

Independent Expert Advisory Committee

MUSKRAT FALLS PROJECT

169 Hamilton River Road
P.O. Box 2129 Station B
Happy Valley-Goose Bay, NL
A0P 1E0

April 10, 2018

The Honourable Eddie Joyce
Minister of Municipal Affairs and Environment
Government of Newfoundland and Labrador
West Block, Confederation Building
P.O. Box 8700
St. John's, NL
A1B 4J6

Dear Minister Joyce,

As Chair of the Independent Expert Advisory Committee (IEAC) for the Muskrat Falls Project, I am pleased to provide this update on the work of the Committee and to deliver its recommendations.

As you are aware, the mission of the IEAC is to independently assess the adequacy of mitigation, monitoring and management of the Lower Churchill Project, and to provide recommendations to the Responsible Ministers with respect to the protection of the health of the Indigenous and local population impacted by the Lower Churchill Project, with particular focus on methylmercury in the lower Churchill River and downstream.

The IEAC has been extremely busy fulfilling its mission since my appointment as Chair in early August. During the last eight months I have chaired over 40 meetings and overseen the work of an extremely committed group of experts and contracted researchers, resulting in the creation and review of over 100 presentations, reports, technical memos and scientific papers. Throughout this process the Committee remained focused on the primary goal of identifying and making recommendations aimed at reducing the impact, where possible, on the health of Indigenous and local populations affected by the project.

We were pleased that you accepted the recommendations made by IEAC (IEAC Recommendations #1-3) on September 22, and during our deliberations have expanded on and used the information that resulted from those recommendations. It is unfortunate that the Reed Harris methylmercury model (being developed for Nalcor) was not completed in time to inform the IEAC's work, as per Recommendation #3. As you know from our correspondence in September, the Independent Expert Committee (IEC - a subcommittee of the IEAC) was expecting to consider both this model and that produced by Dr. Ryan Calder (when he was at Harvard) to inform their decisions. The IEC did, however, receive several submissions and presentations from both modelers and this information was used to inform their decisions.

At this time, the IEAC wishes to make the following recommendations to the Minister of Municipal Affairs and Environment:

IEAC Recommendation #4: Mitigation of methylmercury impacts

The IEAC was not able to achieve consensus with respect to mitigation of methylmercury impacts. Pursuant to the IEAC's terms of reference, the IEAC held a vote on this matter to reach a recommendation. Based on votes by three of the four voting members (Nunatsiavut Government, NunatuKavut Community Council, Affected Municipalities), the IEAC recommends that Nalcor undertake targeted removal of soil and capping of wetlands for the reduction of both the amount and duration of methylmercury production in the Muskrat Falls Reservoir as outlined in Annex A. These details have been discussed with Nalcor and its consultants.

Innu Nation voted for the option of capping wetlands only. The remaining (non-voting) members of the IEAC supported moving forward without any further mitigation.

All IEAC member opinions are attached (Annex B).

IEAC Recommendation #5: Monitoring

Monitoring is an integral activity of a project of the magnitude of the Muskrat Falls project. Recognizing there is already a strong monitoring program in place that fulfills the obligations of the proponent to regulators, it also remains essential that the monitoring program respond to questions and concerns of those who might be impacted by the project. The documents assembled as part of the current IEAC process will provide a foundation for a continued discussion of this important issue. It is therefore recommended by the IEAC that the next 'phase' of the IEAC, or another independent body yet to be established:

- a. Provide recommendations on the design of a community-based monitoring program that has sufficient statistical power and that answers the questions that Indigenous and local populations have about key indicators (i.e. water, key fish species, seal).
- b. Provide ongoing oversight to the implementation of the monitoring program.
- c. Establish a working relationship with the Indigenous and local population to develop pre-established benchmarks for the interpretation of monitoring results, and an appropriate response to those results. These benchmarks would act as triggers for a set of pre-established actions, including but not limited to dietary advice, public health programming, and accommodation and compensation for impacted local and Indigenous populations as described in other IEAC recommendations.

This recommendation was made by full consensus of the IEAC.

IEAC Recommendation #6: Posting of an Impact Security Fund

There needs to be a guarantee that the Indigenous and local population will have access to plentiful, high quality and culturally appropriate alternate foods, whenever possible country foods, if there are impacts to those foods resulting from impoundment of the Muskrat Falls reservoir. The IEAC recommends that Nalcor Energy and the Province negotiate with the local and Indigenous populations an impact security fund that will provide this guarantee. The fund should be linked to the monitoring program and should be linked to pre-established benchmarks and actions. It should be aimed at ensuring that losses to cultural harvesting practices are minimized in the event that monitoring provides evidence that MeHg exposure has increased to a level that increases risks associated with consumption of country foods. The fund should be significant enough to replace loss of country food and compensate for loss of traditional practices related to the harvesting of that food, and to compensate for impacts on human health, both physical and mental, should impoundment result in risks related to methylmercury concentrations in country foods. The Province and Nalcor should discuss the details of an impact security fund directly with the Innu Nation, the Affected Municipalities, NunatuKavut Community Council and the Nunatsiavut Government, and these discussions should begin immediately, with capacity funding available for any relevant expertise that may be reasonably required.

