the commissioning window.

Recommendations:

For an in-house build, the project must ensure that the modification is fully understood and plan contingency time for potential obsolescence issues, discovery work, testing

plans and reports. Also to ensure early involvement of stakeholders to understand how the equipment would integrate into the field.

It is not recommended to perform in-house builds for complex equipment (ie. “mini projects”), such as PL804, as it costs OPG money in efforts to create Cat IDs, place POs, project management, preparing assembly and testing plans, receiving inspection and supply chain for components and detracts from the efforts of the project.

4.3.2 Design Requirements

The Modification Design Requirements (I-MDR-30744-50000) for the CWEST QDP contained design requirements which had been accepted by the vendor but proved not to be achievable. In particular, as documented in I-REF-30744-0706250 (K-402013-RVTM-0001 R04), the MDR for the CWEST System contained design requirements for 100% chip capture and minimum oxide cut depth greater than 0.004” which could not be met.

As per SCR No. N-2017-023085, the Requirements Traceability Matrix (RTM) for the Master EC of the Power and Control Interfaces demonstrated a number of requirements (I-MDR-30744-50003) which were not met as originally stated. In many cases, the requirements as written did not suit the end application and could not be met at the time. For example, specific requirements related to the Temporary Power Cart (DEC 132868) were not met because the item was on hold at the time, and is not required for on-channel inspections.

As per SCR No. N-2016-20821, the MDR (I-MDR-30744-50002) for the Sample Retrieval Cart (SRC) contained clauses which were not design requirements, but preferences from stakeholders. In particular, the MDR stated which jacks and positioning table should be used. In this case the jacks are not rated for the load of the design, but were specified for ease of keeping the same spares in stock. As per Preparation of Modification Design Requirements (N-INS-00700-10007), certain details in the SRC MDR would likely not be considered Critical Design Requirements (CDR) and therefore would have been more appropriate to include in a technical specification.

The first time issuance or revision to an MDR can be a lengthy process which can have many downstream impacts. For the SRC an excessive amount of time was invested in preparing, reviewing, and authorizing the initial issue of the MDR. This initial issue caused the project to work under a compressed schedule. As per SCR No. N-2016-07911, new design requirements emerged from project stakeholder discussions and reviews of initial vendor proposals. This revision caused a delay to the delivery date of the equipment, impacted project schedule and downstream readiness for integration in P1671.

As per SCR No. N-2016-20911 and N-2016-24271, there were assumptions used in the MDR (I-MDR-30744-50001) for the CWEST Wet Module which were not documented or validated. The MDR specified that an existing CFTS cart frame would be used to support the CWM however this assumes that the existing CFTS cart frame is fit for use.

This assumption was not documented or validated, and resulted in many latent design issues that arose during CWEST integration.

Recommendations:

When preparing the modification design requirements document for a modification, ensure that N-INS-00700-10007 (Preparation of Modification Design Requirements), is followed.

Ensure that each requirement is achievable, realistic and reflects the current intended scope of the modification. Furthermore, by eliminating non-CDRs from an MDR it allows for simplification of downstream compliance documents such as the RTM and commissioning specification. When preparing the MDR, all assumptions should be documented and validated.

The issuance and revision of an MDR can be a time consuming process, therefore it can cause a compressed schedule or delays to milestones. Confirm that all requirements are incorporated or captured by having regular stakeholder meetings and that all vendor proposals are reviewed in full.

4.3.3 Bounding Documentation

The design basis for the CWEST tool at Pickering NGS B overly relied on the use of bounding memos and documentation that were used to prove the design of this tooling at the non-OPG CANDU facility. In many cases, OPG accepted assessments for which the analysis was primarily done and OPEX existed for the non-OPG CANDU facility. The strategy of accepting bounding assessments or covering memos to prove the basis of the design was shown to be ineffective.

For example, the vendor wrote a bounding memo for the “Applicability of Existing FMEAS (Failure Modes and Effects Analysis) to the PNGS EA Deployment” (I-REF-30744-0669349). In this case, the original FMEAs and the bounding memo could not provide assurance that the Rolled Joint offset as required by PNGS B works or is designed correctly. During the Final COMs process, it was discussed that a review of the FMEA noted a “potential for incorrect RJ offset values (procedural, etc.)”.

The vendor and OPG were overly reliant on analysis reports to satisfy certain requirements rather than thoroughly testing operation of the tool under conditions representative of PNGS. After a failure of the CWEST to execute in P1751, it was postulated that the analysis supplied by these documents was not adequate and testing was required to validate the PNGS B design.

For example, the “Assessment of the Tool Performance and Integrity at Higher Channel Pressure “ (I-CORR-30744-0628055) was a bounding assessment that describes that the “pressure in the fuel channel during normal tool operation at PNGS, which may be up to a maximum of 76 psi vs. a maximum of 21 psi [at a non-OPG CANDU facility]”. This document stated that the analysis was done at the other facility and was sealed

with a P. Eng. Stamp of one the vendor's engineers. The CWEST tooling also needed to withstand an external pressure test of 125psi and maintain tool integrity. No cutting activities happened during Tool Demonstration Testing (TDT) under pressure, and the motor load was not measured during the external pressure test. This bounding memo also failed to consider the differences in the cable lengths at PNGS B, and how this may affect the motor/drive response in a cutting sequence.

Recommendations:

It is not recommended to use bounding memos or assessments that were initially prepared for another similar facility for new, complicated Fuel Inspection systems due to the sensitivity of changes in the equipment or environment to skew operation. Also, the fact that failure of these equipment would cause a loss of critical path time.

Ensure human performance event-free tools, such as having due diligence and using a question attitude, are exercised by OPG staff in order to question bounding documentation prior to acceptance.

4.3.4 In-Lab Testing

As a result of the original BCS and WARR, the vendor and OPG were overly reliant on analysis reports to satisfy certain requirements rather than thoroughly testing of the tool under conditions representative of PNGS B. The testing instead, should have been reflective of PNGS on-channel conditions, including pressure and temperature conditions, and a similar field run cabling set up.

The in-lab testing of the CWEST system demonstrated many issues with No Load Running Current (NLRC), as documented in SCR # N-2017-10219. The project team should have exercised better questioning attitude with regards to the adequacy of testing and analysis. As a result of this NLRC issue, during execution on channel, the motor current exceeded the pre-defined threshold at the point of cutter contact with the pressure tube causing the CWEST system to 'ramp-in' speed earlier than it should have. This resulted in an imperfect oxide cut in the channel M11, and it caused the CWEST scrape scope of work to be abandoned in the P1751 campaign.

The existing cutter sequence parameters were not adequately verified under PNGS conditions. The MDR requirements for these conditions were satisfied using technical assessments and tests which were not representative of the full range of operation of the CWEST tool under the correct in-channel pressures and equipment setup. While the tool demonstration testing at the vendor facility did include an external pressure test, the focus of this test was on tool integrity checks (i.e. water ingress, etc.) rather than impact to operation. Site acceptance testing did not include tool operation under pressure and the associated acceptance criteria did not adequately scrutinize design margins.

As per SCR No. N-2016-30245, motor stall issues were found during the P1751 commissioning resulting from high currents ranging from 200-600mA while jogging

instead of a nominal 50-130mA as expected during normal operation. The original design of the CWEST tool for a non-OPG CANDU facility routes the servo motor power signals through shielded twisted pair cables.

However, the UDM system cable lengths at PNGS B are approximately double that of the non-OPG facility. This additional length on the servo motor power shielded twisted pair cables means an increase in circuit impedance, and a resulting impedance mismatch that causes erratic signals. OPG had informed the vendor of the additional shielded twisted pair length during early design meetings, and a review of the motor controller OEM manual discovered that the use of shielded twisted pairs were not recommended for this application. Once motor power signals were routed through the UDM tool mechanism #2 power conductors, the motor functioned properly despite the additional cable length.

Recommendations:

Better front end project planning should be used in order to avoid time or schedule pressure affecting the quality and rigour of testing. Ensure human performance event-free tools are utilized throughout system testing. This includes not having a pre-conceived idea or mindset when determining testing conditions, using proper verification techniques and a questioning attitude.

Ensure that the vendor and project staff thoroughly test the operation of the tool under conditions representative of PNGS. The project has the right to not accept testing of tooling and systems if they are not conducted in laboratory setups that have reflective environmental conditions as the intended end use. This includes both pressure and temperature conditions, but also using similar field run cabling set up. Conditions such as sensitivity to cable type and length should be considered when designing and testing systems.

4.4 Technical Oversight & Procedural Adherence

4.4.1 Quality Design Plan

There were challenges that were encountered in using the Quality Design Plan process for the CWEST System (main contract) as opposed to the Modification Process (i.e. N-PROC-MP-0090). This is because the CWEST system is highly complex, and includes several different interfacing pieces of equipment of different disciplines (i.e. tool head, hydraulic and in vault carts, manual tools, retrieval system, software, etc.).

Partial releases of the QDP to the field for installation and commissioning were highly confusing for field staff as they could not understand the current status of the equipment. Also, as the Modification Process was not being utilized, there was lack of equipment codes on drawings, and it was not clear which documentation/drawings were in accepted status.

There were also difficulties encountered in the tracking of deliverable status via the QDP. There is no Affected Document List or Reference Document List in the QDP process. The project essentially had to set up their own Master Document tracking spreadsheet on the project SharePoint site which categorized each document under the QDP or EC. Due to the sheer volume of documents and the number of revisions, it became quite unwieldy to manage for the people maintaining it, let alone for others trying to glean information (approval/acceptance status, revisions, etc.) from it. Eventually, as the document tracking spreadsheet became further out-of-date it was finally abandoned by the group. Due to the fact that design deliverable planning (i.e. Document Scoping checklist) was not completed early enough in the process, the content on this spreadsheet kept increasing/changing.

This problem was made worse by the fact that the Document Scoping Checklist (N-FORM-10521), or any suitable equivalent, was not completed at an early enough phase in the project planning to get any sense of what the specific design deliverables would be in each Work Package (Level 2). This also impacted several other issues (e.g. RTM, scheduling, scoping, 'bounding' documentation, testing vs. analysis).

