

# Methylmercury at Muskrat Falls

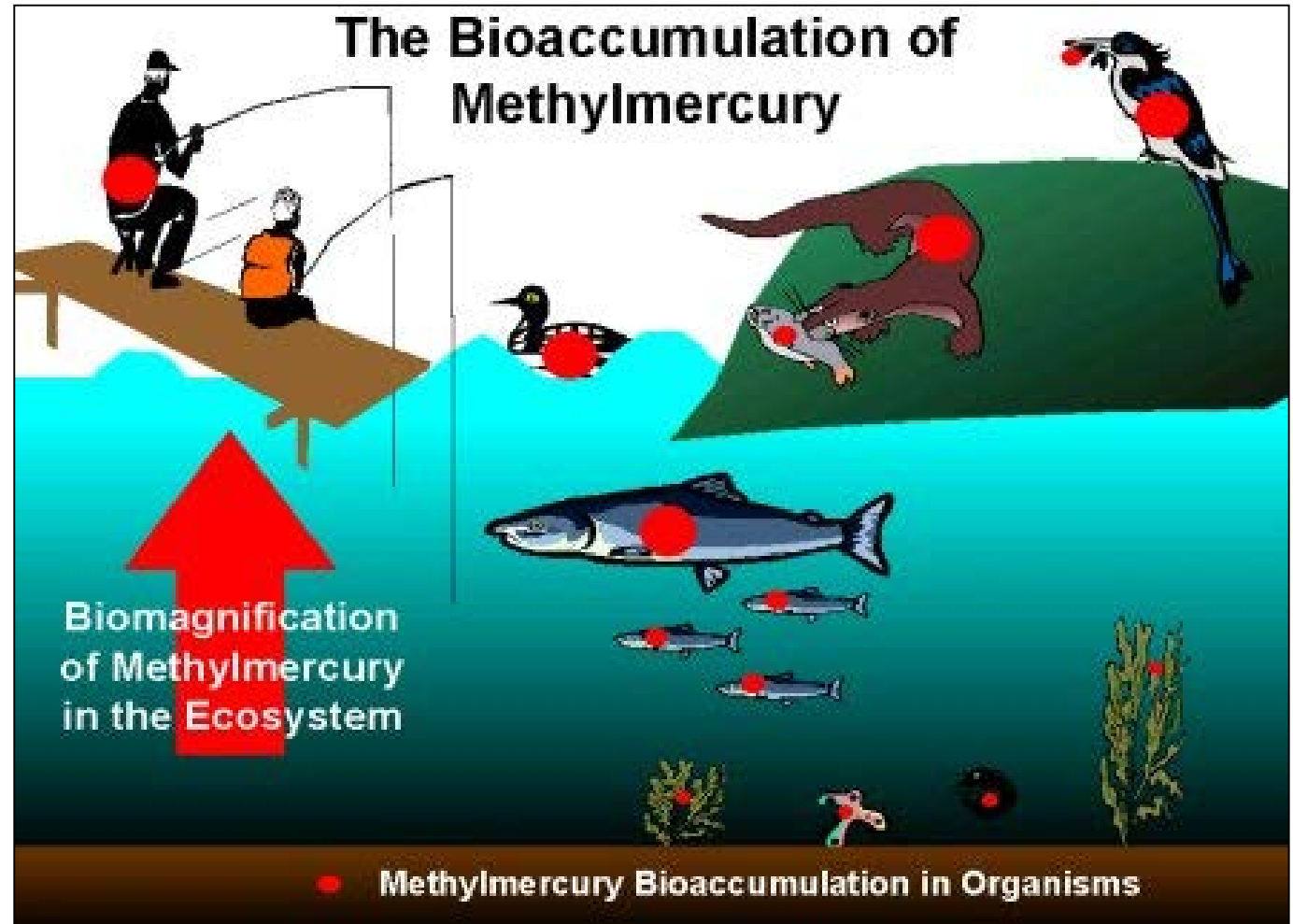


# Overview

- What is methylmercury (MeHg)?
- How might it affect people's health?
- What is the Independent Experts Advisory Committee (IEAC)?
- What were scientists telling us about MeHg at Muskrat Falls?
- What are Nalcor's responsibilities for mitigating MeHg issues?
- What is Government's role in water sampling for MeHg?
- What are the recommendations from the IEAC?

