



Government of Newfoundland and Labrador
Department of Environment and Conservation

Methylmercury and Muskrat Falls: Sharing and Understanding Our Varied Perspectives

Scientific Workshop

St. John's, NL

March 22, 2016

Facilitated by:

Office of Public Engagement

Prepared for:

Department of Environment and Conservation

Hon. Perry Trimper, Minister

Executive Summary

A Scientific Workshop “*Methylmercury and Muskrat Falls: Sharing and Understanding Our Varied Perspectives*” was organized by the Department of Environment and Conservation (ENVC) on March 22, 2016. Technical experts were assembled in St. John’s, NL to constructively review:

- A Human Health Risk Assessment Plan originally submitted by Nalcor Energy in 2014 to satisfy one of the regulatory requirements for the Lower Churchill Hydroelectric Generation Project; and,
- Original research completed by Schartup et al. (2015) titled: “*Freshwater discharges drive high levels of methylmercury in Arctic marine biota*” on behalf of the Nunatsiavut Government.

The Lower Churchill Project was released from environmental assessment in March 2012 following a Joint Review Panel. This project is under construction subject to submission of a number of regulatory monitoring plans. One of these plans deals with the proponent’s approach to monitoring the effects of methylmercury on human health.

The Nunatsiavut Government (NG) contacted ENVC to discuss the downstream effects of the project and implications on the environment and mercury accumulation in fish and seals in Lake Melville. In February 2016 the Minister of ENVC met with the NG and their researchers in Happy Valley-Goose Bay. The NG requested the reservoir be fully cleared of trees and topsoil, an impact agreement, expert advisory committee, and joint decision making authority. The Minister committed to undertaking a workshop to discuss the research presented by the NG and the Human Health Risk Assessment Plan submitted by Nalcor Energy.

The Scientific Workshop was held at the Provincial Government, Confederation Complex, West Block, Conference Room “C” in St. John’s, Newfoundland and Labrador. Eighteen participants attended the workshop. They included representatives from the federal government: Fisheries and Oceans Canada, Health Canada; the provincial government: Health and Community Services, ENVC; and, Nalcor Energy. The NG, including their researchers, were invited but declined to attend. Each participant shared their perspectives on a series of topics. Subsequent to the participants’ remarks a general discussion was then held on each topic led by the workshop facilitator. The comments and recommendations pertinent to the theme/topic were transcribed by the workshop facilitator and Office of Public Engagement.

The Workshop key comments from the discussions are included:

- The Schartup et al. (2015) study is noteworthy in providing insight into mercury cycling in an estuarine fjord environment. Most research to date has focused on freshwater systems where the effects of dams and reservoirs have been extensively studied. The Schartup et al. (2015) research proposed and modelled potential mechanisms for methylmercury production and uptake in the estuarine food web of Lake Melville.
- Participants concluded that the same model inputs for mercury production used in the Schartup et al. (2015) study were used for the Lower Churchill Environmental Impact Statement (EIS) predictions. The two approaches forecast a similar amount of mercury would be produced in the newly formed reservoir and exported downstream. Downstream effects such as the length of time for mercury levels to peak and then to dissipate, dilution and mixing in Goose Bay and Lake Melville, fish movement (near dam turbines or deeper waters) and spatial differences were also discussed.
- As a result of the Schartup et al. (2015) study, DFO Science Branch conducted a review in February 2016 of the Nalcor Energy methylmercury monitoring program downstream of the Muskrat Falls hydroelectric dam. The review recommended an additional sample site (for fish and seals) in the eastern part of Lake Melville. The additional sampling site further downstream would help determine the spatial extent of downstream effects in the Lake Melville estuary.
- Removing all the topsoil from the reservoir as a means to reduce methylmercury is not considered practical. In addition, attempts to remove all the soil and mercury found in the littoral layer would have other significant environmental effects. Trying to create a zero or mercury free situation also means that the body of water would receive no carbon from sediments. This would eliminate fish habitat and reduce natural carbon cycles and productivity in the system (i.e. fish bowl effect). Further the predicted increase or pulse is discussed however the natural decline over time of methylmercury in the reservoir is not considered as methylmercury levels in the environment subside to their natural equilibrium.