Recommendations:

Caution should be taken in employing the QDP within IRI as it has limited use and a further understanding of this process should be employed within the NDE Innovation department.

A QDP release plan should be established with field stakeholder buy-in. And it should be accepted by all involved staff that the approval of the design release milestone is after the date of the Design approval.

Ensure that the Document Scoping Checklist and the schedule reflect a road map of which documents would be required to describe the design and demonstrate it meets requirements as well as Level 3 documents required for all other phases of the project.

4.4.2 Acceptance of Vendor Drawings

An issue identified during the closeout phase of the CWEST Wet Module was that the final revision of the vendor drawings and BOMs were not suitable to issue as Revision 000 in Asset Suite. These documents had OPG document numbers and a vendor revision history, yet had no reference to the vendor document numbers.

This created a configuration management issue where the revision history appeared to correlate with the OPG document numbers rather than the vendor document numbers. Additionally, the final revisions of some of the drawings and BOMs contained OPG electronic change paper stamps, which were incorrectly filled and signed by the vendor.

Since the Purchase Order with the vendor had been closed, the path forward chosen was to issue the complete revision history for each drawing. This strategy guaranteed configuration matched between issued drawings and the equipment at the station.

Recommendations:

It is recommend that prior to acceptance and closure of the Purchase Order, the Project should ensure that the vendor submits drawings which are suitable for final issuance during project closeout.

Also, the Project should ensure that the vendor drawings clearly distinguishes between vendor revision history and OPG revision history.

4.4.3 Pre-Decision Logic & Troubleshooting

Much of the success of the P1861 and P1881 scrape campaigns can be attributed to the development of the UDM contingency plan (I-PLAN-30510-0024) and the subsequent use of the CWEST Operations Execution Troubleshooting Guide (I-INS-30744-00029).

The contingency plan summarizes risk mitigation activities for the UDS for outage fuel channel inspection campaigns at PNGS. Advanced decision making trees (i.e. pre-decision logic trees) are included for all major CWEST activities on-channel and during chip retrieval. For example, the contingency plan and the troubleshooting guide are both utilized every time there is a chip traceability issue.

Recommendations:

For tooling systems, it is recommended to have a contingency plan and troubleshooting guide to avoid additional delays during execution.

4.4.4 Creation of Cat IDs for Spare Parts

The procurement of spare parts for the CWEST System (QDP) was based on the recommended Spare Parts lists provided by the vendors. As per PO 255755 tool warranty, the vendor also supplies critical spares for outages under the same QA process used to build the CWEST Tool.

The intended strategy for spare parts management was to have OPG personnel prepare CAT IDs for the spare part kits, with ROP and TMAX values specified accordingly. The Action Requests (ARs) that were initiated for the P1751 outage spares did not have enough lead time for Supply Chain to address them. This resulted in the vendor having to supply spare parts as per SCR No. N-2016-23274.

Going forward, the expectation was to have each critical spare part assigned a CAT ID set to READY status by mid to late 2017. However, leading up to the P1861 outage, the CAT IDs had still not been created for the critical spare parts. The original ARs had been returned by Supply Chain on the premise that the attributes did not contain sufficient information, and they then went unaddressed due to Project staff turnover. Thus, as per open items for Partial AFS P1751, AR 28198086-07 was initiated in mid-2017 to track the re-creation of these ARs.

After the P1861 outage, leading up to Final AFS, a review of the critical spare parts list determined that the CAT IDs for CWEST system equipment had still not been assigned Cat IDs. They had been returned once again, due to the attributes not being completed. Thus, as per open items for Final AFS, AR 28215254-01, the subsequent CAT ID action requests were then re-created and routed to the NEWITEM supply chain group during the closeout phase of the project.

Recommendations:

As per the Guide to the Modification Process (N-GUID-00700-10000, Section 1.4.1.7 (c), Section 1.4.14.6, and Section 1.9.7.7 (b)(3)(vi)), spare parts required for commissioning or AFS must have at minimum CAT IDs at READY status. In addition, as per Project Life Cycle Management (OPG-STD-0147), critical spare parts must be available during the execution phase of the project.

When requesting CAT IDs for spare parts ensure that the EC panel and attributes are completed in accordance with Inventory Management and Catalogue Maintenance (N-GUID-08176.2-10000). OPEX from the MDS project has shown that as many attributes should be populated as possible, an approved project or end use should be referenced, and an accepted drawing/BOM and/or technical specification should be attached in the assignment notes. When requesting CAT IDs for pre-assembled kits, instead of individual parts, ensure that the detailed breakdown of each specific part that is included in the kit is included in the attribute notes.

The action requests for CAT IDs should be created at least 10-weeks prior to the need date in order to allow the applicable Supply Chain group to receive and complete the request. When requesting CAT IDs to be created with a short need date, ensure the Action Requests are escalated within Supply Chain to ensure they are created in a timely manner.

As per N-INS-00680-10000, Identification of Critical Spares, since IRI equipment does not meet Station Criticality Code 1 (CC1) requirements, supply chain does not input ROP and TMAX when creating the CAT ID. Once the CAT IDs have been created, ensure ROP and TMAX values are requested per Step 1.2.8 of Catalogue Information: Create, Maintain and Replenish (N-PROC-MM-0008). The System Responsible Engineer must then provide justification for the change through AAA notes on the CAT ID in Asset Suite.

4.4.5 Issue Tracking File

The Issue Tracking File (ITF) for the MDS Project proved to be a helpful tool for identifying issues throughout the course of the project. Throughout the lifecycle of the project approximately 589 issues were raised. The ITF was managed on a SharePoint format rather than having a master copy of an excel file in the working folders. This demonstrated to be an effective method of managing an ITF since it created increased visibility and accessibility to the entire project team and stakeholders.

The ITF however was misused leading to a number of ITFs being unresolved at the time of Final AFS. Many of the issues created, were dispositioned as unnecessary to the immediate project since they were recommendations or wants, rather than actual issues that were required to be addressed. Many of the issues were created with vague descriptions and did not have clear expectations or completion criteria.

There were a large number of ITFs left open for a number of years until they were finally addressed leading up to Final AFS or in the closeout phase. Issues such as; using CWEST on replaced channels, or CWEST electrical cooling were left unresolved creating difficulties when trying to declare Final AFS for the CWEST System. When reviewing the ITFs after turning over for operations acceptance, a number of issues were left open.

Recommendations:

It is recommended to manage the ITF of a project on a SharePoint format in order to benefit from the increased visibility, accessibility, and traceability.

However, from the start of the project clear criteria should be established and conveyed to the project team on how to the handle the ITF. This includes conditions for which warrant the creation of an issue, what is expected of the description, and to set an appropriate date for disposition. To ensure there is a level of control, it is recommended to obtain concurrence from the Project Manager prior to adding any issues to the ITFs.

As per N-PROC-MP-0090, ITFs should be created for specified conditions, and appropriate project staff should actively review the ITFs in order to ensure the timely resolution of issues. Prior to Design/Project or NICR EC closeout, the MTL should confirm that every item has been closed or appropriately dispositioned (for example, entered into action tracking as an open item), and that the ITF has been completed and filed.

4.4.6 Equipment Codes

The gap between vendor assigned equipment codes, OPG standard equipment codes, field labelling practices, and work protection procedures created multiple scenarios which affected the project operationally and financially. The lack of consistency in the creation and control of equipment codes across the project caused production time delays, and potential situations to impact worker safety.

As documented in SCR No. N-2018-16537, during the pre-final AFS walk down of the CWEST Wet Module for DEC 131060, the MTL discovered that the equipment label on the CWM was not as expected. The CWM was physically labelled as “P058-30744-CRT003” however as per the Master Equipment List (MEL) it should have been labelled as “P058-30744-CWM1”. A review of documentation related to the CWM showed that both equipment codes had been used inconsistently, since “P058-30744-CRT003” was used on the CWM drawings and flow diagram, whereas “P058-30744-CWM1” was documented in the MEL, procedures, commissioning reports and outage work plans.

Investigation into this issue discovered that the original drawings of the CWM prepared by the vendor for OPG in May 2016 contained the equipment code “P058-30744-CRT003” however MDS equipment codes were not finalized and issued into Asset Suite (outside of the AEL/ECC process) until November 2016.

During the closeout phase of the project, it was noted in the field that labelling of the In-Vault Cart, and Hydraulic Cart did not align with work protection procedures. Without having uniform naming conventions and labelling practices, project deliverables were affected by delays and re-work. Examples include the update to the Power Supply List (PSL) and Flow Sheet, as well as additional work to revise drawings, operating procedures across multiple groups, and field labels for all affected equipment.

As a result of having multiple pieces of the same equipment (spares), the practice throughout the project was to label the equipment sequentially, such as IVC1 and IVC2. However, this created an issue where procedures and documents would therefore call out for both equipment codes in the same instruction, such as “P058-30744-IVC1/IVC2”. This convention prescriptively does not satisfy the MEL and Work Protection in multiple cases.

Recommendations

As per N-GUID-00700-10000 Section 1.1.3.9.7, the IRI organization may maintain configuration of engineering tooling and other IMS equipment without using Asset Suite equipment records. However, where applicable, appropriate procedures in Pickering Equipment and Component Coding Standard (P-ST-09020-00001), Equipment Labeling (N-PROC-OP-0034), and Equipment Data Maintenance (N-PROC-MP-0077) should be considered for best practices in the organization. As per N-GUID-00700-10000 Section 1.4.8.9, typical practice at the Pickering station is to consult with Plant Status Control and the Drawing Office when adding new equipment (e-tags) in order to review the preferred numbering convention. In the IRI facility, this task is managed internally.

When inputting equipment codes into the MEL, it is recommended to follow Section 1.3 of N-PROC-MP-0077 in order to validate that the correct equipment code is referenced on primary documents. Based on OPEX, it is recommended to consult with project stakeholders and supporting groups to finalize the required equipment codes early in the design and ensure that these codes are communicated with the vendor. By establishing these equipment codes early with the vendor, this allows for documentation such as specifications, drawings, and Catalog IDs to be configured correctly and consistently.