# What is Methylmercury?

- Mercury occurs naturally in the environment (air, soil, and water)
- MeHg is formed from inorganic mercury by microbes.
- Newly flooded reservoirs provide nutrients.
- Bio-accumulates in fish and bio-magnifies in the food web.



# How might it affect people's health?

- MeHg is almost completely absorbed by the gastrointestinal tract and is then readily distributed to all tissues including the brain and across the placenta.
- The developing nervous system is the most sensitive system affected by MeHg exposure; hence, infants and children, in whom the nervous system is developing, are at an increased risk of adverse health outcomes,.
- The primary concern about MeHg exposure at low doses is neurological effects.
- MeHg has a half life of 50-70 days.
- Exposure can be measured in hair samples.

# Canadian MeHg Guidance Values

Group and age	Blood value µg/L	Corresponding hair value, µg/g		Recommended action
<b>Pregnant Women</b> <b>Females, birth - 49</b> <b>Males ≤ 18</b>	<b>&lt; 8</b>	<b>&lt; 2</b>	<b>a</b>	<b>No follow-up required</b>
<b>Pregnant Women</b> <b>Females, birth - 49</b> <b>Males ≤ 18</b>	<b>8 - 40</b>	<b>2 - 10</b>	<b>a</b>	<b>Repeat hair/blood test in 6 months</b> <b>provide dietary advice</b>
<b>Pregnant Women</b> <b>Females, birth - 49</b> <b>Males ≤ 18</b>	<b>&gt; 40</b>	<b>&gt; 10</b>	<b>a</b>	<b>Repeat hair/blood test immediately</b> <b>Schedule appointment with public health official</b>
<b>Females &gt; 50</b> <b>Males &gt; 18</b>	<b>&lt; 20</b>	<b>&lt; 6</b>	<b>b</b>	<b>No follow-up required</b>
<b>Females &gt; 50</b> <b>Males &gt; 18</b>	<b>20 - 100</b>	<b>6 - 30</b>	<b>b</b>	<b>Repeat hair/blood test in 6 months</b> <b>provide dietary advice</b>
<b>Females and males at any age</b>	<b>&gt; 100</b>	<b>&gt; 30</b>	<b>b</b>	<b>Repeat hair/blood test immediately</b> <b>Schedule appointment with public health official</b> <b>Refer to physician or medical toxicologist</b>

# What is the Independent Experts Advisory Committee?

- The Independent Experts Advisory Committee (IEAC) on methylmercury (MeHg) was mandated at the meeting of Oct 25/26, 2016 between the Premier and leaders from three Indigenous groups.
- Structure agreed to included an oversight committee (IEAC) and a scientific sub-committee (Independent Experts Committee – IEC).
- The Committee would include representation from 3 Indigenous groups, Province, Canada, Nalcor, and area municipality reps.
- Terms of Reference and budget of approx. \$700,000 was agreed.
- The task of the IEAC as it was agreed was:
  - 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.



# IEAC Mandate

- The protection of the health of the Indigenous and local populations will guide the work of the IEAC. The mandate of the IEAC was:
  - 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 review the plans for monitoring, monitoring results and key findings arising from research and monitoring, about or relevant for mitigation of methylmercury impacts; and,
  - 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.