This recommendation was made by a full consensus of the voting members; member opinions are attached in Annex B.

IEAC Recommendation #7: Management of Human Health

It is imperative that standard advice is provided to pregnant women and the community at large that it is important and safe to eat country foods, including fish and seal, and to choose those that are high in important nutrients and low in methylmercury such as salmon, brook trout and smelt. This message should be woven into public health programming around maternal child health, healthy eating, school health etc. and communicated as a universal message that is not just related to the Muskrat Falls Project. There would be value in an independent body developing and assisting with the dissemination of communication materials, but each community or Indigenous government/organization may wish to take the lead on this task.

a. Current exposure to methylmercury:

Given the current level of concern in the Indigenous and local populations around methylmercury, there is an urgent need to communicate that current practices related to consumption of country food and water are safe. The IEAC strongly recommends that this message be communicated as quickly as possible.

b. Post inundation scenarios and changes in exposure to methylmercury:

As described in Recommendation #5, in the longer term work with the Indigenous and local populations to develop benchmarks for action to ensure an appropriate response and communication plan, including ongoing dietary advice should methylmercury increases in country food be detected through monitoring.

This recommendation was made by full consensus of the IEAC.

I trust that you will appreciate the level of expertise and effort that went into the work of the IEAC. I would be pleased to make myself available to discuss these recommendations with you in more detail and encourage you to contact me without hesitation should you wish to do so.

Sincerely,

A handwritten signature in blue ink, appearing to read 'KR', with a horizontal line underneath.

Dr. Kenneth Reimer
Chair, Independent Expert Advisory Committee

Cc: The Honourable Jim Carr, Minister of Natural Resources Canada
The Honourable Dominic LeBlanc, Minister of Fisheries, Oceans and the Canadian Coast Guard
The Honourable Catherine McKenna, Minister of Environment and Climate Change
The Honourable Ginette Petitpas Taylor, Minister of Health
Yvonne Jones, P.C., M.P, Labrador

Att: Annex A: Details of Recommendation #4: Targeted Mitigation
Annex B: Written Opinions of IEAC Oversight Committee Members

Annex A

Details of Recommendation #4: Targeted Mitigation

Independent Expert Advisory (IEC) Committee

Description of Targeted Mitigation Recommendation

Scenario A:

- Cap all fen and low shrub bog (but not marsh) wetlands ELC areas between 23.5 and 39 m asl with sediments that are low in total organic carbon, locally available and that will be stable (resistant to erosion from water flow) on the reservoir bed.
- Stability of sediment cap is more important than thickness, but assume 50 cm thick for this scenario. Cap should isolate the organic wetland soils, particularly peat accumulations, from the water column.
- Conduct work during frozen ground conditions to minimize ground disturbance.

Scenario B:

- Remove soil from areas that have been previously cleared of trees and vegetation and are accessible by existing roads, between the 23.5 masl contour and the 39 masl contour.
- Exclude areas of slopes greater than 30% and other areas that would require re-profiling.
- Exclude areas that potentially contain sensitive clays (glaciofluvial and glaciomarine)
- Exclude riparian areas.
- Prioritize work on steeper slopes during frozen ground conditions, moving towards flatter areas during thawed ground conditions (to limit runoff from clearance activities).

Annex B

Written Opinions of IEAC Oversight Committee Members

Compiled April 10, 2018

Rationale for NG Decision on Mitigation April 9, 2018

Terms of Reference:

Mission:

To oversee and provide independent assessment of the adequacy of mitigation, monitoring and management measures, and provide recommendations to the Responsible Ministers with respect to those and addition of any further such measures for the protection of the health of the Indigenous and local population impacted by the Lower Churchill Project, and in particular increases of methylmercury in country foods in the Churchill River near Muskrat Falls and downstream, all along the river and including Lake Melville.

Mandate:

The protection of the health of the Indigenous and local populations will guide the work of the IEAC.

With this in mind the IEAC mandate is:

- to use the best available peer reviewed science and Indigenous knowledge, and may consider other relevant research only in addition to and not instead of the above-mentioned peer reviewed science, to assess and recommend options for mitigation of methylmercury impacts, including but not limited to discussing the feasibility, necessity and potential impacts of further clearing of the Muskrat Reservoir;
- to direct the research activities and recommend the design of new monitoring and mitigation measures for the protection of the health of Indigenous and local populations.

Objectives:

Refer to items 1-4 under "Objectives" in the Terms of Reference Document.

Environmental Assessment:

Panel Report

Inuit

The Nunatsiavut Government and Inuit participants stated that the Project would adversely affect their traditional land and resource use activities on land and water within the Labrador Inuit Settlement Area as well as land and water identified in Schedule 12-E area of the Labrador Inuit Land Claim Agreement. They were particularly concerned about the potential for methylmercury contamination because of the importance of harvesting activities in that area for the continuation of their traditional lifestyle. **Should consumption advisories be required in Goose Bay and Lake Melville, the Panel concluded that the Project would have significant adverse effects on the pursuit of traditional harvesting activities by Labrador Inuit, including the harvesting of country food.**

Labrador Inuit Land Claim Agreement

Part 12.2 General

Conservation and the use of the Precautionary Approach are priorities in decision-making that relates to or directly affects Wildlife, Plants or Habitat in the Labrador Inuit Settlement Area.