When assigning equipment codes sequential numbering should be avoided for duplicate equipment (which is not being used at the same time). In the case of “P058-30744-IVC1/IVC2”, the equipment code “P058-30744-IVC” is still appropriate, satisfies Work Protection procedures, and can address multiple pieces of the same equipment. To differentiate between multiple equipment serial numbers and model numbers can be used.

4.4.7 Cable, Connector and Hose Labelling

Prior to Final AFS of the CWEST QDP in August 2018, incorrect naming convention of cable and connectors was identified in their respective labels. Throughout the drawing package for CWEST Cable and Connectors (I-REF-30744-70000) as well as on the procured cables and connectors, an issue was raised that the labels contained Kinectrics' terminology instead of using OPG naming convention. The terminology that the vendor used in the first revision of the cable and connector drawing package in 2015, was used for three years until corrected just prior to execution window in the P1881 outage.

As an example, SCR No. P-2018-04152 describes a one (1) hour critical path delay that was experienced during the P1861 outage as a result of the CBL8 (Universal Delivery Machine to In-Vault Cart cable) replacement having labelling nomenclature which did not match Work Protection Tag (PC17). The CWEST System carts are integrated into Approved Isolation Procedures (AIP) and Approved Work Protection Procedures (AWPP) which caused CBL7 (In-Vault Cart to Hydraulic Cart 120VAC Power) and CBL8 of the package to be taken on a case by case basis in order to ensure work protection was still met.

An error likely situation was discovered during CWEST commissioning activities in P1671 with regards to CWEST and SLAR system hoses (DEC # 130034). Both systems utilize a pneumatic and hydraulic hose named HOS500 and HOS501, respectively. The two sets of hoses are uniquely identified and labelled in accordance with their full equipment code however they only differ by a SCI. Since both system hoses are setup at the same time during UDM install in the vault, a human performance event could have taken place if it had not been identified.

The labels and names of the CWEST system hoses were changed in the first change paper revision of the drawings (NUCL-DRAW-30744-81020 / NUCL-DRAW-30744-81021) in late 2016. A review of the drawings during closeout of the project in 2019 determined that the revised labels did not align naming convention, and therefore did not match the field labels or work protection procedures.

Recommendations:

Required equipment codes should be finalized early in the design. By establishing the codes early, this allows for the correct labels on cable, connector, and hose drawings to be finalized prior to commissioning.

When labelling equipment in IRI, it should be recommended that an effective equipment labelling program, such as N-PROC-OP-0034, be reviewed and followed in order to minimize the risk of human performance errors in the field. OPEX from commissioning activities during P1671 demonstrates that special caution should be taken when labelling equipment on similar systems which are operated or setup simultaneously.

Equipment received from manufacturers do not come with OPG standard equipment labels therefore it is critical that drawings and equipment are reviewed once received (field and paper walkdown) in order to ensure an OPG standard label is applied.

4.4.8 Legacy Equipment – CFTS Cart

The CWEST Wet Module (CWM) required to be mounted on a cart with a slide table which allows advancement and retraction of the end fitting and allows for proper alignment between the end fitting and the UDM snout. In addition, the Wet Module assembly/cart needs to be sufficiently mobile to allow personnel in double plastic suits and gloves to manoeuvre it in tight spaces (i.e. in the vault and through the airlock doors). It was identified early on in the design that the SLAR section had a spare Calibration Facility and Tooling Station (CFTS) cart available for this purpose. This particular cart was known to interface well with the UDM, therefore would reduce the risk of introducing a new cart design, and save costs associated with vendor design, build and manufacturing.

As per SCR No. N-2017-04896, the CFTS cart was free-issued by OPG to the vendor to serve as the base of the CWM, but was not sent to the vendor's facility as it had been used in a radioactive environment. The CWM was then designed as a separate item that was to be mounted on top of the existing CFTS cart.

During commissioning of the CWEST Wet Module, a number of deficiencies were discovered with using the CFTS cart as a base as per the finalized as-built drawings of the CWM and the CFTS. The CWM Center of Gravity (CofG) issue was discovered as the CWM/CFTS assembly began to tip over when the sliding table was advanced forward. This posed a conventional safety concern for those workers required to manually manoeuvre the cart. Since the CWM was designed separately from the CFTS cart, it did not appear that the appropriate analysis was performed. Upon discovery of the issue, a contractual difference of opinion was experienced between OPG and vendor with regards to who was the responsible party performing such analysis. The final vendor analysis concluded that a 1000lb counterweight at the back of the assembly would counteract the tipping effect.

Undocumented modifications were identified with the CFTS cart where configuration management was lost and the cart was left in an unanalyzed state. As per SCR No. N-2016-20910 and N-2016-20908, the casters and jacks on the CFTS cart were identified to have been replaced and added, and therefore they did not match the design drawings. These issues appeared to have been legacy changes that were not documented via the Engineering Change Control (ECC) process. When performing analysis to resolve the conditions found in SCR No. P-2017-20657, it was determined that the existing casters would need to be replaced because the model/make could not be identified on the Bill of Materials (BOM). Therefore, it was unsure whether the current casters could handle the additional weight added to the CWM/CFTS cart assembly.

While addressing the CofG issue, it was discovered that the weldment drawing did not specify existing welds found on the CFTS cart. A QC inspection was performed and

revealed multiple additional welding which were undocumented. Engineering performed a subsequent walk down and historical QA documentation search and could not confirm which welding standards were used. This situation poses a risk when lifting the cart during UDM integration in the East Annex. To address this risk, the project team developed an alternative lifting plan which utilized slings in order to reduce the stress on the questionable welds.

Finally, integration of the CWM for commissioning further discovered that the ergonomics of the Wet Module/CFTS cart assembly were not ideal. The width of the CWM is much smaller than the width of the CFTS cart, and the height of the cart combo compared to ground level means that workers required temporary work platforms to access it, as well as working at heights above the shoulders. Due to the decision to utilize the CFTS cart, the design was not completed with human factors engineering (HFE) in mind. The HFE assessment, which was completed at the end of the fabrication stage, made suggestions for improvements to use the CWM safely. However, it was too late to do major design work to correct any ergonomic issues.

Recommendations:

When utilizing legacy equipment, ensure a pre-condition assessment is completed. This pre-condition assessment should include a paper and field walk down of the equipment to confirm there are no configuration management issues, and degradation concerns associated with fatigue/cyclical use or environment (i.e. radiation). During the design process with any modification, in addition to the use of legacy equipment, ensure that human factors is incorporated early into the Conceptual/Preliminary design.

When free-issuing legacy equipment to a vendor for design work, ensure that any analysis or assessments are completed to incorporate the vendor design with the legacy equipment. When possible, it is recommended that the legacy equipment be shipped to the vendor facility during design and fabrication to demonstrate the two are compatible and to minimize latent issues.

Since there are similar existing carts that are being used by multiple other departments within IRI and Station Maintenance, ensure that this OPEX is shared appropriately.

4.4.9 Verification of Design – COMS and Walkdowns

Throughout the lifecycle of the MDS Project, a number of design deficiencies were discovered in the field, which could have been identified in processes such as COMS and walkdowns conducted at the appropriate time in the design process.

As per SCR No. N-2018-02410, a pre-installation walk down of the equipment under the QDP led to an issue where CBL8 had insufficient length when the IVC is configured on the rolling shield in the west vault opposed to the east vault. This mirroring effect was not considered when a walk down was performed to determine the cable lengths. In addition, as per SCR No. N-2017-07799, during execution of CWEST In-vault connections in the P1751 outage, it was discovered that CBL24 was short by around

5ft. While the design team had done a review of cable lengths, including analyzing vault location drawings and discussing with field stakeholders, an actual field walkdown to measure the distances between different components of the entire CWEST system was not completed.

When the decision to utilize the existing CFTS cart with the CWEST Wet Module, there was no pre-condition assessment and/or field walk down performed to identify the latent design issues discussed in Section 4.4.8 of this report. As per SCR No. N-2016-24271, there was no walkdown performed on the cart until the discovery of the tipping issue.

Furthermore, walkdowns conducted for Final AFS of the SRC, PL804 and CWM identified multiple configuration management issues. The walkdowns identified an undocumented magnet modification to the gate on the SRC, a light colour discrepancy on the front of PL804, and equipment code inconsistency with the CWM.

The project was also unable to deliver a tow-bar solution for the CWM/CFTS cart assembly prior to P1861, after the length of the tow-bar was found to be too short to extend past the guide sleeves of the CFTS and rendered the tow-buggy unable to reach the tow-bar when installed. This interference was discovered during the review of the installation work package supplement, however was missed during the COMS review in the Detailed Design phase.

An issue missed during the COMS process, as well as during the 20% and 80% design reviews and the factory acceptance test, was that the load rating on the working platform of the SRC may not be sufficient. The load rating is 600lbs for three persons, however the concern raised was that some people may weight more than 200 lbs, or may bring additional equipment onto the platform. The rating was then updated to 2000lbs through a further assessment by the vendor.

The MDS Project however, as per SCR N-2017-06541, N-2017-04032 and N-2016-14084, utilized best practices in regards to documenting any changes in COMS quorum through SCRs. This aligns with the governance stated in Section 1.3 of Constructability, Operability, Maintainability, and Safety (N-PROC-MP-0083).

Recommendations:

Throughout the Planning and Execution phases of the project lifecycle, ensure that COMS and walkdowns are conducted as required by the accessibility and complexity of the modification. Also,

As per the Modification Process (N-PROC-MP-0090 R016), Section 1.2.1.1(b)(1) the creation of an MDR should include an initial COMS. From Section 1.3.2, when a COMS review is conducted, where practical, it is recommended to walkdown the field and perform drawing-to-drawing and drawing-to-field comparisons to confirm configuration prior to, in parallel with, or following the COMS review. As appropriate, walkdowns should be used to determine and confirm the practicality of the design. As per Section 1.6.4, once installation of the modification is complete the FTL should arrange and

conduct a post-installation walkdown, where practical, and document any issues in the ITFs. Finally, as per Section 1.9.4, if required by the modification outline, the MTL should conduct an AFS walkdown with the FTL, DTL, Performance Engineer/Officer (or SRE) and any other affected stakeholders.