# IEAC Membership

## IEAC Staff

Dr. Ken Reimer – IEAC Chair

Marina Biasutti-Brown – Research Director

Roxanne Mitsuk – Senior Administrative Assistant

## Oversight Committee Members and *Alternatives*

Greg Nuna, *Peter Penashue, Donna Paddon, Cathy Guirquis* – Innu Nation

Carl McLean, *Rodd Laing* – Nunatsiavut Government

George Russell, *Brigid Rowan* – NunatuKavut Community Council

Peter Madden, *David Haley* – Nalcor Energy

David Kieser, Mayor NW River, (Jamie Snook, Mayor HVGB originally) – Area Municipalities

Abla Hanna, *Jennifer Dorr, Isabelle LaPorte* – Government of Canada

Martin Goebel, *Haseen Khan* – MAE, Government of NL



# Scientific Sub-Committee (IEC)

## Scientists (Western Knowledge)

Dr. Jane Kirk (Environment Canada) – NG

Dr. Trevor Bell (MUN) – NG

Dr. Wolfgang Jansen (North/South Consultants) – IN

Dr. David Lean (Lean Environmental) – NCC

Dr. Maureen Baike, MD (Health Canada) – Municipalities

Mr. James McCarty (Amec Foster Wheeler) – Province

## Traditional Knowledge Experts

Mr. Stewart Michelin – NunatuKavut Community Council

Mr. Dave Wolfrey – Nunatsiavut Government

Mr. Etienne Pone – Innu Nation

# What were scientists telling us about MeHg at Muskrat Falls?

## Calder (formerly Harvard University):

- Peak MeHg production in reservoir increased to 0.19 ng/L
- Up to 380% increase of MeHg in L. Melville (from 0.016 to 0.06 ng/L)
- 195% increase in MeHg exposure among 95<sup>th</sup> percentile of females and children <12 years old. (from 0.19 to 0.56 µg/kg BW/day)

## Nalcor scientists:

- 1 year average concentration in reservoir 0.067ng/L.
- Effect not expected to extend beyond mouth of Churchill River.
- No human exposure predictions made.

# What are Nalcor's responsibilities for mitigating MeHg issues?

## Monitoring:

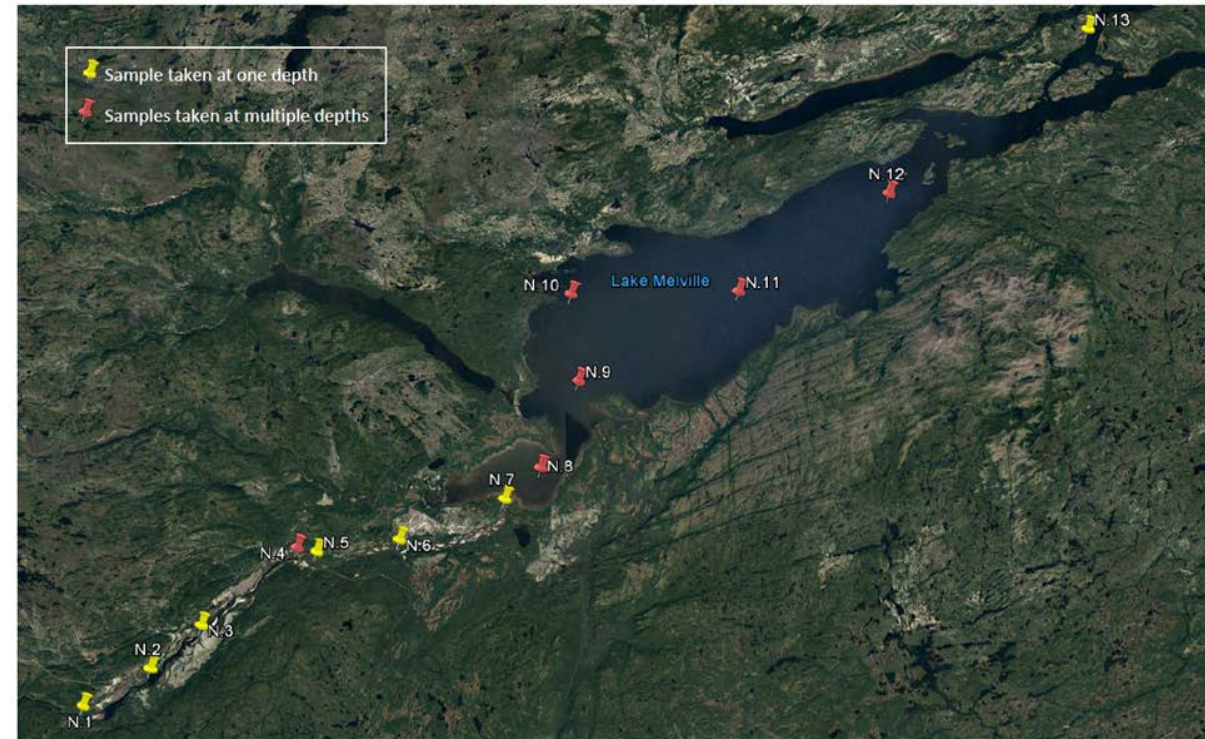
- MeHg Environmental Effects Monitoring Plan - Osprey and River Otter (top predators)
- Aquatic Environmental Effects Monitoring Plan – Hg in water, key fish species, seal, plankton
- Human Health Risk Assessment – MeHg in country foods, human hair samples, dietary surveys
- MeHg monitoring Plan for Surface Water – MeHg, Hg and other water quality parameters throughout the Churchill and Lake Melville system