Methylmercury Science

There are now many scientific studies that now show a well-established, positive, linear relationship between concentrations of organic carbon in flooded soils and associated lower vegetation, and the rate of mercury methylation. Because of this linear relationship any increases in methylmercury in the system will have negative impacts on human health. It is not the impact of the increases in methylmercury in the water that is of concern, it is the bioaccumulation and biomagnification of the methylmercury through the ecosystem to species that Labrador Inuit

consume and depend on. As methylmercury moves through the ecosystem, concentrations increase by magnitudes in the higher trophic level species.

It is imperative that we do what is possible to minimize the amount of carbon entering the system. The only reasonable option to reduce this carbon is the targeted removal of soil and the capping of wetlands.

Conclusion:

After reviewing the peer reviewed science as well as the scientific and Indigenous knowledge that was gathered prior to and during the IEAC process, we feel that the potential impacts and risks in not implementing additional mitigation measures prior to flooding are too high. Following the direction of the Terms of Reference, we must do everything we can to protect the health of the Indigenous and local population through mitigation efforts to minimize impacts from methylmercury before the reservoir is inundated. Once inundated, no additional mitigation measures for methylmercury can take place.

Our Land Claim Agreement says that the use of the Precautionary Approach are priorities in decision making that relates to or directly affects Wildlife, Plants or habitat in the Settlement area. Canada and the Province of NL are signatories to this agreement and signed on to this principle. Labrador Inuit have a communal food fishery licence to harvest from Lake Melville and the Labrador Inuit Settlement Area. Fishing and harvesting in Lake Melville is critical to our food security and way of life. We must do everything we can to ensure that Labrador Inuit have culturally appropriate and healthy food available to them, and that current cultural practices can continue.

We are supporting the IEAC recommendations on Human Health and Monitoring. With regards to Mitigation we are supporting Option 5, the combination of targeted soil removal and wetland capping. This is the best option to ensure the health and wellbeing of Labrador Inuit and was supported by the majority of experts.

Some participants say there are unknown risks to targeted soil removal. Soil removal is not a new concept. Storage sites for this soil can be engineered using best practices. Removal of this soil in frozen conditions would maximize the removal efforts by removing most of the carbon in these areas, while reducing the potential negative impacts of soil removal. The science shows that removal of the carbon will lower impacts from methylmercury in country foods in the Churchill River and Lake Melville ecosystems, which meets the mission of the IEAC.

We recognize that even after “Option 5” mitigation there is still a risk of methylmercury contamination up through the food chain and dietary advice may still be required. The IEAC is also making a recommendation to establish an impact security fund to be negotiated with the impacted parties. The Nunatsiavut Government supported this recommendation on the condition that this recommendation is in addition to the Option 5 mitigation, not as a substitute. Compensation is not mitigation, and there is still time to implement mitigation measures to reduce the production of methylmercury in the downstream environment from Muskrat Falls.

If the harvesting rights of Labrador Inuit, our rights to practice our culture and our health are impacted by the project the Nunatsiavut Government reserves the right to take legal action. We would like this noted in the record.

Carl McLean
Deputy Minister
Lands and Natural Resources
March 13, 2018

NCC Justification Regarding IEAC Final Recommendations

We have reviewed the Nalcor and the Calder models and associated documentation, the IEC recommendations, and the individual opinions of the IEC members. We recognize that there are uncertainties associated with the estimates of MeHg production generated in the IEC Recommendations on Mitigation (March 5, 2018) under the various Scenarios (No Mitigation (Option 1) and Mitigation (Options 2-5)). However, we should bear in mind that uncertainty cuts both ways. These large uncertainties mean that impacts could be substantially smaller than predicted by the various models, but also considerably larger, resulting in unsafe levels of MeHg in country foods.

NCC therefore supports a cautionary and robust approach to mitigating the risks associated with potentially elevated MeHg levels from the Muskrat Falls impoundment. **This multi-pronged approach is submitted as a package of complementary and mutually reinforcing measures and includes:**

- (1) Recommendation #4, the targeted removal of soils and vegetation and the capping of wetlands;
- (2) Recommendation #5, the design and deployment of an Adaptive Monitoring Program overseen by the future IEAC;
- (3) Recommendation #6, the posting of an Impact Security Bond to guarantee access to plentiful, high-quality and culturally appropriate alternate foods, whenever possible country foods, and to ensure that losses to cultural harvesting practices are minimized in the event that MeHg exposure has increased to a level that poses a substantial risk (to be determined) to country food consumption and cultural harvesting practices; and
- (4) Recommendation #7, regarding dietary advice about the importance and safety of country food and other relevant public health information.

NCC proposes that Recommendations #4 to #7 be implemented as a package to protect the health of the Indigenous and local populations. While NCC has agreed with IEAC Recommendation #5, we suggest that the Responsible Ministers and the future IEAC take into account the following additional recommendations related to the monitoring program.