When performing COMS Reviews, follow N-PROC-MP-0083 and the guide to the COMS process (N-GUID-00700-10001), for requirements and best practices. COMS should be performed a minimum of two times during the modifications process (or as defined by the modification outline). Typically this is once during scope definition/modification planning phase, and a final COMS during the detailed design phase before finalization of as-built drawings. As per Section 1.1.9 of N-PROC-MP-0083 R010, COMS requires close cooperation between Ergonomics and Human Factors Engineering Subject Matter experts.

5.0 COMMUNICATIONS PLAN FOR THE LESSONS LEARNED REPORT

This Lessons Learned Report will be distributed to the following key stakeholders and affected parties of the Machine Delivered Scrape Project:

Sabrina Nestor, Manager, IRI NDE Innovations

Nick Berube, Manager, Delivery & Maintenance Systems

Stuart Baxter, Manager, IRI Fuel Channel Inspections

Satya Mallampalli, Manager, IRI Technical Services

Paul Fabian, Manager, OPG Major Components Engineering

Michael Clarke, Manager, Field Operations, Reactor Maintenance

Bradley Greenland, Manager, Fuel Channel Innovation

This report will also be communicated to all Project Staff. The report will also be made available in the common repository where all documents are kept, and is filled under the special lessons learned report category “LLD” which ensures it is easily found.

6.0 CONCLUSIONS

The Machine Delivered Scrape tooling performed well in the P1861 inspection campaign, completing its full inspection scope safely. There was an improvement in the P1881 inspection campaign in terms of timing, as it finished early. Communication and collaboration were the keys to its success. This report highlights valuable OPEX and insights gained though its project management and design oversight. By documenting and communicating the lessons learned, this report contributes to the body of knowledge and experience that can be drawn upon for future projects.

6.1 Summary of Recommendations:

Section	Area for Improvement	Recommendations
4.1.1	Schedule Management	- Follow Nuclear Project Management Governance (N-MAN-00120-10001-SCH & N-GUID-00120-10131) to establish a quality WBS that is tied to a project schedule that is updated regularly.
4.1.2	Scope Management	- Ensure the PMP is written at the initiation stage of the project and references a complete scope via a WBS. - Revise PMP throughout the gated process to incorporate changes in scope. - When defining scope determine “wants vs. needs”.
4.1.3	Contract Management	- Use multiple line items within one PO to capture all deliverables of the project. - Consider different types of cost reimbursable contract models instead of only fixed price or time and materials.
4.1.4	Cost Management	- Follow Nuclear Project Management Governance (N-MAN-00120-10001-COST) early in the project life cycle. - Request support from the Nuclear PMO to establish a workable WBS with costs at a WP level. - Establish a CBS in Ecosys.
4.1.5	Work at Risk Releases	- Use better front end planning to avoid using WARRs.
4.2.1	Ultrasonic Transducer Probes	- Ensure testing conditions on tooling for qualification purposes does not exceed the threshold for fatigue failure and is appropriate for the application.
4.2.2	Revision Control	- Issue NCARs through Supply Chain when issues with the vendor’s quality programs are discovered.
4.2.3	Vendor Procedures	- Consider site specific design changes to adapt vendor procedures to function at PNGS B. - Perform table-top reviews of the procedures.
4.3.1	In-House Builds	- Ensure modification is fully understood and a contingency plan is created for potential obsolescence issues, discovery work, testing plans and reports.
4.3.2	Design Requirements	- Ensure each requirement is achievable, realistic, and reflects the current intended scope of the modification. - Eliminate non-CDRs from the MDR and include them in a technical specification.
4.3.3	Bounding Documentation	- Not recommended to use bounding memos or assessments that were initially prepared for another facility for FOAK/FIAW fuel channel inspection systems. - Use human performance tools, such as having due diligence and using a questioning attitude, when accepting bounding documentation.
4.3.4	In-lab Testing	- Operation of equipment should be tested under conditions representative of the specific site (i.e. pressure and temperature).

Section	Area for Improvement	Recommendations
		- Consider conditions such as sensitivity to cable type and length. - Use human performance tools, such as using a questioning attitude and proper verification techniques, when determining testing conditions.
4.4.1	Quality Design Plan	- QDP has had limited use within IRI therefore take further care to understand the process. - Establish a QDP release plan with field stakeholder buy-in. - Ensure that the DSC and the schedule reflect a road map of which design and other Level 3 documents are required.
4.4.2	Acceptance of Vendor Drawings	- Prior to acceptance and closure of the PO, ensure the vendor submits drawings which are suitable for final issuance. - Vendor revision history and OPG revision history should be clearly distinguishable.
4.4.3	Pre-Decision Logic & Troubleshooting	- Create a contingency plan and trouble shooting guide to avoid additional delays during commissioning and execution.
4.4.4	Creation of CAT IDs for Spare Parts	- Ensure ARs for CAT IDs are submitted with enough lead time and have sufficient detail in the attributes. - Ensure an accepted drawing/DBOM and/or technical specification is referenced in the attributes. - SRE must submit AAA request for ROP/TMAX once CAT ID is created.
4.4.5	Issue Tracking File	- Manage ITF on a SharePoint site. - Establish clear criteria on what is expected of the ITF. - Ensure ITFs are completed in a timely manner and dispositioned prior to Final AFS.
4.4.6	Equipment Codes	- Consult with stakeholders to obtain concurrence and uniformity across the project with assigned equipment codes. - Finalize equipment codes early in the design and communicate these codes with the vendor to update documentation. - Avoid sequential numbering for spare equipment (i.e. P058-30744-IVC1 & P058-30744-IVC2). - Ensure Work Protection is reviewed and updated when equipment codes are established or revised.
4.4.7	Cable, Connector, Hose Labelling	- Establish equipment codes early in the design so labelling can be updated to reflect proper terminology. - OPEX demonstrates labelling on equipment on similar systems which are operated or setup simultaneously could lead to human performance events. - Equipment received from manufacturers do not come with OPG standard equipment labels, therefore review and update drawings and equipment once received.
4.4.8	Legacy Equipment – CFTS Cart	- Perform a pre-condition assessment before using legacy equipment (paper and field walkdown), as well as any analysis. - Ensure human factors is incorporated into the conceptual/preliminary design phases. - Free-issued legacy equipment should be shipped to the vendor facility during the design and fabrication stages to ensure design is compatible and latent issues are minimized.
4.4.9	Verification of Design – COMS & Walkdowns	- Perform COMS and walkdowns at the appropriate times of the project as per Modification Process (N-PROC-MP-0090) and COMS (N-PROC-MP-0083). - COMS requires close cooperation between Ergonomics and Human Factors Engineering SMEs.

Appendix A: SCRs Related to Project Management

Event Date	SCR Number	Title	Description
2015/11/13	N-2015-27043	Change papers for EC # 127144 prepared beyond scope of work of CWEST project	Change papers required to proceed with RFP were prepared which included design changes associated with the Mark II umbilical which were beyond the agreed documented scope for the Mark I Umbilical in support of CWEST project.
2015/12/01	N-2016-00294	PCRAF required for Machine Delivered Scrape project #66600	Spending on the Machine Delivered Scrape project was lower than planned for 2015 and a PCRAF was required to move cash flow from 2015 to 2016.
2016/01/01	N-2016-02895	Project 28-66600 - PCRAF not approved before using contingency to pay for extra work	Project number 28-66600 for Machine Delivered Scrape exceeded released cashflow and utilized project contingency. There was no PCRAF approved to release contingency to cover costs. An approved PCRAF is required to facilitate the use Project contingency.
2016/03/28	N-2016-08970	Machine Delivered Scrape Project 66600 - Maintenance Test Rig Delivery Date Delay	Delivery dates for maintenance carts found to be significantly past date specified in AR. Situation arose from a series of issues throughout project development which were: improper scoping, insufficient resource allocation and availability, and poor communication between parties.
2016/05/02	N-2016-11556	P1751 Campaign Work Management Milestones Missed - Machine Delivered Scrape Project 66600	Campaign Work Management milestones for P1751 DL03, DL09, DL04, DL05, DL06, DL08, DL09, DL12, DL13 have been missed.
2016/05/11	N-2016-12641	P1761 CWM Milestone Missed - DL04 Machine Delivered Scrape	P1761 milestone DL04 (Prelim Execution Level III Schedule) missed due to lack of info available to prepare the schedule. Work Order and tasks are not in Passport for P1761 MDS.
2016/05/20	P-2016-13616	P1671: Late Scope Addition for Machine Delivered Scrape (MDS)	Work Orders for CWEST were not added in time for milestone in 5-Jan-16 for scope freeze. The MDS project was approved in the outage however scope was not defined. These WOs will add about ~ 200 to 300 tasks on the project. It is unknown whether all the tasks required to be completed in project would impact on approved duration of 132 Hrs. MUSATC 2016/05/20 13:22 : Scope freeze milestone completion was September 01, 2015

