PLANT VISIT AND MANUFACTURING INSPECTION MUHR FABRICATION FACILITY IN BRANNENBURG, GERMANY

Prepared for: Natural Resources Canada and Nalcor

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Date: January 1, 2016

Quality Assurance Statement

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1. General

On November 09, 2015, the Independent Engineer (IE), MWH, represented by Nik Argirov, together with two senior management representatives from Nalcor, and the Lower Churchill Project (LCP) Package Engineer responsible for the subject manufacturing contract met with Muhr's company management and performed project equipment (Trash Rack Cleaning System) inspection at the production facility in Brannenburg, Germany.

Muhr has been sub-contracted by Andritz Hydro to supply a Trash Rack Cleaning System. Andrtiz Hydro will complete transportation of the equipment to site, assembly, erection and commissioning, and associated training of Nalcor's operating personnel with technical supervision by Muhr.

The purpose of this plant visit was to verify the status of Muhr's work and to review their QA/QC process relative to the manufacturing of the equipment supplied under this contract.

2. Orientation meeting

The meeting started with a thorough safety briefing followed by overview presentation of the Muhr's history, policies, products and operations. Emphasis on the safety procedures indicates sound management of the facility and care for its staff.

The company was founded in 1959. It has since been an owner-managed operation with a current staff of 70 people and main office and fabrication facility in Brannenburg, Germany. With more than 2000 successful project installations, Muhr has well established presence in the global market.

The company has two divisions: Bulk and Hydro. Under Bulk are the Bulk Loading Systems, Mixing Systems and Railcar Dumping Systems. The Hydro division includes Trash Rack Cleaning Systems, Hydro – Mechanical Equipment, Cooling and Process Water Treatment and Fish Protection Technologies. The scope of the offered services includes consulting, conception & development, production, installation & commissioning, training and aftersales support. The company has the following certifications:

- EN ISO 9001:2008 Quality Management System
- Protection of Environment: Authorized manufacturer
- Welding (for execution of structural steel components):
    - Welding Certificate EN 1090-2 and
    - Conformity of Factory Production Control EN 1090-2

The technical content of the presentation covered:

- Description and pictures of different trash rack operating systems and machines manufactured by Muhr
- Detail description of the Muskrat Falls Trash Rack Cleaning Machine - HYDRONIC M-7000 (The World's Largest Trash Rack Hydraulically Operated Machine!)
- An overview of the three system's modes of operation- Trash Rack Cleaning (manual and semi-automatic), Bottom Debris and Silt Removal (using Poly Grab and/or Clamshell Bucket) and 50t Stop Log Hoist Operation
- An overview of project progress and scope of material supply – The System is fully assembled and with completed FAT. The next phase of the project is shipment of the equipment to site and site installation

3. Factory tour

The Factory tour consisted of an observation and a tour of the already assembled and operational Trash Rack Cleaning System (Photo 1). The machine was already completely assembled and erected on a previously constructed concrete platform equipped with gantry rails and limit switches on the rollway. Due to the size of the equipment, the whole system was erected outdoor at the facility's yard. A tower crane positioned near to the equipment was used during the assembly and erection of the machine. It will also be used for the dismantling of the equipment in preparation for shipping to the project site. The Factory Acceptance Test (FAT) was already completed.

The IE observed the machine in operation. The operator demonstrated different system's actions including, articulated arm forward and upward movements, telescopic arm extension and retraction, rotation of the base console, Vario Cleaning Head (Photo 2) actuation and Gantry Stop Log Hoist operation.

A guided walk through the equipment followed this. Metal staircase leads to the first level platform where the Stop Log Hoist drums are positioned. The drums are operated by a hydraulic drive. The second level deck accommodates the electrical room with all control cubicles and the trust bearing (the main horizontal rotational base for the articulated arm). The operator's observation / control cabin and the machine room (HPU) are located at the third and top level of the machine. The two electrical and machine rooms as well as the operator's cabin are equipped with HVAC (heat, ventilation and air-conditioning) systems. The operator's cabin is equipped also with a TV monitor connected to a video camera installed at the tip of the telescopic arm. The operator can thus monitor the underwater conditions and the position of the arm. The machine controls are conveniently located at the armrests of the operator's swivel chair.

The operator demonstrated excellent proficiencies in controlling and manipulating the equipment with extreme precision.

4. Comments and Conclusions

The following conclusions and comments are presented:

- Muhr's staff key competencies, organization, project management and production facilities are appropriate for completion of the contracted scope of work.
- The IE found the workmanship of the manufacturing very good. The contractor's attention to details and the fabrication execution and assembly were found to be of impressive precision and excellent quality.
- The manufacturing process has been carried out in compliance with very high standards of safety, quality and environmental criteria as well as in compliance with the specified industry standards and contract's technical specifications.
- Giving the state of completion of the equipment it was obvious that Muhr's selection, management and quality control of the third party vendors and subcontractors were of very high standard.
- The project is ahead of schedule. The remaining scope of the work includes disassembly and shipping the equipment to site, reassembly, erection and commissioning, and finally training of Nalcor's operators. It is important to note that the Muhr's operator will be performing the training on site.

APPENDIX NO. 1

Photographs

Photo 1: Trash Rack Cleaning System erected at Muhr's fabrication facility yard

Photo 2: Vario Cleaning Head with hydraulic cylinder / actuator