December 2020

Plain Language Summary - Water Sampling Program
Muskrat Falls Reservoir, Churchill River and Lake Melville

In October 2016, Nalcor Energy engaged Wood Environment & Infrastructure Solutions (formerly Amec Foster Wheeler) to undertake water sampling, as per the Methylmercury Monitoring Plan for Surface Water Quality, Muskrat Falls Reservoir, Churchill River and Lake Melville (the Plan) issued by the provincial government. The Plan provides data to detect changes in methylmercury concentrations in water following the increases in water levels with the creation of the Muskrat Falls reservoir. The Plan is overseen by the Department of Environment, Climate Change and Municipalities (the Department).

Since March 24, 2017, the Department has been releasing ongoing results collected as part of the Plan. The information and data can be viewed on their website at:
https://www.gov.nl.ca/eccm/methylmercury-mrf/

Monitoring and the sharing of data is important for people who harvest country food in and around the lower Churchill River and Nalcor will continue its commitment to ongoing monitoring. Information and collected data is available on the Muskrat Falls Project website at:
https://muskratfalls.nalcorenergy.com/environment/generation/methylmercury-monitoring/

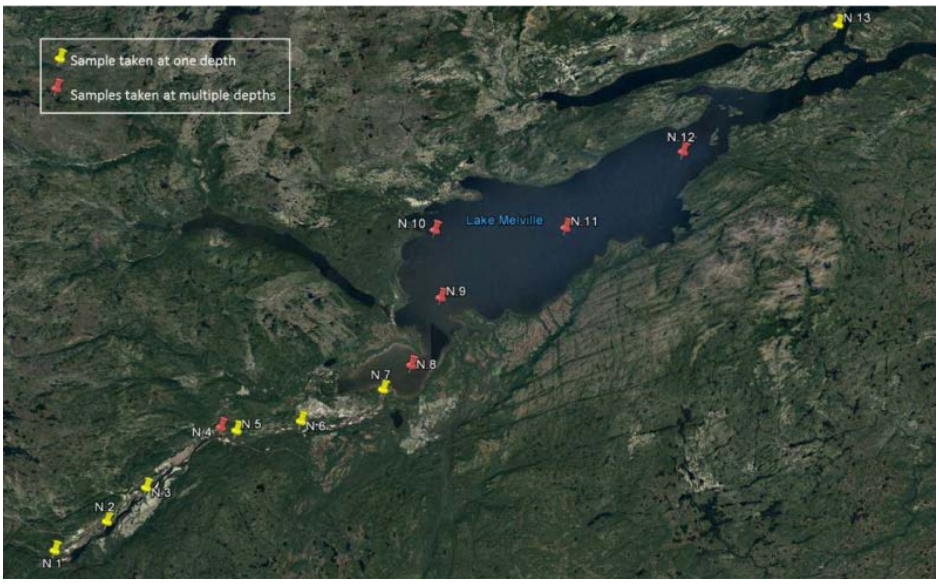
In summary, the measured values in water for the first full year after impoundment are very similar to those predicted by Reed Harris Environmental Ltd. (Harris 2018) and W.F. Baird & Associates Coastal Engineers Ltd. (Baird 2018) and are within safe limits. These values are consistent with what was predicted and expected in the first year following creation of the reservoir. The Muskrat Falls reservoir is reacting in a similar way to other reservoirs following the first year of flooding.

Summary of Water Sampling Program

The Plan includes baseline (before the reservoir was created), impoundment (when water levels were raised to create the reservoir) and post-impoundment (after the reservoir was created) sampling of water at 13 stations located upstream of the Muskrat Falls reservoir area, within the Muskrat Falls reservoir or impoundment area, downstream of Muskrat Falls in the lower Churchill River, Goose Bay and Lake Melville as far east as Rigolet (see Figure 1). The program also collects samples upriver in areas outside the Muskrat Falls reservoir to be used as a natural control for every sampling round. As per an Independent Expert Advisory Committee recommendation, Wood collects samples weekly at all locations when water temperatures exceed 6^{o}C. When water temperatures are below 6^{o}C, sampling occurs bi-weekly unless there is a change in reservoir water elevations by Nalcor which would re-trigger weekly sampling.

Water sampling by Wood began in October 2016 with samples being collected to capture natural methylmercury concentration before changes were made to water levels at Muskrat Falls. In early February 2017, water levels were raised upstream of Muskrat Falls in the reservoir reaching about 22.5m elevation to create the “headpond”. The first set of samples collected after the headpond was created was on February 6, 2017. The process to raise the river to full supply level of 39m elevation, called impoundment, began on August 7, 2019 and was completed on September 5, 2019. Since October 2016, nearly 2,000 samples have been collected and analyzed.