Event Date	SCR Number	Title	Description
2016/05/20	N-2016-13555	Campaign Work Management (CWM) - MDS P1761	The following milestones will not be met for the MDS program in P1761 (Summer 2016) as described in I-PROC-AS-0004: DL03: Long Lead Materials Identified DL05: IMS Initial Work Order Assessment Complete and DL09: IMS Purchase Orders for Long lead Materials Issued.
2016/06/15	N-2016-15921	Campaign Work Management (CWM) - MDS P1751	The following milestones will not be met for the MDS program in P1751 (Spring 2017) as described in I-PROC-AS-0004: DL15: PC1's Submitted
2016/06/28	N-2016-16919	P1751 Campaign Work Management Milestone Missed - Machine Delivered Scrape Project # 66600	Campaign Work Management milestone P1751 DL16 (Work Package Assessing Complete) has been missed.
2016/06/28	N-2016-16908	Campaign Work Management (CWM) - MDS P1671	The following milestones will not be met for the MDS program in P1671 (Fall 2016) as described in I-PROC-AS-0004: DL15: PC1's Submitted and DL25: IMS Work Permit Confirmation.
2016/07/04	P-2016-19531	Machine Delivered Scrape for P1671: Risk with Scraping the Far Rolled Joint with Circ Wet Scrape Tool (CWEST)	There is potential late scope change required for scrape in P1671 due to risk of performing Far RJ scrape Vendor highlighted a risk in first time evolution of Far RJ Scrape which is currently in scope for P1671, with the CWEST scrape tool. (Far rolled joint scrape was never performed at BP with CWEST). There is a very small probability of the tool -mis-scraping or being stuck in the far end fitting.
2016/07/05	N-2016-17506	P1751 Campaign Work Management Milestone Missed - Machine Delivered Scrape Project # 66600	Campaign Work Management milestone P1751 DL17 (All MRs Approved) has been missed.
2016/07/15	N-2016-18446	Campaign Work Management (CWM) – MDS P1751	The following milestones will not be met for the MDS program in P1751 (Spring 2017) as described in I-PROC-AS-0004: DL13: Final Staff Demand and Preliminary Crew Schedule
2016/07/15	N-2016-18445	Campaign Work Management (CWM) – MDS P1671	The following milestones will not be met for the MDS program in P1671 (Fall 2016) as described in I-PROC-AS-0004: DL25: IMS Work Permit Confirmation
2016/07/15	N-2016-18444	Campaign Work Management (CWM) - MDS P1671	The following milestones will not be met for the MDS program in P1671 (Fall 2016) as described in I-PROC-AS-0004: DL15: PC1's Submitted
2016/07/29	N-2016-19263	P1671 DL26- ALARA Plans Reviewed and Agreed MDS	DL 26 for MDS will not be complete by the due date of August 1st. All resources are deployed to MDS commissioning activities. New date proposed for completion of the ALARA Plan is September 15, 2016.

Event Date	SCR Number	Title	Description
2016/08/30	N-2016-21646	P1751 - MDS-DL19- DL19: Outage Pre and Post –Requisites Scheduled	DL 19 for MDS is due September 2nd and cannot be met in time due to staff constraints.
2016/09/10	N-2016-24742	Campaign Work Management (CWM) – MDS P1761 - DL05: IMS Initial Work Order Assessment Complete	The original recovery plan actions have not been completed for DL05 - IMS Intitial Work Order Assessment with a revised TCD of 30NOV16.
2016/10/06	N-2016-24969	Campaign Work Management (CWM) – P1761 MDS	The following milestones will not be met for the MDS program in P1761 as described in I-PROC-AS-0004: Regarding Deliverable DL13 - Final Staff Demand and Preliminary Crew Schedule.
2016/10/06	N-2016-24968	Campaign Work Management (CWM) – MDS P1751	The following milestones will not be met for the MDS program in P1751 as described in I-PROC-AS-0004: Regarding Deliverable DL13 - Final Staff Demand and Preliminary Crew Schedule.
2016/11/01	N-2016-27748	MDS Milestone # 29 - Regulatory Approvals Obtained Was Missed	The project management plan (PMP) did not appropriately address the impact of regulatory requirement CSA N285.4 (12.3.4.2 Procedures) on MS29 (N-PROC-MA-0013), and therefore did not make this submission early enough to meet the TCD of 01-Nov-2016.
2017/01/03	N-2017-02176	Machine Delivered Scrape Project 28-66600: 2016 Budget Under Spend Resulting in Need for New PCRAF	The Machine Delivered Scrape (MDS) Project 28-66600 had PCRAF-004 approved at AISC in December 2016 to capture a new project baseline schedule/budget. This PCRAF forecasted a new 2016 budget based on the most up to date status of the project at the time. However, once the final year-end costs were tabulated, the actual value ended up being $440k less than the new budget in the PCRAF.
2017/01/13	N-2017-00907	Campaign Work Management (CWM) – UDM, SLAR, MDS and ANDE P1751 DL28 Will Not Be Met	The following milestone will not be met for UDM, SLAR, MDS and ANDE program in P1751 (Spring 2017) as described in I-PROC-AS-0004: DL28 - Equipment Ready for Service and Turned Over to Operations.
2017/03/10	N-2017-08304	CWEST P1751 Execution PO 270921 - Vendor Cost Reporting Challenges	Vendor did not provide weekly cost reports to support their pre-approved spending. Vendor notified MDS PM that they were likely to overspend the approved amount of this PO before the CWEST on-reactor campaign would be complete.
2017/07/04	N-2017-17545	Machine Delivered Scrape Project 28-66600: IMS Director of Engineering Milestones A/R 28198331 - Extensions Required	The following IMS Director of Engineering Milestones need to be extended as a result the additional time and effort to resolve the CWEST tool issues, and provide oversight of the CWEST vendor, as summarized by SCR N-2017-10219.

Event Date	SCR Number	Title	Description
2017/07/29	N-2018-18188	CWEST is precluded from deployment on replaced fuel channels	As per the CWEST Software Categorization Report (I-REP-30744-00001), CWEST is precluded from use on replaced channels, either pre-service or during operation. This is due to an unassessed condition of performing scrape in high residual stress regions found in replaced fuel channels.

Appendix B: SCRs Related to Vendor Quality Issues

Event Date	SCR Number	Title	Description
2015/06/02	N-2015-16396	MDS Project – Vendor ITP not accepted prior to test	The vendor submitted the ITP for MDS console and cable build to OPG for review; however, did not follow up with OPG and started testing prior to gaining acceptance of this ITP. It is a requirement of Z299.3 to have customer acceptance of the ITP prior starting testing.
2016/11/30	N-2016-29830	Machine Delivered Scrape Project 28-66600: Pre-P1751 Commissioning - CWEST UT Probe Issues	During P1751 Commissioning Testing, the CWEST UT Probe 'B' failed test as part of I-ATP-30744-90003. The expected signal on the CWEST HMI was not observed.
2016/12/01	N-2016-30010	Machine Delivered Scrape Project 28-66600: Pre-P1751 Commissioning - CWEST Tool #2 UT Probe Issues	Re-occurring UT signal issues related to CWEST tool SN002 during Acceptance Testing. Each of the three UT probes have had individual issues. At first it appeared that all three were suffering from the same poor signal quality, but then each individual UT probe began experiencing issues.
2016/12/23	N-2017-01341	Machine Delivered Scrape Project 28-66600: Trending of Issues Discovered with CWEST Tool System	OPG became aware of tool issues requiring correction by the vendor. OPG requested the vendor to submit non-conformance report (NCR) numbers for these items in order to document how their design, procedures and quality program will be improved to eliminate similar problems in the future.
2017/02/01	N-2017-02831	Machine Delivered Scrape Project 28-66600: CWEST Tool #2 - UT Probe Issue Discovered During Vendor Testing	During CWEST tool #2 tool demonstration testing (TDT) at their facility, they discovered problems with the UT probe functionality. This tool had previously been at Pickering for commissioning with UDM, but had to be shipped back to the vendor for repairs due to some of the original UT probes failing (as documented in SCR N-2016-29830).
2017/04/02	N-2017-07860	Machine Delivered Scrape Project 28-66600 Execution - Dry UT Probe Checks Failed	During the execution Dry Ultrasonic Testing Checks, no sample tray signal could be detected during the test. Three further attempts were made and were unsuccessful.
2017/05/23	N-2017-24979	Machine Delivered Scrape Project 28-66600: CWEST Continued Tool Build Quality Issues	OPG has become aware of many CWEST tool build issues requiring correction by the vendor during lab testing in preparation for the P1861 outage. These issues continue a trend of build quality problems previously experienced during design and commissioning for the P1751 outage (many of which were documented in SCR N-2017-01341).
2017/07/20	N-2017-21953	Machine Delivered Scrape Project 28-66600: CWEST Tool 1 - Cut in Motor Harness Cable Jacket Discovered	During the Circumferential Wet Scraping Tool #1 reassembly at the vendor site, it was discovered that there was a cut in the motor harness cable jacket.

Event Date	SCR Number	Title	Description
2017/07/25	N-2018-01988	Machine Delivered Scrape Project 28-66600: Hydraulic Cart Pressure Gauge out of Calibration Sticker Not Updated	During preparations for P1861, while disconnecting CWEST in-vault carts, the calibration sticker was read and observed to be out of date.
2017/08/23	N-2017-20024	Machine Delivered Scrape Project 28-66600: CWEST Tool #3 Fore UT Probe Failure During Testing at Vendor's Site	"During testing of the Circumferential Wet Scrape Tool (CWEST) system at the vendor's site, the Fore UT Probe on OPG CWEST tool #3 failed.
2017/08/28	N-2017-20028	Machine Delivered Scrape Project 28-66600: CWEST Tool #2 Fore UT Probe Failure During Testing at Vendor's Site	Initially, at the vendor site during the weekend of 26-Aug-2017, the vendor noted UT Signal issues on OPG CWEST Tool #2. The vendor at the time believed it was a failed UT instrument. After completing troubleshooting, the vendor determined that it was instead the Fore UT Probe on OPG CWEST Tool #2 that had failed.
2017/09/05	N-2017-21955	Machine Delivered Scrape Project 28-66600: CWEST Tool 2 - TLV Valve Discovered Broken During Tool Function Checks	During post harness replacement tool function checks, it was found that Tool Valve 1 (TLV-1) was leaking. All accessible TLVs were checked and it was found that TLV-3 was cracked.
2017/09/07	N-2017-21956	Machine Delivered Scrape Project 28-66600: CWEST Tool 3 - TL-SV3 Wire Jacket Nicked During Tear Down	During vendor tool rebuild of the Circumferential Wet Scrape Tool at vendor facility, it was identified during the tear down process that a wire jacket (TL-SV3, of CWEST Tool #3) was nicked.
2017/09/20	N-2017-21671	Machine Delivered Scrape Project 28-66600: CWEST Tool #3 Water Ingress Discovered During Tool Demonstration Testing	During tool #3 tool demonstration testing (TDT) at the vendor's site, water ingress was observed at the interface of the motor harness and main tool harness connectors, resulting in the CWEST motor to not respond as expected. The failure was discovered during an external pressure test.
2017/09/22	N-2017-22038	Machine Delivered Scrape Project 28-66600: Vendor Drawings Contain Errors	The vendor submitted revised drawings to support modifications for P1861. After OPG review, it was found that the top level drawing listing the suite of drawings for specific equipment did not contain the correct revision numbers.
2017/11/08	N-2017-27555	Machine Delivered Scrape Project 28-66600: Uncontrolled Software Version Installed During CWEST Commissioning	The CWEST vendor discovered on 26-Nov-2017, during an investigation of the issues documented in SCR N-2017-27101, that an uncontrolled version of the approved CWEST software had been installed onto the CWEST SCADA systems at both OPG and the vendor's facility prior to P1861 commissioning activities.

