

Muskrat Falls Corporation

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Mr. Nik Argirov
Independent Engineer
Argirov Engineering
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LTR-MFG001-0032

Dear Mr. Argirov:

Subject: Protection & Controls Issues Identified by Independent Engineer following Factory Visit to Andritz Hemi Controls (Reference: "Meeting in St. John's and Visit to Soldiers Pond, December 3 to 6, 2018", Nik Argirov, March 24, 2019)

As you are aware, we have completed our review of the issues identified by the Independent Engineer in the Protection and Controls design for the Turbine Generator Supply Package CH0030.

Since these points were initially raised, we have discussed them with Nalcor Operations - Power Supply Engineering and they have also met with you and your team to discuss these points and the rationale for the positions taken on them.

This letter is intended to document the disposition of the matters raised, as noted below:

1. Closing of Intake Gate (Over tripping)

The current design approach for the intake gates is that they will be closed for both mechanical and electrical turbine/generator lockout events. This arrangement was influenced by a recommendation from our industry advisory board during the design phase of the project.

After their recommendation was made, the PDT took the additional step of consulting the Centre for Energy Advancement through Technological Innovation (CEATI) International. This exercise revealed that approximately half the users of CEATI drop the head gates for various lockout relay operations as opposed to only dropping the head gates for the mechanical lockout.

Power Supply Engineering concurred with the IE observation that there may be situations where the head gates trip somewhat more frequently than if the head gate trip were not interlocked with electrical protection at Muskrat Falls. However, it is their opinion that the safest approach at this time for the operation of the new assets is to proceed as designed.

Power Supply Engineering has taken note of the IE's observation and will monitor the intake gate operations. After commissioning, the Power Supply Engineering team will monitor intake gate overtripping activities and depending on the results, they will re-evaluate the protection scheme to determine if any changes are warranted. It is worth noting that any trips that require access to rotating parts for inspection will require the head gate to be closed as well as downstream stop logs installed, as this is a requirement of Nalcor's Work Protection Code.

In the absence of a clear industry consensus and the requirement under Nalcor's Work Protection Code, we have elected to leave the arrangements as originally recommended by our advisory board in place.

2. Shear Pin Failure

With respect to the Muskrat Falls wicket gate shear pin failure, Power Supply Engineering advised that all plants reviewed were consistent with application of alarm on shear pin failure. The wicket gate shear pin failure should be an alarm and at the discretion of the operator, the unit can be unloaded and shutdown. During the review it was confirmed the unit can safely operate with up to three shear pin failures. A single point failure indication is acceptable under these circumstances.

An automatic shutdown of a generating unit will immediately take up to approximately 200 MW of generation off line, and Nalcor Operations would prefer to exercise operator discretion before unloading the machine.

Given this consideration, and consistent with Nalcor's current operating practice, we have elected to make no changes to the as-designed shear pin alarm arrangement.

3. Turbine Pit Flood Level

As previously discussed, Andritz Hydro has been directed to provide a high water level alarm indication in the turbine pit and also a second trip relay at a higher level.

4. Electrical and Mechanical Overspeed

As discussed, the final overspeed settings will be confirmed during the commissioning for the turbine/generator units. This is already a planned step in the commissioning process.

5. Intake Gate Emergency Closing Circuits

As discussed, Andritz has been directed to provide and install dedicated head-gate drop buttons in the MF plant control room.

6. Intake Bulkhead Gate – Removal

The approach taken at the Muskrat Falls plant with respect to the removal of the intake bulkhead gate is consistent with other plants in the Nalcor system. Bulkhead gate removal is a manual process and operator experience is relied upon to carry out the steps necessary to remove them. No plants in the Nalcor system have a permissive in place to prevent operation of the bulkhead hoist until pressure between upstream and interstitial space is at or near equalized.

Both Power Supply Engineering and the PDT concur that sufficient overload alarms and equipment protection are already provided, and no further action is warranted.

7. Draft Tube Stop Logs Removal

The approach taken at Muskrat Falls Plant with respect to removal of the draft tube stop logs is consistent with treatment of bulkhead gates and with other plants in the Nalcor system.

There are no plants in the Nalcor system that have a permissive in place to prevent operation of the stop log hoist until pressure between draft tube and tailrace is at or near equalized. As noted above, operator experience is relied upon to remove the draft tube stop logs.

No changes to the design for the systems supporting draft tube stop log removal will be made.

In closing, we appreciate the feedback provided and welcome any further observations and feedback you and the IE team may have in the future.

Yours truly,



Gilbert J. Bennett, P. Eng., FCAE

Executive Vice President, Power Development

cc. Dawn Layden, M. Eng., P. Eng., VP, Engineering Services Power Supply (Acting)