Figure 1 Water sampling locations for Methylmercury Monitoring Plan



Methylmercury Predictions and Measurements

Scientists Harris (2018) and Baird (2018) produced updated methylmercury models to help predict potential changes in methylmercury concentrations in water following the creation of the Muskrat Falls reservoir. These reports are available here: Harris (2018), Baird (2018).

Wood has analyzed the water sample results following impoundment (September 9, 2019 to August 24, 2020) and compared the measured mean annual total methylmercury concentrations in water to these 2018 updated predictions. It is expected that methylmercury concentrations in water reach their peak quickly after impoundment and then begin to decline. Here is the analysis for various locations for the first year following impoundment.

1. *Within the Muskrat Falls reservoir (stations N2, N3 and N4):*
   The mean annual total methylmercury concentration in water is as predicted in this area. The predicted value in water was 0.055 nanograms per litre (ng/L) (0.02 ng/L baseline value plus 0.035 ng/L predicted increase value), or 2.9x baseline. The water samples from the first full year after impoundment show a mean annual concentration of 0.055 ± 0.004 ng/L, an estimated 2.9x baseline.

2. *Downriver of Muskrat Falls (stations N5 and N6):*
   The mean annual total methylmercury concentration in water downriver of Muskrat Falls is near predicted levels in this area. The Harris models (ResMerc, and FLUDEX) predicted that outflow concentrations from the reservoir would be 2-3x baseline in the first year. At the time of Harris' modelling, the Calder et al. (2016) baseline of 0.017 ng/L was used since it was based on a more robust baseline dataset (https://scholar.harvard.edu/files/pbalcom/files/calderothers-est2016.pdf). The predicted mean annual increase in total methylmercury concentration in water was estimated at 0.051 ng/L (3x 0.017 ng/L baseline). Based on samples collected from downriver of Muskrat Falls, the mean annual concentration in the first year after impoundment was 0.055 ± 0.007 ng/L or 3.2x baseline.

3. *Goose Bay (station N8):*
   The mean annual total methylmercury concentration in water is slightly higher than predicted in this area. In Goose Bay, the Baird Hydrodynamic model predicted a 2.1 x increase from baseline in the upper 20m of the water column in the first year after impoundment, or an anticipated concentration of 0.036 ng/L (2.1 x 0.017 ng/L baseline). Based on measurements over the first full year after impoundment, the mean annual concentration in Goose Bay was 0.043 ± 0.006 ng/L or 2.5 x baseline.

4. *West Lake Melville (stations N9, N10, N11):*
   The mean annual total methylmercury concentration in water is as predicted in this area. In western Lake Melville, the Baird Hydrodynamic model predicted a 1.4x increase from baseline in the upper 20m of the water column. This would equate to an estimated increase to 0.024 ng/L. Measurements at these stations during the first full year after impoundment provided a mean annual concentration of 0.024 ± 0.003 ng/L or 1.4x baseline. Note: surface samples were relatively higher in concentration than those collected near the halocline but all would be in the upper 20m of the water column. The halocline is the level where the salt water meets the fresh water.

5. *East Lake Melville (station N12):*
   The mean annual total methylmercury concentration in water is slightly higher than predicted in this area. In eastern Lake Melville, the Baird Hydrodynamic model predicted a 1.3x increase from baseline in the upper 20m of the water column. This would equate to an estimated increase to 0.022ng/L. Measurements at this station during the first full year after impoundment provided a mean annual concentration (surface and halocline) of 0.026 ± 0.008 ng/L or 1.5x baseline. Similar to western Lake Melville, surface samples were relatively higher in concentration than those collected near the halocline.

In summary, the measured values in water for the first full year after impoundment are very similar to those predicted by Harris (2018) and Baird (2018) and are within safe limits. These values are consistent with what was predicted and expected in the first year following creation of the reservoir. The Muskrat Falls reservoir is reacting in a similar way to other reservoirs following the first year of flooding.

