

February 24, 2014

The Honourable Joan Shea

Minister of Environment and Conservation

4th Floor, West Block

Confederation Building

St. John's, NL A1B 4J6

Dear Minister:

I am writing concerning the North Spur instability issue at the Muskrat Falls power development of the Lower Churchill River in Labrador and your responsibilities under the Water Resources Act SNL2002 c W-4.01 as amended (“the Act”) in relation to Dam Safety.

I refer specifically to your “Safety of Works” oversight duties under Section 44 of the Act and your right to issue Dam Safety directives under sub-section 44(3).

I also refer to the requirement under Section 48 of the Act that all persons wishing to construct a dam must file an application in the form set out in Schedule C.

As you know, an application under Schedule C must contain a “Dam Safety Review Report “ and an “Emergency Preparedness Plan”.

I seek your assurance that all the procedural and substantive safety requirements under the Water Resources Act have been met with respect to the North Spur issue at Muskrat Falls.

I also request that, if Nalcor has completed a Schedule C Application, Dam Safety Review Report and Emergency Preparedness Plan with respect to instability and potential catastrophic failure of the North Spur, that they (and all supporting documentation) be made public – so that the projected impact on and the critical warning period available to down-stream residents in Goose Bay-Happy Valley and environs can be determined .

As you and your officials are no doubt aware, the overall reservoir containment system at Muskrat Falls consists of two quite distinct elements.

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On the south side of the river, Nalcor proposes to build a 1 km long complex of concrete dams.

On the north side of the river, Nalcor proposes to rely on a 1 km long 50 m high “natural dam” of sand and sensitive clay called the North Spur.

The risk of a failure of a south side concrete dam has been the subject of a number of “Dam Break” studies which were later filed with the Joint Federal- Province Environmental Review Panel.

In April 2008, Hatch Ltd. submitted The Lower Churchill Project GI1190 - Dam Break Study Volume 1 to Nalcor which analysed several dam break scenarios but in all cases assumed that Gull Island would be constructed prior to Muskrat Falls.

See http://www.ceaa.gc.ca/050/documents_staticpost/26178/39444/at-01.pdf

In May, 2010, a Supplemental Dam Break Analysis was carried out by Hatch Ltd. extending the area of analysis to include Shetshatshiu and Northwest River under the same Gull Island before Muskrat assumption. See http://www.ceaa.gc.ca/050/documents_staticpost/26178/44546/v2-f.pdf

In December, 2010, as the result of a request from the Federal Provincial Joint Review Panel to Nalcor, Hatch Ltd. conducted a further dam break analysis, inundation mapping, and consequence assessment, this time for the case where Muskrat Falls was built first and failed - MF1330- Hydraulic Modeling and Studies 2010 Update Report 3: Muskrat Falls Dam Break Study

See <http://www.pub.nf.ca/applications/muskratfalls2011/files/exhibits/abridged/CE-24-Public.pdf>

All these analyses focused on such issues as:

(1) the amount of warning downstream inhabitants would have before the onrush of water from the dam failure hit the Happy Valley- Goose Bay area - a factor that greatly determines the potential for downstream loss of life;

(2) the probable area that would be flooded; and

(3) the probable consequences of such a flood in terms of both financial loss and loss of life .

Quite apart from whether these studies were adequate with respect to the failure of a concrete dam at Muskrat Falls, **these studies omit any review whatsoever of the failure of the North Spur portion of the Muskrat Falls reservoir containment system.**

For the information of you and your officials , I have attached an extensive commentary and analysis by Dr. Stig Bernander , a world recognized expert on landslides in “sensitive clay” conditions such as exist at the North Spur.

Dr. Bernander’s comments express his serious concerns that there may be serious gaps and errors in the engineering analysis of the North Spur stability issue as made public by Nalcor and their engineering advisors SNC-Lavalin.

I urge you and your officials to study Dr. Bernander’s document very carefully .

Note in particular his references to the potential for the development of “downhill *progressive* landslides” at the North Spur.

Further note that he states in the last paragraph on the first page of his outline, that downhill *progressive* landslides were associated with the fast and devastating 3rd Phase of the infamous Norwegian Rissa landslide of 1978 which saw the ground liquefy and the slide progress 1 km horizontally along nearly level ground in a mere 5 minutes.

In 1981, an instructional video was issued by the prestigious Norwegian Geotechnical Institute which very graphically illustrates this 3rd phase of the Rissa slide.

See <http://www.youtube.com/watch?v=3q-qfNIEP4A>

It is obvious that the issues raised by Dr. Bernander are of the most serious nature possible and go to the Muskrat Falls project’s basic constructability and continued safe operation after project “completion” in 2017/18.