Recommendation #5. Adaptive Monitoring Program (AMP)

The NCC recommends that the monitoring program description (Recommendation #5) be strengthened to ensure that the program is truly an Adaptive Monitoring Program (AMP) and includes, minimally:

- (1) A monitoring plan that is designed with high sensitivity to detect, with *high confidence*, a set of increasingly higher threshold changes (L_1, L_2, \dots) in MeHg exposure levels.
- (2) A set of autonomous and non-discretionary actions that would be implemented should monitoring show that levels have exceeded a certain specified threshold. In short, the plan would specify: if monitoring indicates that MeHg exposure has increased to level L_1 post-impoundment, action set $\{A_1\}$ will be implemented. If, subsequently, levels increase to level L_2 , a second set of actions $\{A_2\}$ will also be implemented. In other words, once a certain threshold of MeHg exposure is reached, a non-discretionary set of actions is triggered, with responsible authorities being obliged to respond as specified. Advance establishment of triggers (thresholds) has two important effects (a) it will depoliticize the process and ensure efficient and effective action is taken quickly if thresholds are exceeded; (b) it provides some reassurance to communities that, should the problem be larger than expected, there is a plan in place that will be deployed automatically and rapidly.
- (3) A set of criteria and associated procedures for ensuring that (a) the AMP includes the elements specified in (1) and (2); (b) the AMP is appropriately deployed; (c) the AMP monitoring results are evaluated and made publicly available in a timely fashion; and (d) compliance by regulatory authorities with the specified trigger actions.

Process: The AMP would be overseen by a future version of the IEAC Committee. Design, deployment and evaluation of the AMP will require a range of expertise rather different than that of the IEAC, including mission-based monitoring design, power analysis, environmental health risk assessment, risk management,

and behavioural sciences. Moreover, expertise in finance, economics and risk management would be required to structure the setting up of the proposed Impact Security Bond and the associated triggers.

Member Representing the Affected Municipalities

Recommendation: Targeted Soil Removal and Wetland Capping

(provided in an email)

I would like to provide my own reasoning for choosing and agreeing upon recommendations that were offered up from the work of the IEC including the Indigenous Experts.

We support the idea that once flooding begins there is a real prediction that levels of MeHg will rise. Based on modelling of both Reed Harris, and Ryan Calder, using the best information available similar outputs were forecasted, and both predict significant increases. The rise of MeHg can be more of what is predicted, and can also be less as well, but any rise does have meaning for human exposure to a toxic contaminant.

Both studies or models show that there will be peak values as well as long term concentrations over decades of time due to flooding and without any mitigation both models show that the risk to human exposure is also going to rise over the same amount of time, which leaves very little mistaking that by doing nothing the risks remain and increase for the indigenous and local populations who do thrive on country foods.

I myself had a great conversation with one of the Indigenous Experts namely Stewart Michelin who in turn helped me to fully understand how the previous 7 months of research and work had led him to believe that option 5, targeted soil removal plus capping of wetlands was the only option that really satisfies the terms of reference using peer reviewed science. He helped me to understand that there is a linear positive relationship between the organic carbon and methylmercury and thus a reduction in MeHg is tied with the amount of soil removed.

We both agreed that trying to remove all the soil would be more harmful than good on a few different levels, and that capping the wetlands alone would not be sufficient and only really partially address part of the problem.

There was a majority of scientists and indigenous experts that all felt targeted soil removal and capping together would be the best method to reduce both the amount of MeHg, and the duration of methylmercury production and this perspective would be best described as the only action that the local communities will agree and support.

I truly hope this offers perspective into our view on mitigation options.

David Kieser

RE: Opinion on IEAC Recommendations for Monitoring, Management and Mitigation

On Behalf of the Innu Nation (Greg Nuna and Peter Penashue, representatives for Innu Nation to the IEAC)

IEAC Recommendation #4: Mitigation of Methylmercury Impacts

The IEAC is making the recommendation that Nalcor undertake targeted removal of soil and vegetation, and capping of wetlands. Innu Nation disagrees with this recommendation.

We are concerned with how this decision was made, the large gaps in the information available to the Independent Experts Committee and the Oversight Committee, and also that the implementation of this recommendation could have more significant impacts than we know about.

Options Presented to the Oversight Committee

Five options for mitigation were presented to the Oversight Committee:

- Option 1 – No further action for mitigation
- Option 2 – Full clearing of soils and vegetation
- Option 3 – Targeted removal of soils and vegetation
- Option 4 – Capping of wetlands
- Option 5 – Combination of Options 3 and 4

The experts appointed to the Independent Experts Committee did not unanimously support any one of these options. Three experts (Dr. Maureen Baikie, Dr. David Lean, and Mr. Jim McCarthy) voted for Option #1, and a fourth expert (Dr. Wolfgang Jansen) voted for Option #4. All 4 of these experts say that the risks involved with targeted soil removal is not something they would accept in exchange for the potential benefits, i.e. a possible (and what some of them described as an insignificant) decrease in the methylation of mercury through the removal of soil and vegetation.