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Participants' Key Comments and Themes
Pertaining to the Methylmercury and Muskrat Falls

Scientific Workshop

St. John's, March 22, 2016

Results

The comments and conclusions of the participants at the workshop are presented in accordance with the Agenda (see Annex A).

Opening/Welcome

The Honourable Perry Trimper, Minister ENVC welcomed participants and explained the general objectives of the workshop. Namely, to examine all information presented by the proponent Nalcor Energy, field research completed by NG / Schartup et al. (2015), and technical input/information by those in attendance. He acknowledged attending a meeting with the NG, Harvard and Memorial University researchers in mid-February to discuss the recent research in Lake Melville and the potential downstream effects on mercury of the Muskrat Falls project. The NG's Lands and Natural Resources Minister Darryl Shiwak is agreeable to answer any questions that we send them after.

Review of Workshop Process and Agenda

Bruce Gilbert (Workshop Facilitator) described the workshop process, agenda and record keeper role.

Participant Introductions

All participants described their background and interests for attending the workshop (see Annex B for participant biographies).

- Dr. David Allison, Chief Medical Officer of Health, Health and Community Services
- Darryl Johnson, Director of Environmental Health, Health and Community Services
- Dr. Claudia Sabru, Regional Medical Officer of Health, Health and Community Services
- Dr. Janice Fitzgerald, Public Health, Health and Community Services
- Michelle Roberge, Team Leader Triage and Planning Fisheries Protection Program, DFO
- Dr. Robin Anderson, Research Scientist, Ecological Sciences Section, DFO

- Rob Willis, Senior Toxicologist and Risk Assessor, Dillon Consulting Ltd.
- Marion Organ, Environmental Services Manager, Nalcor Energy
- Peter Madden, Regulatory Compliance Lead, Nalcor Energy
- Jackie Wells, EA Commitments/Environmental Effects Monitoring Lead, Nalcor Energy
- Greg Kaminski, Senior Environmental Health Assessment Specialist, Health Canada
- James McCarthy, Senior Aquatic Biologist, Amec-Foster Wheeler
- Reed Harris, President, Reed Harris Environmental Ltd.
- Paul Carter, Environmental Scientist, Environment and Conservation
- Martin Goebel, Assistant Deputy Minister, Environment and Conservation
- Bas Cleary, Director, Environment and Conservation
- Susan Piercey, Manager, Office of Public Engagement

Opening Comments

Martin Goebel provided opening comments for ENVC. The Joint Review Panel Report of Nalcor Energy's EIS documents and Panel hearings was released in 2011. The Provincial Government released the project subject to an extensive list of terms and conditions as outlined in the *Lower Churchill Hydroelectric Generation Project Undertaking Order 18/12*. The Human Health Risk Assessment Plan (HHRAP) and Environmental Effect Monitoring Plan (EEMP) were combined into one document, and, the wetland and riparian habitats EEMP and compensation plans are also required to be completed. On March 17, 2015 the revised HHRAP and EEMP were resubmitted for review. The NG has said the HHRAP does not have sufficient details in the Plan. Their main issue is regarding mercury. The NG engaged researchers from Harvard to complete original research related to questions around the methylation of mercury following construction of the Muskrat Falls project. Schartup et al. (2015) have put forth a study that the NG feels supports their concerns. On November 9, 2015 the NG submitted a letter with four requirements to reduce impacts on Inuit health and rights including the following:

- (1) Fully clear the future Muskrat Falls reservoir (vegetation and topsoil)**
- (2) Negotiate an impact Management Agreement**
- (3) Establish an independent Expert Advisory Committee**
- (4) Grant Inuit joint decision-making authority over downstream environmental monitoring and management**

The Schartup et al. (2015) study identified different predictions for methylmercury levels downstream. This included a layer of freshwater flowing into the estuary with higher potential for methylation of mercury at the fresh/brackish interface within the water column. Methylmercury loading from the lower Churchill River to Lake Melville was predicted to increase by 25 to 200% over Nalcor Energy's estimates, as was widely publicized in the media. The NG embarked on a media campaign with the theme of "Make Muskrat Falls Right". As part

of the workshop, ENVC asked how these estimates compare to Nalcor Energy's predictions of no significant effects past the mouth of the lower Churchill River and on the HHRAP.