Moreover, it seems obvious given the propensity of Quick Clay to fail suddenly, that the amount of warning time available to downstream inhabitants in the case of the failure of the North Spur could be much shorter than the 0.8 to 1.2 hours of warning time Hatch Ltd has calculated would be available in the case of the failure of one of the south side concrete dams.

And further that the sudden onrush of the combined flood of liquefied North Spur “Quick Clay” together with, and driven by, the released reservoir/river water could have an entirely different and potentially far more devastating character and impact from the concrete dam failures studied.

Dr. Bernander’s analysis also demonstrates that additional, extensive drilling and geotechnical field operations and analysis must be carried out in areas adjacent to the North Spur proper , that until now have apparently not been drilled up and studied by Nalcor or SNC Lavalin .

These basic geotechnical data gaps must be filled before any proper North Spur Dam Break Study can be prepared.

It is also critical, in the name of transparency and openness, that all past and future geotechnical studies relating to soil and instability issues at the North Spur be made public at the earliest possible date.

For the benefit of you and your officials , the following is a non-exhaustive list of important studies that have not been made public by Nalcor. Such studies should be made public together with all associated drilling results, field data and stability calculations.

(1) Acres Canadian Bechtel (1964 and October 1965) Muskrat Falls Development, a report to the British Newfoundland Corporation Limited (particularly Volume 2 and associated drilling and field data);

(2) Lower Churchill Consultants. (June 1976) Muskrat Falls Development Geotechnical Review of 1965 Layout, a report to the Gull Island Power Company Limited.

(3) Acres Consulting Services Ltd. (January 1978), Muskrat Falls Development - Main Report and Appendix, a report to Newfoundland and Labrador Hydro.

(4) SNC-Lavalin Newfoundland Ltd., (March 1980), Engineering Report and 1979 Field Investigation Program, Volumes I to IV, No. 11.99.10.

(5) SNC – AGRA (1998) Muskrat Falls Feasibility Study Volume 2: 1998 Geotechnical Investigations; includes the results of the geotechnical investigations carried out by the consulting firm of Jacques Whitford in the summer of 1998 together with the relevant plates and appendices incorporated after the text of the report.

(6) SNC-Lavalin (2013) North Spur Geotechnical Reports (all) .

Moreover, given the potential of the sensitive clay at the North Spur to fail under relatively small earth tremors, the North Spur warrants a specific seismicity study.

Unfortunately, the seismicity study supplied by Nalcor to the Joint Federal Provincial Review Panel with regard to dam failure at Muskrat Falls is specifically restricted to the “solid” rock conditions that underlie the concrete dams on the south side of the river.

This analysis is not applicable to the hundreds of feet of sensitive clay underlying the North Spur.

See "Report on Earthquake Hazard Analysis: Gull Island and Muskrat Falls Dam sites"
http://www.ceaa.gc.ca/050/documents_staticpost/26178/39444/v2-02.pdf to view the concrete dam only seismic review

It must be stressed that, even in the absence of these critical documents , there is still sufficient documented evidence of the presence of sensitive clays (including "Quick Clay") at the North Spur to ring a North Spur safety alarm bell.

In such a risky situation, where a "natural dam" comprised of "sensitive clay" like the North Spur, is called on to play a critical role in holding back the Churchill River, the highest level of Dam Safety must be achieved and that to reach that goal, a full and independent North Spur Landslide Risk Assessment must be carried out.

A general review of the North Spur Quick Clay instability issue can be found at www.muskratinfo.ca.

I would again urge you and your officials to study the serious concerns raised by Dr. Bernander in the attached document very carefully as any catastrophic failure at the North Spur would bring into question you and your officials' due diligence.

In the words of Dr. Bernander in his Conclusions:

"Based on what I have seen, the evidence points to the presence of serious, apparently unresolved, safety risks associated with possible Downhill *Progressive* Landslide formation at the North Spur part of the reservoir containment system at the Muskrat Falls Hydro Development."

To ignore this statement of serious concern by an internationally renowned landslide expert would be an abandonment of a due diligence to which Newfoundlanders and Labradorians are entitled.

Yours truly,

Cabot Martin

151 Waterfordbridge Road

St. John's, NL

cc Mr. Jamie Chippett, Deputy Minister, Environment and Conservation NL

cc Hon. Derrick Dalley, Minister of Natural Resources NL

cc MWH Canada Inc., Independent Engineer , Lower Churchill Project (by mail)

cc Dr. Gregory R. Brooks , Geological Survey of Canada , Natural Resources Canada

Attachment : Bernander, Stig (January 2014) OUTLINE of SERIOUS CONCERNS on the ADEQUACY of LANDSLIDE ANALYSIS at the NORTH SPUR, MUSKRAT FALLS (10 pages)

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