The remaining experts – 2 western science experts (Dr. Trevor Bell and Dr. Jane Kirk) and the 3 Indigenous knowledge experts (Mr. Stewart Michelin, Mr. David Wolfrey and Mr. Etienne Pone) – voted for option 5, saying that it would be an effective means to reduce the methylation of mercury, and they want to see something done before flooding. What we heard from these experts is that this is in part a ‘moral’ decision – so that if future generations look back at what the committee did, it can be said that they at least tried to do something that might avoid impacts.

Avoidance of methylation of mercury is an important objective, but it can’t be pursued without regard to the risks of creating even more impacts on Innu lands, Innu people and Innu rights, and on other people in the area. The problem is that the option of targeted soil and vegetation removal on the scale being suggested is a risky experiment itself. It has never been done for another project and whether it is actually possible is still an extremely important and unanswered question (even the most recent SNC Lavalin report dated March 21, 2018, leaves open questions about timelines, safety, available equipment and infrastructure, etc.).

Risks of Increasing Methylation by Removing Soil and Vegetation

IEC experts have stated there are risks and uncertainty involved in removing any soil; it could result in an increase of mercury methylation in the reservoir. Dr. Wolfgang Jansen suggested some measures to avoid it (based on literature and practices from the forestry industry) in a memo dated September 27, 2017. But, those suggestions pre-date any feasibility study or discussions about what targeted vegetation and soil removal would be possible for the Muskrat Falls reservoir. The IEAC doesn't know, and so Innu Nation doesn't know, if these suggestions are possible or effective in reducing the risk in the case of the Muskrat Falls reservoir.

No Assessment of Impacts on Lands and Environment

There is no assessment or analysis of other impacts that this mitigation measure might have to the surrounding environment. For example, impacts on land use, wildlife and the like. Soil and vegetation removal is based on various assumptions, e.g. the soil will be moved no more than 3 km away, an area will be excavated for disposal of the soils, etc. (see SNC Lavalin Memo #42, and SNC Lavalin report, March 21, 2018). But, the IEAC doesn't know, and so Innu Nation doesn't know, what will be the impact on land use, habitat, harvesting rights in the area, etc. as a result of all these activities that are required to allow for soil and vegetation removal.

The mandate of the IEAC includes making recommendations about the protection of health of Indigenous and local populations "impacted by the Lower Churchill Project, and in particular increases of methylmercury in country foods in the Churchill River near Muskrat Falls and downstream, all along the river and including Lake Melville." The IEAC was not exclusively mandated to focus on impacts to communities in the Lake Melville area; the terms of reference clearly require study and consideration of human health impacts to communities relying on country foods in the Churchill River and near Muskrat Falls as well.

So the recommendations are also supposed to be about the protection of health of Innu and their harvest and consumption of country foods, which includes land animals. The IEAC is then also tasked with ensuring that its recommendations do not harm such harvesting and consumption. Whether or not mass soil removal is actually feasible is not limited just to a question of 'is it possible'. It also should have included questions about whether it was feasible to do it without causing damages to Innu harvesting rights, for example, to Innu lands, to archaeological and cultural resources, and so on.

Questions About Whether Increase of MeHg will be Significant in Country Foods

Some of the experts are critical of Dr. Ryan Calder's predictions and his model. Dr. David Lean and Dr. Jansen say based on a review of empirical evidence, so facts and data gathered from other reservoirs in Canada and about the Muskrat Falls reservoir, they do not agree with Dr. Calder's model. They do not think that the predictions are accurate.

We have been told that there is agreement between Nalcor's and Dr. Calder's predictions about the increase of methylmercury in water. But, Nalcor's consultant had not completed his model in time for consideration. Also, the agreement between the two in predictions is not about increases in fish and other species, so the comparison and information is incomplete. There is no agreement respecting methylmercury increase in species that are consumed. The most commonly

consumed species – Atlantic salmon, brook trout, rainbow smelt and rock cod – will not see significant increases.

We are concerned that the support for targeted soil and vegetation removal is not based on the scientific and Indigenous knowledge expertise, but – as Dr. Kirk put it – it is based on personal morals or a belief that any exposure to methylmercury is dangerous (IEC meeting with OC, March 21, 2018). Dr. Kirk implied that Health Canada guidelines about threshold levels for methylmercury are not the right measure. This is directly contradicted by Dr. Baikie, and other human health experts invited to advise the experts committee, that say that the Health Canada guideline should be followed and there is no indication that it will be changing. Dr. Baikie says that increase in methylmercury in country foods is best managed through dietary advice and community appropriate health programming. That, according to Dr. Baikie, is the best way to mitigate potential human health impacts.

Conclusion

Given the above, Innu Nation is not prepared to support a recommendation that calls for targeted soil and vegetation removal of the Muskrat Falls reservoir. There are significant gaps in the information and research considered by the IEAC, and there are risks involved in targeted soil and vegetation removal; these risks are not outweighed by the potential benefits (i.e. an estimated 20-25% reduction in predicted methylmercury increases).

At this time, Innu Nation would support a recommendation that directs, in the remaining time we have before inundation of the reservoir, of Option #4 – capping wetlands. We support this option, subject to any additional assessment and study required to ensure this is done in a way that minimizes and/or accommodates for any further impact on Innu lands.