Participant Remarks – Round # 1: Sharing Broad Perspectives

Advice presented to the Joint Review Panel by DFO indicated that there may be elevated methylmercury levels in some fish species and seals downstream of the reservoir including into Goose Bay and Lake Melville. As a condition of DFO's *Fisheries Act Authorization, Section 35*, Nalcor has to conduct a comprehensive multiyear monitoring program to report on bioaccumulation of methylmercury in fish and seals within the reservoir and downstream, including Goose Bay and Lake Melville to verify spatial extent and duration. This also includes collection of methylmercury data for 5-6 years before impoundment, followed by at least 20 years post impoundment, and will be used by DFO to monitor the health of fish and seals.

An Aquatic Environmental Effects Monitoring Program is an adaptive management program to monitor any adverse environmental effects on fish and seals for the project. Any new information is useful and will be considered by DFO in requiring any changes to monitoring - e.g. Schartup et al. (2015) study, DFO (2016) *Review of Mercury Bioaccumulation in the Biota of Lake Melville*, and results of the monitoring program.

Nalcor submits regular monitoring reports to DFO with mercury data. This information is published on Nalcor Energy's website and it can be used by departments in review of various things, such as the HHRAP.

There is a high level of mercury research in Canada in freshwater systems but limited investigations in estuary systems and open oceans. The data goes back to the 1970's for Lower Churchill River (> 35 years).

The Schartup et al. (2015) study is proposing a mechanism for elevated levels of methylmercury in Lake Melville resulting from flooding. This new research was the basis for the review by the Canadian Science Advisory Secretariat DFO (2016) *Review of Mercury Bioaccumulation in the Biota of Lake Melville*.

The Schartup et al. (2015) study predicted about the same mass of methylmercury going downstream after flooding as used in Nalcor baseline data for the EIS. The Schartup et al. (2015) study estimated an increase of 25 to 200% in the methylmercury load to the estuary from the lower Churchill River. The modelling by Nalcor in the EIS predicted a 60 to 90% increase in methylmercury concentrations being exported from the reservoir.

The differences may be due to the estimates of existing methylmercury concentrations in the system, rather than the increases in methylmercury associated with flooding. The Schartup et al.

(2015) study also concludes that methylmercury in the water column of Lake Melville is important and this is influenced by inputs of carbon from upstream.

A key issue is how far downstream increases in methylmercury will be measurable and exceed limits. The Schartup et al. (2015) study analysis presents a case for these effects extending further into Lake Melville than predicted by Nalcor in the EIS.

The effects of methylation in the reservoir will vary depending on the location in Lake Melville. Mercury levels will dissipate further out into Lake Melville, from the tailrace at Muskrat Falls.

Over 90% of baseline fish samples at this time have non-detectable levels of mercury.

The Schartup et al. (2015) study identified a new process that may result in additional methylation of mercury within Goose Bay and Lake Melville.

Does the Schartup et al. (2015) study change the environmental assessment approach? No, but it needs to be considered with respect to the extent of monitoring. Monitoring was previously extended into Lake Melville but further extensions should be considered.

The adaptive management approach to the current Environmental Effect Monitoring Programs allows consideration to monitoring changes to programs to be able to measure changes (or no changes) in fish further east in Lake Melville.

The Canadian Council of Ministers of the Environment (CCME) Aquatic Life guideline for methylmercury is 0.004 micrograms per litre. The numbers used in the Schartup et al. (2015) study are in nanograms (several orders of magnitude lower).

