



MANUFACTURING INSPECTION

POWER ELECTRONICS STAFFORD, REDHILL, UK

JUNE 27, 2019

Prepared for: Natural Resources Canada and Nalcor Energy

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Quality Assurance Statement

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1. GENERAL

On June 27th, the Independent Engineer (IE), Argirov Engineering Inc (AEI), together with Nalcor representative, participated in GE factory visit in Redhill, UK. This GE “Grid Automation” manufacturing facility is in the process of developing and testing software designed to control and protect the Labrador Island Link (LIL) HVDC.

IE visited the plant to discuss the work progress and anticipated schedule for rollout to the project sites and commissioning of the LCP HVDC Control, Protections and HMI software. Other discussion topics were the development work progress, milestones achieved to date, deficiencies, anticipated time frame for factory system tests (FST) and factory acceptance testing (FAT).

IE were presented with copies of the “LCP Project Status Review Report – June 13th, 2019” prepared by Amplitude Consultants.

ATTENDEES

IE: Nik Argirov and Vlad Kahle

LCP: Rosanne Williams

GE: Mumtaz Danesh and Richard Smith (part time)

2. MEETING AGENDA

- Safety review and orientation (GE)
- Introductions (All)
- Purpose of IE visit (IE)
 - Communicate adverse impact of schedule slippage
 - Quality assurance and public image consequences of potential system unreliability
 - Confirm test and deliver timelines
- Protection & Control (P&C) software progress update (GE)
 - Punch List Status/Closeout
 - Plan for Completion of Bi-Pole
 - Overall P&C Project Schedule
- Q&A session (All)
- Lunch
- Wrap-up and closeout

3. MEETING NOTES

- Critical issue is to ensure that quality of LIL software is not compromised by compressing the development and test schedules. It was emphasized that HVDC operational reliability is critical to the stability of NL grid.
- IE communicated to GE that the LIL project progress and performance are scrutinized by both the Canadian and Newfoundland governments.

- Electrode line fault locator (ELFL) progress briefing was given by Richard Smith. The system was designed for 4 km fault location accuracy; the high voltage equipment has been installed and tested. Control cabinet is being fabricated and it is expected to be shipped to site in 4 weeks. This system is not deemed to be critical to the operation of LIL.
- Protection and Control hardware has been installed at the sites.
- Preliminary Bi-Pole software version 1.1.1 was delivered by end of May 2019.
- Quality control is the responsibility of a 'Validator' team. They will integrate the software modules during the IST phase.
- HMI development is carried out by a separate team. Operational sequencing is tested as a part of the integration tests.
- GE assured the IE that the quality of the testing will not be compromised by the compressed schedule; it is however anticipated that fewer of type B bugs will be fixed prior to roll out of the software for FAT.
- Software bugs have been categorized as:
 - Type A for anomalies that affect the systems' operational safety. Those bugs have to be fixed prior to releasing the software for on-site operational testing.
 - Type B for deficiencies in alarms and equipment status indications. Type B bugs should be documented and evaluated for the potential risks to the HVDC system operational safety and for any restrictions they impose on the system operations.
- List of the software bugs should be available first week in July. NALCOR will co-sign on completion of the factory tests.
- Planned next steps and time estimates by GE include:
 - June 27: Intended start date for interim site tests (IST).
 - July 17: Software development freeze. All major software bugs to be eliminated by this date.
 - July 27: Originally planned FST start.
 - August 14: Probable FST start.
 - August 27: Planned FAT completion.
 - September 17: Current forecast for software release.

4. COMMENTS AND CONCLUSIONS

While the plan still shows expected completion of the factory acceptance tests (FAT) by the end of August 2019, there is little confidence that the target will be met.

IE suggest it is essential that any software bugs remaining prior to the roll-out be thoroughly evaluated for operational risks and operating restrictions. NALCOR should play a key role in this risk assessment.

As the testing schedule is being compressed and there appears to be just minimum allowance for medium-high software bug fixes. In addition, there is a high risk of not achieving the current milestone dates for Bi-Pole software completion. Consequently, the overall status of the project is red.

In conclusion, it should be noted that the Phased Delivery Approach introduced in April 2017 was not a successful strategy. It did not deliver the expected Mono-Pole operational functionality, and further it introduced schedule delays and additional risks in delivery of the Bi-Pole operations.