IEAC Recommendation #5: Monitoring

Innu Nation supports the IEAC Recommendation #5 about monitoring. We agree that this recommendation is being made by consensus.

IEAC Recommendation #6: Impact Security Fund

Innu Nation supports the IEAC Recommendation #6 about an impact security fund.

IEAC Recommendation #7: Management of Human Health

Innu Nation supports the IEAC Recommendation #7 about management. We agree that this recommendation is being made by consensus.

Dr. Kenneth Reimer

Chair, Independent Expert Advisory Committee

Dear Dr. Reimer:

The Government of Canada is supportive of the constructive work undertaken by the Independent Expert Advisory Committee (IEAC). Canada has participated through the appointment of a federal scientist to the IEAC expert sub-committee, by making the full breadth of federal science available to support the IEAC expert sub-committee's work, and through my participation as a non-voting member on the IEAC Oversight Committee.

As a non-voting member of IEAC and in light of provincial jurisdiction over the recommendations being considered, the Government of Canada anticipates to have a limited role in the implementation of any IEAC recommendations. In light of your request that non-voting members of the IEAC Oversight Committee provide views on the IEAC's expert sub-committee's recommendations, I offer the following comments.

The IEAC expert sub-committee presentation delivered to the IEAC Oversight Committee on March 8 and 9, 2018 and the individual IEAC expert sub-committee members' supporting opinions confirm that there remain points of debate and scientific uncertainty on the relationship between impoundment at the Muskrat Falls facility, methylmercury and human health. In particular, the IEAC expert sub-committee did not reach consensus on the magnitude of expected methylmercury caused by full impoundment at the Muskrat Falls facility, about the effectiveness of each of the various options for targeted mitigation (i.e., wetland capping, targeted soil removal), or the environmental consequence of implementing mitigation options, including potential impacts on fish and fish habitat in the future flooded area.

Considering the outcomes of the IEAC expert sub-committee, as described during the IEAC Oversight Committee meetings of March 8 and 9, 2018, it is the Government of Canada's position that the IEAC should seek, per its terms of reference, to achieve consensus in making recommendations to the Responsible Ministers.

The Government of Canada believes two recommendations would be essential:

- First, an awareness campaign seeking to ensure communities downstream from the Muskrat Falls facility are aware that country food is currently safe for consumption; and,

- Second, an enhanced methylmercury monitoring program, in locations downstream from the Muskrat Falls facility capable of providing communities with information on the presence of methylmercury that could have an impact on country foods.

The Government of Canada would also support a consensus IEAC committee recommendation that the provincial government, Indigenous governments and Nalcor implement an Impact Fund that would, if methylmercury levels in country foods reach pre-defined thresholds, facilitate the continuation of harvesting practices and the ongoing consumption of safe country food or alternative foods.

Thank you for your work as Chair; your efforts and those of the other members of the IEAC, including members of the IEAC expert sub-committee, are greatly appreciated.

Kind regards,

Abla Hanna
Director, Resource Development Project Operations
Natural Resources Canada

Minority Opinion:

Martin Goebel

Option 1: No further action for (physical) mitigation

After reviewing all of the data and presentations that were made by the scientific sub-committee (IEC) since the information was provided to the Oversight Committee, I made the following conclusions. Firstly, I strongly agree with both recommendations for future monitoring and human health management. However, I do not support the physical reservoir mitigations as they were proposed, but that is not to say I support no action for mitigation because the first two recommendations are in fact mitigations.

Modelling was the main tool used by the IEC to estimate the key endpoint of the effect of the Muskrat Falls project on methylmercury (MeHg) and ultimately how it might affect the MeHg exposure on the population. Calder's model¹, originally derived from the Harvard model² was refined due to improved assumptions on inputs and correction of errors during this process. The Calder model however cannot be tested or compared in other existing reservoirs. This is why, in my opinion, real data obtained by measurement from the Churchill River system must be given a high degree of consideration.

Actual surface water monitoring was conducted continuously for well over a year in accordance with a plan agreed to by the IEAC members³. With over 800 water samples analyzed for MeHg and many other parameters, the data do not support the Calder model because at this point in time we need to remember that about 25% of the reservoir area is already flooded. Dr. Iris Koch commented⁴ on the validity of Azimuth's⁵ analysis of that data and discounted it relative to the experimental error but never mentioned the data for Lake Melville specifically which had even lower results on average.

A second source of real data was the soil flux experiment which attempted, in part, to ascertain the relative benefit of soil treatment such as vegetation removal and topsoil removal. Three out of four samples actually produced higher MeHg soil flux than the corresponding untreated soil samples⁶. This current finding is quite at odds with the papers^{1,2} that reported a 14 fold increase in flooded soil flux.

Never the less, assuming the validity of the Calder model in a relative way, it was used to compare the effect of physical mitigation options on MeHg exposure for the area population⁷. The impact in terms of exceeding the Health Canada pTDI was shown using an upper 95 percentile of one population sub-group in one community. But the option of soil clearing and vegetation, using the Calder model showed the risks were only *somewhat* mitigated even for this higher risk sub-group and certainly when looking at the graphs, it is obvious that the benefit of such mitigation is small relative to the modeling uncertainty. Having a worse outcome in terms of methylmercury was clearly in the realm of the modeling predictions.