Event Date	SCR Number	Title	Description
2017/11/21	N-2017-27101	Machine Delivered Scrape Project 28-66600: CWEST Tool Interrupted Cut Avoidance Modification Commissioning Test Failed	During CWEST commissioning activities in the East Annex prior to P1861, the CWEST interrupted cut avoidance modification test failed. After this event occurred, during team discussions to identify an immediate path forward, OPG inquired and the vendor identified that the factory acceptance testing had not actually tested the interrupted cut avoidance modification by initiating a cut and pressing the e-stop button. Instead, they performed other partial tests and believed that was sufficient for declaring it acceptable.
2017/11/28	N-2017-28138	Machine Delivered Scrape Project 28-66600: CWEST Tool Heads UT Probe/Harness Replacements	The CWEST vendor has informed OPG that it plans to replace the UT harnesses in CWEST tools. The vendor's ongoing investigation has identified that the UT harness manufacturing process is inadvertently causing damage to UT probes and there's a possibility that any of the probes could randomly fail even after testing has confirmed them acceptable.
2018/05/29	N-2018-12567	Machine Delivered Scrape Project 28-66600: CWEST Tool, Deficiencies identified on vendor design drawings not acceptable by OPG	During vendor (Kinectrics) documentation review acceptance process by OPG on CWEST Tooling, following issues were discovered: a) Several DRW-s, part of the design package, were not provided to OPG. b) Several other DRW-s provided with incorrect revisions for acceptance. c) Welding assemblies DRW-s are not sealed with professional engineering stamp as per requirement.
2018/07/16	N-2018-15886	P1881 CWEST Integration: Tool #003 Cutter Actuator Issue	During P1881 CWEST Integration activities in the East Annex, vendor staff discovered that the Tool #003 cutter actuators were not stroking as expected.

Appendix C: SCRs Related to Engineering Design

Event Date	SCR Number	Title	Description
2016/05/05	N-2016-12432	MDR Rejection: CWEST Maintenance & Test Rigs	A revision to I-MDR-30744-50001 was submitted to the IMS design authority for approval. The submission through smart form was rejected as the revision history did not properly match the changes to the body of the document. The changes were minor in nature, as they did not impact the technical contents in the body of the document.
2015/09/15	N-2017-03085	Machine Delivered Scrape Project 28-66600: Update to I-MDR-30744-50003 (MEC#131116) Needed	As part of the Requirements Traceability Matrix (RTM) review for MEC#131116, there are a number of requirements (I-MDR-30744-50003) that have not been met as originally stated. In many cases, the requirements as written do not suit the end application and cannot be met. Specifics of each MDR requirement are tracked in the RTM and under Project ITF#515 with technical justifications where required.
2016/07/25	N-2016-29831	Machine Delivered Scrape Project 28-66600: CWEST System – Networking Switch Firmware Upgrade	During Circumferential Wet Scrape Tool (CWEST) system testing at the vendor site, it was identified that the required configuration of the SCADA panel networking equipment was not being retained by the during a power cycle. An incorrect configuration could result in an abrupt software malfunction that would stop CWEST scraping activities.
2016/08/02	N-2016-19691	EC 133017 CWEST Panel PL804 Not Functioning As Expected During Commissioning	During commissioning activities for CWEST-UDM interfacing panel PL804 (DEC #133017), it was discovered that the axial and rotary positional information was not being received / interpreted correctly by CWEST SCADA, and also that the fibre optic signal was not being passed along to the SLAR-UDM interfacing panel PL801.
2016/08/04	N-2016-19943	P1671 MDS Commissioning: Unable to Reset CWEST E-Stop Condition	During the execution of CWEST commissioning test procedure I-ATP-30744-90003 R000 Appendix D: E-Stop Testing it was discovered that the CWEST E-Stop circuit could not be reset from an E-Stop condition. The UDS E-Stop circuit was determined to be fully functional and working as a UDS E-Stop could be reset from an E-Stop condition once all UDS and CWEST Pushbuttons were released. The problem was isolated to the CWEST E-Stop circuit.

Event Date	SCR Number	Title	Description
2016/08/09	N-2016-25784	Machine Delivered Scrape 28-66600: E-Stop Lamp Activation on CWEST Equipment Not Consistent With UDS System Equipment	The CWEST system introduced 4 additional E-stop buttons to the overall UDS system (includes SLAR/ANDE) E-stop circuitry. Within the UDS system, if any E-stop buttons is activated, all buttons illuminate. However, for E-stop buttons on the Cwest Hydraulic Cart, In-Vault Cart and SCADA, they only illuminate if that specific button is depressed. For PL804 as part of the Cwest system, there is a separate lamp that follows the UDS convention (i.e. illuminates when any button is pushed), but the button's lamp itself is not utilized.
2016/08/11	N-2016-20412	EC 133017 CWEST Panel 804 Not Functioning As Expected - Signal Inversion	During commissioning activities for CWEST-UDM interfacing panel PL804 (DEC #133017), it was discovered that the axial and rotary positional information was not being received / interpreted correctly by CWEST SCADA.
2016/08/18	N-2016-20821	Machine Delivered Scrape (MDS) Project - Inclusion of Non-Critical Design Details in Sample Retrieval Cart Modification Design Requirements (MDR)	I-MDR-30744-50002 contains clauses which are not design requirements, but preferences from stakeholders. Specifically, the MDR states which jacks "should" be used, and which positioning table should be used. The jacks are not rated for the load of this design, but were specified for ease of keeping the same spares in stock.
2016/09/28	N-2016-24271	Machine Delivered Scrape - Wet Module	I-MDR-30744-50001 specified that an existing CFTS cart frame would be used to support the Wet Module. This assumes that the existing CFTS cart frame is fit for use; however assumption was not documented or validated. In addition, no walkdown was performed until discovery of tipping issue per SCR N-2016-20911.
2016/11/17	N-2016-28644	Machine Delivered Scrape Project 28-66600: Pre-P1751 Commissioning - Incorrect Wiring Configuration from Umbilical to CWEST In-Vault Cart	During the execution of K-402013-PSWI-5004 R02 (I-INS-30744-00005 R0) Step 3.3 Loopback connector testing of the UDM umbilical, PL210, and catenary it was discovered that Pin E (#5) of CBL100 was an open connection where a specific resistance was expected from the resistors located in the loopback connector connected to the female connector of the umbilical.
2016/11/18	N-2016-28771	Machine Delivered Scrape Project 28-66600: Pre-P1751 Commissioning, CWEST Wet Module and Test Coupon Alignment	During initial commissioning of the CWEST Wet Module (CWM), it was discovered that the reference scribe lines on the CWM Coupon were not aligning with the CWM Top-Dead Centre (TDC) or any key CWM features as intuitively expected. The coupon has fixed orientation and they could not get it to align with TDC, as expected.
2016/11/24	N-2016-30245	Machine Delivered Scrape Commissioning - CWEST tool motor rotation issue	During CWEST tool non-cutting activities, high and unstable motor current was observed and motor would not stall as expected.

Event Date	SCR Number	Title	Description
2016/11/24	N-2016-29573	P1751 CWEST Commissioning - delay due to CWEST tool motor rotation issue	During CWEST tool non-cutting activities, high and unstable motor current was observed and motor would not stall as expected.
2016/12/19	N-2017-01242	Machine Delivered Scrape Project 28-66600: CWEST Tool #1, High No load Running Current in Pocket C	Under PO#255755, equipment vendor notified OPG that they discovered a high no load current in cutter pocket C of CWEST Tool Head #1 leading to a false trigger during the cut sequence when performing cutter qualifications. They were able to confirm that this is not a spurious issue but an actual mechanical problem.
2017/02/24	P-2017-04728	Machine Delivered Scrape Project #28-66600 – Wet Module/CFTS Issues Requiring Improvement	The following issues have been with the CWM/CFTS cart combo raised: 1. The CFTS cart with Wet Module on top is difficult to maneuver as a result of the additional weight needed to correct center of gravity issues (documented in SCR N-2016-20911). 2. In order to manipulate some Wet Module components, workers must reach above shoulder height without a working platform. This is not ideal from an ergonomic perspective. 3. The existing CFTS cart frame has seen some age related degradation (e.g. fatigue, past use)
2017/04/03	N-2017-07871	Machine Delivered Scrape Project 28-66600 Execution - Chip Tray Indexing Issue	Chip Tray Indexing Issue
2017/04/05	N-2017-08175	Machine Delivered Scrape Project 28-66600 Execution: P1751 CWEST Critical Path Delay - Imperfect Oxide Cut	Signature plot for oxide cut was not as expected during M11 Roll Joint cut 1 (RJ1). A long ramp in on an Oxide cut appeared to be a false current trigger.
2017/04/07	P-2017-08318	P1751 – CWEST Oxide Chip Lost – M11 - Recovered	While performing chip tray retrieval per I-INS-30744-00024 R001A after the CWEST tool was taken off-channel during execution in P1751, it was expected that the first layer of the cut—in the form of an oxide chip from the fuel channel—would present itself in one of eight slots in the chip retrieval tray, but this did not occur. This oxide cut was not completed; it was a portion of an expected oxide cut taken by the CWEST tool. Such a cut was produced due to a high no-load running current resulting in a false trigger during the cut sequence. This oxide cut had different physical properties (ex. lower weight, density, etc.) than a typical oxide cut produced by the CWEST tool. Refer to SCR N-2017-08175.