## Commitment (required by Minister Trimper as condition of HHRAP release June 14, 2016):

*“Should downstream methylmercury monitoring identify the need for consumption advisories as a result of the project, Nalcor shall consult with relevant parties representing Lake Melville resource users. Based on the location of the consumption advisories these users could include Aboriginal Governments and organizations as well as other stakeholder groups. Following consultation, Nalcor shall provide reasonable and appropriate compensation measures to address the impact of the consumption advisory.”*

# What is Government's role in water sampling for MeHg?

- Initial surface water monitoring plan was developed by WRMD environmental scientists and after refinements proposed by NG, was accepted by the IEAC.
- Sample collection and laboratory analysis paid for by Nalcor.
- 13 stations, 6 with multiple depths and 15 parameters
- Bi-monthly sampling minimum
- Results are posted on MAE website.
- MAE continues to provide technical oversight.



# What are the recommendations from the IEAC? (monitoring)

- 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:
- Provide recommendations on the design of a community-based monitoring program that has sufficient statistical power and that answers the questions about key indicators (i.e. water, key fish species, seal).
- Provide ongoing oversight to the implementation of the monitoring program.
- 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 dietary advice, public health programming, and accommodation and compensation for impacted local and Indigenous populations as described in other IEAC recommendations.



# What are the recommendations from the IEAC? (impact security fund)

- Guarantee to access to plentiful, high quality and culturally appropriate alternate foods if there are impacts to country foods resulting from impoundment of the Muskrat Falls reservoir.
- Nalcor Energy and the Province negotiate an impact security fund that will provide this guarantee.
- Linked to the monitoring program
- Pre-established benchmarks and actions
- 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.
- 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.
- Capacity funding be available for any relevant expertise that may be reasonably required.



# What are the recommendations from the IEAC? (health management)

- Standard advice be provided to pregnant women and the community at large that it is important and safe to eat country foods
- 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.
- 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.
- As described in “monitoring”, 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.

# What are the recommendations from the IEAC? (mitigation)

- Based on votes by 3 of the 4 IEAC voting members (Nunatsiavut Government, NunatuKavut Community Council, Affected Municipalities)
- 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 (Province, Canada and Nalcor) supported moving forward without any further physical mitigation.

# Mitigation Analysis (Soil removal)

- Soil removal is intended to remove the carbon that feeds the microbes that create MeHg. Not intended to remove mercury as such. Challenging project unlike anything ever attempted before.
- Up to 15,465,000m<sup>3</sup>. (481 football fields 6 m deep assuming 1.5m removal. Cost up to \$742M. Up to additional \$19.4M for wetland capping.
- Modelled benefit of removal only reduces MeHg in Lake Melville by 6 – 26 % depending on the model parameters used to estimate.
- Model does not account for environmental effects of soil disposal along shoreline.
- A worse outcome within the realm of possibility, Soil flux experiment is inconclusive at best. 3 of 4 samples increased MeHg flux upon soil removal.