Massive soil removal from a reservoir has never been attempted anywhere. Consequently, there is no real data to show its actual effectiveness nor can one predict the consequences on reservoir stability, sediment loading, effects of soil placement in the watershed and ultimately whether it will make things worse by releasing more mercury into the system. Dr. Bell, in his verbal presentation to the Oversight Committee, stated that these concerns would be addressed because the excavated material would be removed from the drainage basin. But this was not a project design assumption in the feasibility study⁸.

With or without this soil and vegetation removal option, it will be necessary to plan for implementing targeted intervention as necessary to fully protect the health of effected population group. Indeed, it speaks to the absolute uncertainty of the soil option that there is a discussion around some form of surety, such as a bond, to be in place if soil removal does not work. If such a bond were to be an option for ensuring Government's commitment to take any necessary actions under the monitoring and health management recommendations, the highly risky, questionable and clearly ineffective option of soil removal should be avoided.

- 1 A.T Schartup et al., Freshwater discharges drive high levels of methylmercury in Arctic Marine biota, PNAS 2015
- 2 R.S.D Calder et al., Future Impacts of Hydroelectric Power development on Methylmercury Exposures of Canadian Indigenous Communities, ACS Pub. 2016
- 3 NL, Dept. of Municipal Affairs and Environment, IEAC, Methylmercury Monitoring Plan For Surface Water Quality Muskrat Falls Reservoir, Churchill River and Lake Melville, 2016, http://www.mae.gov.nl.ca/methylmercury_mrf.html
- 4 R. Baker et al., Relationship Between Muskrat Falls Reservoir Elevation and Mercury Concentrations, Lower Churchill River October 2016 – September 2017, Azimuth Technical Memo, Nov 2017
- 5 I Koch, Measurement uncertainty associated with methylmercury concentrations in the Lower Churchill River and Lake Melville from October 2016 to November 2017, Technical Memo, Dec 2017
- 6 P. Balcom, E. Sunderland, Final Report, Churchill River soil flux core experiments, October 2017, Information Package provided to IEAC, Mar 2018
- 7 R.S.D. Calder, Methylmercury exposure forecasts among Lake Melville Inuit under hypothetical scenarios for soil removal at Muskrat Falls and using certain updated and alternative model parameter inputs, Information Package provided to IEAC, Mar 2018
- 8 SNC Lavalin Inc, Muskrat Falls – Soil and Vegetation Removal From the Future Reservoir Area, feasibility report provided to IEAC, Dec. 2017

IEAC Recommendation #4

Nalcor Energy supports Option 1 – No further action for mitigation.

Nalcor does agree with and support both recommendations for future monitoring and human health management. However, Nalcor does not support the removal of soil from the reservoir as proposed by some members of the IEAC.

It is Nalcor's position that there has been no evidence provided by the Independent Expert Committee (IEC) that the unprecedented and extremely costly undertaking of large-scale soil removal provides a measureable benefit in protecting human health. For reference, SNC-Lavalin prepared a preliminary capital cost estimate for targeted soil removal identifying a range between around \$409 and \$742 million, not including contingency, contractor risk premiums and costs associated with potential construction delays for the Muskrat Falls (MF) Project. Nalcor supports the conclusion for no targeted soil removal that was made by the majority of the scientific experts (four of six IEC experts), all of whom were selected by the Oversight Committee. Targeted soil removal as a mitigation measure has not been proven to reduce methylmercury and similar carbon removal studies provide evidence that additional methylation may be the outcome (Jensen, 2018; IEC Opinions on recommendations for Mitigation, 2018; Mailman and Bodaly, 2005;2006). In addition, outputs from the Calder et al. (2016) model, with considerations outlined below, illustrate no effective reduction in the subset of the population that is purported to be at risk of methylmercury-related effects between the 'no further mitigation' and the 'targeted soil removal' scenarios (Calder presentation to IEC 1-Mar-2018).

The precautionary approach in this case would not be to execute a large-scale soil removal program with an unknown/unproven outcome. In addition, there is evidence from the soil core studies undertaken by the IEC that soil removal has no measureable benefit (Kirk presentation to IEC 27-Jan-2018). There will be incremental environmental effects related to this undertaking, including, but not limited to hydrocarbon release, water quality deterioration, greenhouse gas release, wildlife interaction, aquatic habitat destruction, loss of traditional land and land use, and waste management issues. Targeted soil removal will also promote soil erosion along the lower Churchill River banks and could further weaken slope stability. Disturbance of the surface layer of soils has been demonstrated to increase the surface area and enhance the risk of methylmercury production.