Event Date	SCR Number	Title	Description
2017/04/28	N-2017-10219	Machine Delivered Scrape Project 28-66600: Unsuccessful Completion of P1751 CWEST Scrape Scope of Work	The Machine Delivered Scrape Project experienced several issues with the CWEST tool and supporting equipment during off-reactor integration/commissioning, as well as on-reactor usage, which resulted in delays to execution activities, and finally an inability to complete the Pickering Unit 5 2017 Outage Fuel Channel Inspection Scope of Work (as specified by NK30-SOW-31100-10007-SCN3-R000).
2017/10/28	N-2017-25909	Machine Delivered Scrape Project 28-66600: CWEST Equipment E-Stop Lamp Illumination Mod Problem	During P1861 East Annex Universal Delivery Machine System (UDS) testing, it was discovered that the E-stop lamps on CWEST equipment (P058-30744-HYD1, P058-30744-IVC1, P058-30744-SCADA1) stay illuminated after a UDM Master Reset. The adverse condition occurred because there was a misunderstanding in the interpretation of the scope change requirements between OPG and Kinectrics.
2017/11/09	N-2017-25946	Machine Delivered Scrape Project 28-66600: CWEST In-Vault Cart E-Stop Lamp Remained Lit After Reset	During execution of System Power Up (K-402013-PSWI-5005-R06) to support pre-P1861 testing of the UDM Software Release 10 (WO # 05173057-24), the In-Vault Cart E-Stop lamp remained illuminated after the CWEST HMI E-Stop was reset.
2017/11/10	N-2017-26294	Machine Delivered Scrape Project 28-66600: CWEST 058-30510-PL804-2 Axial/Rotary Position Errors	During UDS testing, it was discovered that axial and rotary positions were displaying irrationally on CWEST SCADA and SLAR SCADA.
2017/11/22	N-2017-27412	Machine Delivered Scrape Project 28-66600: CWEST Tool Head #2 Oxide Chip Traceability Issues During Commissioning	Chip Traceability Issues (P1861)
2017/12/16	N-2018-00149	Machine Delivered Scrape Project 28-66600: CWEST System Communications Fault During Tool #3 Integration on UDM	A CWEST system communication fault occurred during the CWEST tool #3 integration with UDM in the East Annex. Scrape #2 was completed with a normal unremarkable scrape profile displayed (expected), followed by a communications fault (unexpected). Control system was unable to advance chip tray as a result of repeat communication issues. NOTE: similar conditions were experienced at vendor site with troubleshooting ongoing.

Event Date	SCR Number	Title	Description
2018/01/11	N-2018-00795	Machine Delivered Scrape Project 28-66600: Abnormal Scrapes Discovered During CWEST Tool #2 Integration Chip Recovery	While completing the Integration Plan for CWEST Tool Head #2, 6 cuts were taken on the CWEST wet module coupon #1. While performing the chip tray retrieval, the following issues were immediately observed using the camera system: Broken chip fragment in Chip Tray Position 1 Expected chips in Chip Tray Positions 2 through 5 Missing oxide chip in Chip Tray Position 6 No chips were found in Chip Tray Position 7 and 8.
2018/02/18	P-2018-04209	P1861 Delay to UDM CWEST commissioning	When performing tool head operational checks WO 5095210-18, movement of sample trip tray stopped and didn't respond to move command
2018/02/18	P-2018-04186	P1861 UDM - Delay to CWEST commissioning - chip tray install	Chip Traceability Issues (P1861)
2018/02/20	N-2018-04329	P1861 CWEST Channel C10 Scrape Potential Traceability Issue	Chip Traceability Issues (P1861)
2018/02/21	N-2018-04441	P1861 CWEST: Channel M02 Chip Retrieval Findings	Chip Traceability Issues (P1861)
2018/02/23	N-2018-04652	P1861 CWEST: Channel P05 Chip Retrieval Findings	Chip Traceability Issues (P1861)
2018/02/24	N-2018-04667	P1861 - Lost Chip and Traceability Issues During CWEST Scrape Campaign on Channel R20	Chip Traceability Issues (P1861)
2018/02/25	N-2018-04709	P1861 CWEST: Chip Retrieval Findings on G18	Chip Traceability Issues (P1861)
2018/02/25	N-2018-04679	P1861 CWEST: Fault During Tray Index on G18	During CWEST operations on G18, after the completion of the third scrape, a motor overcurrent fault occurred during the tray index sequence preventing the completion of the index to position #4.
2018/02/26	N-2018-04741	P1861 CWEST: Channel L15 Chip Retrieval Findings	Chip Traceability Issues (P1861)
2018/02/27	N-2018-04887	P1861 CWEST: Channel P17 Chip Retrieval Findings	Chip Traceability Issues (P1861)
2018/02/27	N-2018-04898	P1861 CWEST: Oxide Cut Signature Plot on Channel S12	During the oxide cut for RJ#1 on channel S12, the motor signature plot was not as expected.
2018/02/28	N-2018-05013	P1861 CWEST: Channel S12 Chip Retrieval Findings	Chip Traceability Issues (P1861)
2018/03/01	N-2018-05552	Machine Delivered Scrape Project 28-66600: Trend of CWEST Chip Capture and Traceability Concerns During P1861	Chip Traceability Issues (P1861)
2018/03/01	N-2018-05100	P1861 CWEST: Channel J08 Chip Retrieval Findings	Chip Traceability Issues (P1861)

Event Date	SCR Number	Title	Description
2018/07/16	N-2018-15886	P1881 CWEST Integration: Tool #003 Cutter Actuator Issue	During P1881 CWEST Integration activities in the East Annex following Integration Procedure I-OP-30744-50001 and I-INS-30744-00012, Tool Function Checks - Appendix B.1 Clamp and Cutter Actuator Hydraulic Functional Check, vendor staff discovered that the Tool #003 cutter actuators were not stroking as expected. Prior to the start of CWEST Integration the vendor concluded that Tool #003 is considered ready for P1881 integration activities at PNGS through functionality and readiness assessments documented in K-402074-TM-0001 R01- Tool 3 Functional Assessment.
2018/10/21	N-2018-22190	P1881 CWEST: Fuel Channel H02 Chip Retrieval Findings	Chip Traceability Issues (P1881)
2018/02/22	P-2018-04497	P1861 UDM - CWEST: Channel O09 Two Oxide Chips Missing	Chip Traceability Issues (P1861)
2018/10/22	N-2018-22268	P1881 CWEST: Fuel Channel B17 Chip Retrieval Findings	Chip Traceability Issues (P1881)
2018/10/23	N-2018-22352	P1881 CWEST: Fuel Channel D08 Chip Retrieval Findings	Chip Traceability Issues (P1881)
2018/10/25	N-2018-22589	P1881 CWEST: Fuel Channel J10 Chip Retrieval Findings	Chip Traceability Issues (P1881)
2018/10/25	N-2018-22559	P1881 CWEST: Fuel Channel K12 Chip Retrieval Findings	Chip Traceability Issues (P1881)
2018/10/26	N-2018-22651	P1881 CWEST: Fuel Channel N08 Chip Retrieval Findings	Chip Traceability Issues (P1881)
2018/10/26	N-2018-22606	P1881 CWEST: Fuel Channel L15 Chip Retrieval Findings	Chip Traceability Issues (P1881)
2018/02/26	P-2018-04804	P1861 CWEST - Delay due to lost chip during L15 retrieval	Chip Traceability Issues (P1861)
2018/10/27	N-2018-22708	P1881 CWEST: Fuel Channel T06 Chip Retrieval Findings	Chip Traceability Issues (P1881)
2018/10/27	N-2018-22699	P1881 CWEST: Fuel Channel R19 Chip Retrieval Findings	Chip Traceability Issues (P1881)

Appendix D: SCRs related to Technical Oversight & Procedural Adherence

Event Date	SCR Number	Title	Description
2015/06/02	N-2015-16396	MDS Project – Vendor ITP not accepted prior to test	The vendor submitted the ITP for MDS console and cable build to OPG for review; however, did not follow up with OPG and started testing prior to gaining acceptance of this ITP. It is a requirement of Z299.3 to have customer acceptance of the ITP prior starting testing.
2016/02/24	N-2016-17956	Change papers not signed attached to Design EC 133017 CWEST SCADA AND PICKERING UDM INTERFACE PANEL AND CABLING	Extended assessment of the change papers prepared for Design EC 133017 have revealed additional flaws in R000.
2016/05/05	N-2016-12432	MDR Rejection: CWEST Maintenance & Test Rigs	A revision to I-MDR-30744-50001 was submitted to the IMS design authority for approval. The submission through smart form was rejected as the revision history did not properly match the changes to the body of the document. The changes were minor in nature, as they did not impact the technical contents in the body of the document.
2016/05/25	N-2016-14084	Machine Delivered Scrape Project 28-66600 - CWEST Sample Retrieval Cart Final COMS Quorum	During COMS meeting it was discovered that due to emergent work, UDM/CFTS SRE could not attend final COMS meeting and therefore quorum was not met. Emergent work was due to issues with UDM campaign.
2016/06/07	N-2016-15222	Machine Delivered Scrape Project 28-66600: Delay in Free Issuing Materials to Vendor due to Rapid Response Process Challenges	A breakdown in the procurement process between IMS Projects, Warehouse and Supply Chain occurred, and resulted in the delay of an end fitting shipment. This delay subsequently impacted the delivery date of the CWEST Wet Module CFTS.
2016/06/08	N-2016-15449	Design EC 133017 CWEST SCADA and Pickering UDM Interface Panel and Cabling rejected by approver	Design EC 133017 R002 was submitted for approval to Design Section Manager. During the approver's review following errors were discovered: Change paper NUCL-DRAW-30510-10108 was scanned and attached to the bookmarked record without an approval signature. Approval of change papers attached to bookmarked record was performed by an individual not qualified.