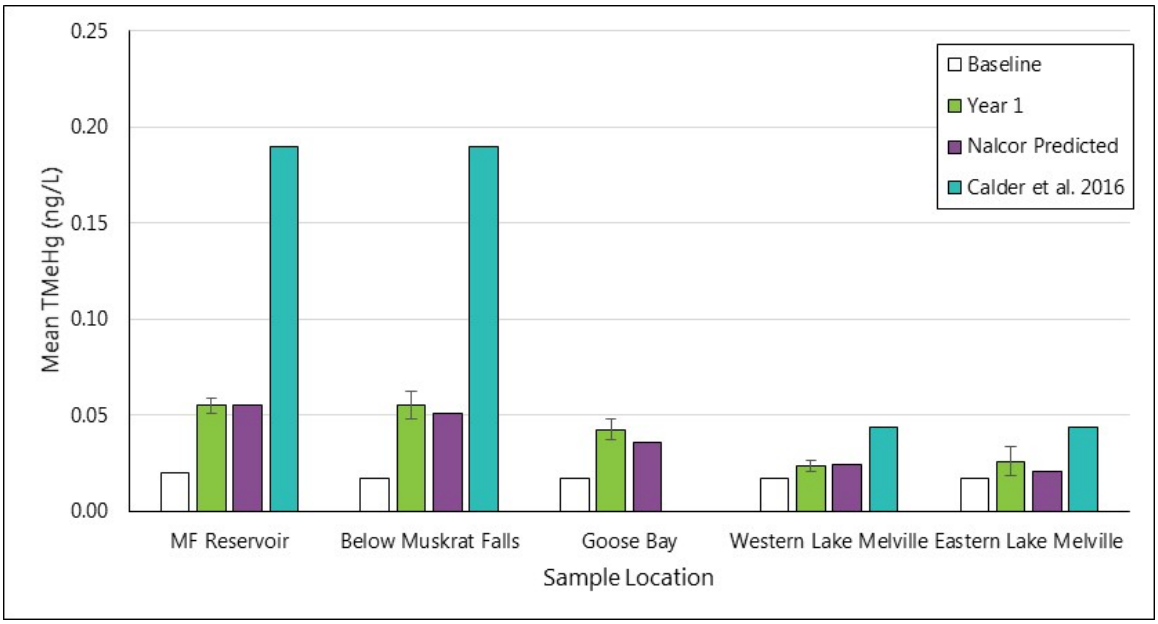
Table 1 provides a summary of the predicted and measured values as discussed in the commentary above. Included in this table are the predicted increases in methylmercury for the Muskrat Falls reservoir and downstream as modelled in 2016 by Ryan Calder (Calder et al, 2016). Figure 2 provides the same data in a graph format.

Table 1 Predicted and measured mean annual increase in total methylmercury concentration in water

Location	Predicted (Harris & Baird, 2018) (ng/L)	Measured* (ng/L)	Predicted (Calder et al, 2016) (ng/L)
Muskrat Falls reservoir (N2, N3, N4)	0.055 2.9x baseline	0.055±0.004 2.9x baseline	0.180
Immediately downstream of Muskrat Falls (N5, N6)	0.051 2-3x baseline	0.055±0.007 3.2x baseline	0.180
Goose Bay (N8)	0.036 2.1x baseline	0.043±0.006 2.5 x baseline	No predicted value
West Lake Melville (N9, N10, N11)	0.024 1.4x baseline	0.024±0.003 1.4x baseline	0.044
East Lake Melville (N12)	0.022 1.3x baseline	0.026±0.008 1.5x baseline	0.044

* September 9, 2019 to August 24, 2020

Figure 2 Predicted and measured mean annual increase in total methylmercury concentration in water



DEFINITIONS

Baseline: a minimum or starting point used for comparisons.

Halocline: the level where the salt water meets the fresh water.

Impoundment: is the process of increasing the water elevation behind a dam to create a reservoir.

Methylmercury: mercury is naturally present in soil, plants and animals, lakes and rivers, air, and in many of the foods we eat every day.

When reservoirs are created for hydroelectric dams, soils and vegetation are flooded and naturally occurring mercury in the soils and vegetation are converted into a different form of mercury known as methylmercury. As vegetation in the flooded area above the dam (plants, leaves, moss, etc.) breaks down and rots, it produces organic carbon. The organic carbon is a food source for certain types of bacteria that can convert mercury into methylmercury. As a result, after water levels rise with flooding (called impoundment) methylmercury levels slowly increase in reservoirs above the dam and also downstream of reservoirs. These increases are temporary.

Muskrat Falls reservoir: the area filled with water from the Muskrat Falls generation facility upstream to Gull Island.

Post-impoundment: after the water levels in the reservoir have reached their full operating elevation level.

Total methylmercury: methylmercury associated with the solids in the sample, as well as the methylmercury in water.