The Lower Churchill Project (LCP) was subject to one of the most rigorous environmental assessment (EA) processes in Canada based on the original project description. LCP received release from this process and was sanctioned based on this decision. Given the many uncertainties regarding soil removal as a viable mitigation measure to reduce methylmercury production, the Joint Review Panel suggested that regulators undertake a pilot study to assess the approach. If a decision is made for targeted soil removal, Nalcor would need to submit a project registration document under the NL Environmental Protection Act, Part X, given the undertaking is listed in the EA Regulations, 2003. It is the opinion of Nalcor that the proposed measure would represent a significant variation from the project description from the previous EA and the environmental effects assessment would be void. Nalcor would also need to submit a Request for Project Review given the substantial variation to the existing project description provided for the MF Fisheries Act Authorization (13-01-005). All proposed project activities are subject to Aboriginal consultation as outlined by the Province of NL. All activities related to the MF Project are subject to the conditions of the Impacts and Benefits Agreement with Innu Nation and a decision to undertake targeted soil removal would be the subject of extensive consultation activities. In all these processes, clear understanding of the benefits and risks associated with the proposed activity would be required.

Nalcor and its scientific consultants have undertaken an extensive review of the findings in the Calder et al. (2016) paper. These experts specializing in reservoir studies from across North America, reviewed the available science regarding methylmercury production following reservoir creation and have concluded that the MF reservoir has the characteristics of a low methylating reservoir. This assertion was confirmed with written support from appointed IEC scientists (IEC Opinions on recommendations for Mitigation, 2018). While, expert review (and analysis) identified numerous differences of opinion regarding the predictions made in Calder et.al. (2016), all were unanimous on one thing – the Calder et al. (2016) model significantly overestimates the amount and duration of export of methylmercury to Lake Melville. This position is also supported by the significant amount of MF specific research,

including the Reed Harris RESMERC model (Harris, 2018), the Reed Harris Regression Model (Harris, 2018), the Canadian Reservoirs Comparison Matrix (CRCM; Azimuth, 2012), and the Azimuth analysis regarding mass balance (Azimuth, 2018).

Research at reservoirs, such as from Quebec (Schetagne et al. 1999, Bilodeau et al. 2017) and the Experimental Lakes Area (Hall et al. 1995), where flux and net loss of inorganic mercury from flooded soils has been empirically measured, do not support the magnitude and rate of flux purported by Calder et al. (2016) (664 ng/m²/d). Rather other studies support a much smaller flux that diminishes substantially over time and is not of sufficient duration to load the downstream system to the magnitude predicted by Calder et al. (2016). Thus, the flux rate used by Calder et al. (2016) is not supported by any empirical reservoir-based study and was not validated by any real world data. Another proof of this is in the relative increase in freshwater fish Hg concentrations predicted in Calder et al. (2016) – up to 10x over baseline. The maximum change observed in even the largest reservoirs in Canada, with much greater relative amounts of flooded soil do not exceed 8x (Bodaly et al., 2007, Bilodeau et al., 2017, Paranajape and Hall, 2017 and others). This conveys further conservatism to the Calder et al. (2016) model. In addition, the mass balance analysis clearly illustrates that the MF reservoir could only supply a fraction of the methylmercury needed to change methylmercury concentrations in Lake Melville biota to the post-flood levels predicted by Calder et al. (2016). The mass balance assessment that confirms this lower prediction has been endorsed by expert peers in this area of study (Paterson, 2018; Azimuth, 2018).

The aquatic monitoring program undertaken to support the LCP has collected thousands of fish samples that provide information regarding species distribution in the lower Churchill River, Goose Bay and Lake Melville. The information provided by this program suggests that many of the species identified in the Calder model will have less or no interaction with any potential project-related increases in methylmercury (Amec, 2017;2018). Revisions to the model at the request of the IEC provided more reduction in the forecasted methylmercury levels than the soil removal option alone (Calder presentation 1-Mar-2018; IEC Summary Document – Mitigation). It is our opinion that this data, and the fact that existing concentrations in the system are extremely low, diminish any risk for a potential effect on human health. This opinion is supported by research and data undertaken by experts on this topic.

Finally, it is the opinion of Nalcor and expert consultants that the Azimuth Mass Balance technical memorandum (Azimuth, 2018) and the Aquatic Species Habitat Utilization Overview (Amec, 2018) demonstrate that the most conservative estimates for the magnitude of exposure to biota to methylmercury in Lake Melville is negligible. This conclusion is firmly based on real-world data and provides evidence superior to the modelling approach.

IEAC Recommendation #6

Nalcor Energy supports implementing a mechanism for addressing impacts of the project, but not in addition to IEAC Recommendation #4

Nalcor agrees in principle with IEAC Recommendation #6, however this recommendation should not be considered in addition to the Recommendation #4, which Nalcor opposes for the many reasons noted above; but as a possible alternative to these physical measures.

Nalcor cannot accept the adverse impacts of a large-scale, soil removal program as a project effect. In the opinion of experts in reservoir-based impacts, physical disturbance of soils within the reservoir will result in adverse effects. A security fund should not be used to address impacts that are clearly avoidable.

Nalcor commits to consulting with and working with Indigenous groups and stakeholders in the communities to address any impacts on food security and traditional practices resulting from the Muskrat Falls Project, as proposed during the environmental assessment. Nalcor cannot assume any risk for methylmercury production arising from the implementation of Recommendation #4 (targeted soil removal). Any increase in methylmercury production arising from the implementation of Recommendation #4 would not be a project effect, but rather it would arise from the consequences of the proposed measure.

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