Event Date	SCR Number	Title	Description
2016/07/21	P-2017-01015	Machine Delivered Scrape Project 28-66600: outdated MSDS Datasheets and Incorrect Chemical Amounts Submitted to Chemistry Department	PO # 255755. Outdated MSDS Data sheets were used for the assessment of certain chemicals to be used on the CWEST tool head. Additionally, in some cases, the incorrect chemical amounts were submitted to be used for chemical assessments. This issue was discovered when the project team was compiling a memorandum for the chemical approvals.
2016/07/28	N-2016-19251	P1671 CWEST E/A Commissioning - E-Stop Cable (from PL804 to PL801) Issue	During setup of the CWEST system for East Annex testing, it was discovered that the E-stop cable which was to connect from PL804 to PL801 would not mate on one end because an incorrect connector was selected as part of the design.
2016/08/02	P-2016-19651	Late HFE Worksheets (Part A) for MEC131600 (CWEST Wet Module)	Part A of the N-FORM-10221 Human Factors Engineering (HFE) Worksheets for CWEST Wet Module (MEC131600) is not being completed prior to completion of detailed design (not approval).
2016/08/15	N-2016-20910	Machine Delivered Scrape (MDS) Project - Wet Module CFTS Cart Legacy Configuration Management Issue for Casters	During the integration of the new Circumferential Wet Scrape Tool (CWEST) Wet Module, it was discovered that the Wet Module cart had a configuration management issue: the casters found on the wheels of the cart were replaced, but do not match the originals.
2016/08/15	N-2016-20908	Machine Delivered Scrape (MDS) Project - Wet Module CFTS Cart Legacy Configuration Management Issue for Jacks	During the integration of the new Circumferential Wet Scrape Tool (CWEST) Wet Module, it was discovered that the Wet Module cart had undocumented modifications. Specifically, jacks were found on the cart and the field crew has advised the casters installed have been replaced without updating the BOM.
2016/08/15	N-2016-20911	Machine Delivered Scrape Project - Wet Module CFTS Cart Center of Gravity Issue	The Wet Module used to support the new Circumferential Wet Scrape Tool (CWEST) becomes off-balance when sliding table is extended forwards. This poses a conventional safety concern for those workers required to manually manoeuvre the cart, particularly if there are any surface changes to the path of movement e.g., cable protector.
2016/08/26	N-2016-21458	Machine Delivered Scrape Project - Wet Module CFTS Cart Welding Issues Discovered	While addressing the center of gravity issue for the Wet Module (see contributing SCR) it was discovered that the weldment drawing did not specify exiting welds found on the cart.

Event Date	SCR Number	Title	Description
2016/09/08	N-2016-25790	Machine Delivered Scrape Project 28-66600: Equipment Labels on CWEST Hoses Similar to SLAR Hoses	CWEST and SLAR HOS500 and HOS501. Although the hoses are uniquely identified and labeled in accordance with their full equipment code, it is still an error likely situation that a wrong hose be identified for work in the field. Both the Cwest and SLAR are setup at the same during UDM install in the Vault.
2016/09/13	N-2017-16213	Calculation Report - CWEST Cart counterweight structural loads accepted by non-qualified personnel	While designing CWT/CFTS Cart Tow Bar, the calculation submitted by the Vendor were reviewed. It was noted that I-CALC-30744-50007, Calculation Report - CWM/CFTS Cart Counterweight Structural Loads was accepted by non-qualified personnel.
2016/09/19	N-2016-23274	Machine Delivered Scrape Project 28-66600: Time Required for CAT ID Creation Impacting Project Schedule	The position in the queue for these CATID requests to be created do not provide sufficient time to order these materials and have them on hand for installation during the Machine Delivered Scrape Project P1751 integration window.
2016/09/21	N-2016-23594	Machine Delivered Scrape Project 28-66600 - Sample Retrieval Cart - Design EC 133346 Platform Load Rating Issue Discovered During 100% Design Review	During review of drawing package for Design EC 133346 a concern was raised that the load rating on the working platform may not be sufficient. The load rating is 600 lbs for 3 persons. The concern is that some people may weight more than 200 lbs, or may bring along and stage additional equipment onto the platform. This issue was missed during the COMS process.
2016/11/04	N-2017-05054	Machine Delivered Scrape Project 28-66600: Master EC 126526 Release Milestones	As part of review for partial AFS on MEC#126526, it was discovered that the DOM REL#3 milestone associated with DEC#130034 was not signed off prior to use of the two CWEST Hydraulic Cart hoses during East Annex Testing. However, the DA REL#3 was signed off for DEC#130034 prior to field use.
2017/02/01	N-2017-03488	Machine Delivered Scrape Project 28-66600: Minor EC133935 Revision Required to Capture Field Fit Issue in UDM PL210	SCR# N-2016-30245 identified rewiring requirements in 30510-PL210. In order to make the required changes to UDM PL210, EC133935 REV005 was initiated and approved 20JAN2017. When the Control Tech went to install the rewiring arrangement it was discovered that the UDM Umbilical TP leads were too short to make the required connections according to the EC133935 REV005. The EC had to be changed to meet the umbilical length issue.

Event Date	SCR Number	Title	Description
2017/02/10	N-2017-04032	Machine Delivered Scrape Project 28-66600 - Change in Individuals from Final COMS to Partial AFS	From the Final COMS to Partial AFS, many of the signatories have changed for Sections B, C, D, E and F across the following CWEST packages: CWEST QDP - I-DP-30744-50000 MEC#131116 - CWEST Power and Control Interfaces MEC#126528 - CWEST Sample Retrieval Cart MEC#126526 - PNGS UDM MK1' Umbilical
2017/02/13	N-2017-03736	CWEST Wet Module (CWM) very difficult to maneuver.	MDS sample retrieval cart very difficult to maneuver. Cart had new caster installed after the additional weight installed on the back side of the frame to move C of G towards the center. Casters have 3" wide wheels that makes It very hard for them to swivel. Potential heavy mechanics, pinch points and body mechanics hazards present. This problem is going to get even worse when the cart is going to be used in the reactor building as the floor there is not as even and smooth as it is in the east annex.
2017/02/24	P-2017-04728	Machine Delivered Scrape Project #28-66600 – Wet Module/CFTS Issues Requiring Improvement	The following issues have since been raised with the CWM/CFTS cart combo: 1. The CFTS cart with Wet Module on top is difficult to maneuver as a result of the additional weight needed to correct center of gravity issues (documented in SCR N-2016-20911). 2. In order to manipulate some Wet Module components, workers must reach above shoulder height without a working platform. This is not ideal from an ergonomic perspective. 3. The existing CFTS cart frame has seen some age related degradation (e.g. fatigue, past use)
2017/02/27	N-2017-04896	Machine Delivered Scrape Project #28-66600 – Wet Module/CFTS Issues Requiring Improvement	The following issues have since been raised with the CWM/CFTS cart combo: 1. The CFTS cart with Wet Module on top is difficult to maneuver as a result of the additional weight needed to correct center of gravity issues (documented in SCR N-2016-20911). 2. In order to manipulate some Wet Module components, workers must reach above

Event Date	SCR Number	Title	Description
			shoulder height without a working platform. This is not ideal from an ergonomic perspective. 3. The existing CFTS cart frame has seen some age related degradation (e.g. fatigue, past use)
2017/03/14	N-2017-06541	Machine Delivered Scrape Project 28-66600: DEC 134215 - Change in Individuals from Final COMS to Partial AFS	From the Final COMS to Partial AFS, some of the signatories have changed for Sections B, C, D, E and F across the DEC 134215.
2017/04/01	N-2017-07799	Machine Delivered Scrape Project 28-66600: P1751 off-reactor commissioning – In-Vault Cabling Too Short	During execution of CWEST In-Vault connections, it was discovered that CBL24, which connects the CWEST In-Vault cart and the ANDE Cart via CBL23, did not have enough length. It was short by about ~5ft.
2018/01/28	N-2018-02410	Machine Delivered Scrape Project 28-66600: In-Vault Cart Power Cable (CBL8) Length	During P1861 UDM In-Vault setup, it was discovered CBL8 which is used to power the CWEST In-Vault Cart had insufficient length to reach UDM PL102.
2018/02/16	P-2018-04152	P1861 UDM Delay - CWEST Power Cable Nomenclature Required Update	When replacing cable 8 in west vault, replacement cable did not match the nomenclature of the PC17. Changed replacement cable nomenclature to match the PC17. 1hr delay incurred.
2018/02/16	P-2018-04163	P1861 UDM - Delay to CWEST commissioning	During CWEST initial power-up, unexpected alarm observed on fiber optic connection between ICC and vault. Fiber optic lines were checked and found one line not connected at in-vault cart - 3 hrs delay.
2018/07/19	N-2018-16537	Machine Delivered Scrape Project 28-66600: CWEST Wet Module Equipment Labelling Discrepancy	During a pre-AFS walkdown of the CWEST Wet Module (CWM) for DEC 131060, it was discovered that the equipment label on the CWM was not as expected. The CWM is currently labelled in the field as “P058-30744-CRT003”, however as per the Master Equipment List (MEL), it should be labelled as “P058-30744-CWM1”.
2018/08/14	N-2018-17510	CWEST MEC#131116 - Power And Control - Requirement Traceability Matrix (RTM) template (N-FORM-11621) was modified during the preparation work	Requirement Traceability Matrix (RTM) for Power and Control prepared package submitted to the verifier has not used the recommended template as per N-GUID-00590-00001.
2018/10/20	N-2018-22174	P1881 CWEST: Determination of Rotary Offset Error	During the execution of P1881 CWEST per Work Plan I-WPL-30744-5000004 R01 it was discovered that the 'DM Rotary Cut Position Offset' parameter in the CWEST HMI database was incorrect, the wrong sign (+/-) was applied to the parameter

Event Date	SCR Number	Title	Description
			during manual database entry as per procedure I-INS-30744-00044 R01.