Health Canada is reviewing the models and assumptions that are being used by Nalcor Energy and their consultants for the human health research. This is to determine whether the monitoring and data being used meets the appropriate standards and will provide correct advice for any mitigation actions that need to be taken (i.e. health advisories, monitoring and follow-up studies). Health Canada's role is as experts in HHRA study approach.

Nalcor has obtained approval from the NL Health Ethics Research Board to conduct the HHRAP.

Nalcor has attempted to consult with the NG but they would not participate. Approval was received from only two of the three Aboriginal groups being consulted. Nalcor indicated they are committed to EA stewardship as the effects of the project need to be managed.

An interim HHRAP was included in the EIS submitted to the Joint Review Panel in 2011. Work on the final HHRAP is just getting underway. The steps for preparing the HHRAP include:

- (1) Hazard Identification – What health problems are caused by the pollutant?
- (2) Dose-Response Assessment – What are the health problems at different exposures?

- (3) Exposure Assessment – How much of the pollutant are people exposed to during a specific time period? How many people are exposed?
- (4) Risk Characterization – What is the extra risk of health problems in the exposed population?

General Discussions

Round #1: Comparing/Contrasting Perspectives

Similar numbers are being used in the Schartup et al. (2015) study as were used in the EIS prediction models by Nalcor Energy for the mass of methylmercury that will be produced as a result of flooding the new reservoir which will flow downstream. The Schartup et al. (2015) study would suggest that sampling should be extended further downstream than the original modelling which is reasonable.

DFO was uncertain during the Joint Panel Review regarding the potential extent of methylmercury downstream into Goose Bay and Lake Melville. These areas are part of the environmental monitoring study. The Schartup et al. (2015) study has provided some new information that an additional monitoring site would be useful.

An additional sampling site in Lake Melville monitoring would be beneficial to answer boundary extent conditions.

Participant Remarks – Round #2: Exploring Sub-Themes

HHRA Plan: General discussion

It is important for the preparation of the risk assessment that mercury data on the fish and seals are obtained.

It is important to have an acceptable baseline plan and having all stakeholders agreeing to the plan to provide comments. There will always be some uncertainty; that interpretation may differ depending on who is interpreting but it is easier to agree on a path forward.

In the context of the regulations it makes sense to combine the HHRAP and EEMP.

Nalcor is doing a final baseline HHRAP which is a regulatory requirement. This is a complex study especially when focusing on methylmercury as significant information has to feed into the HHRA. This kind of HHRAP is also dependent on literature reviews.

In terms of outcomes there will be tables prepared for each fish species and HHRAs. Looking at foods as the main exposure there will be some link back to what the hair results showed and whether it fits with the results of the hair sampling measurements. Often hair sampling results are

much lower than exposure modelling would predict, due to conservative measurements which may result in overestimating. There are a number of other things that affect the HHRA. It is also important to ensure the benefits of eating fish and seal are not lost. It is not just mercury in them but other things that counter the effects of mercury as well.

How do we conclude whether full vs partial clearing of the reservoir is insignificant or not?

If you stripped vegetation and organics in soils you could prevent much of the methylmercury. There are practical and environmental issues to consider though in terms of disposal of cleared materials and potential detrimental effects on habitat in the reservoir and downstream.

A full tree clearing or a no tree clearing scenario would result in only approximately a 10% difference in removing mercury from the reservoir.

You would basically sterilize the reservoir if all organic layers (soil) were removed. The result would be creating an empty fish bowl, which would likely have adverse effects on fish and fish habitat.

The amount of soil that would be removed was estimated to be one kilometre in diameter and 20 meters high.

Regarding, the origins of inorganic mercury, much of the mercury in waterbodies originates from atmospheric deposition. Some atmospheric deposition falls directly into waterbodies. Another portion falls into watersheds, and some of that is transported into streams, rivers and lakes.

The Schartup et al. (2015) Study: General discussion

With regard to the timing of peak and return to baseline methylmercury concentration levels, the Schartup et al. (2015) study implies that the process would continue in perpetuity but past evidence indicates that reservoirs reach their peak in 10 to 15 years and then return to original baseline conditions.

The question was asked is there anything unique about this area to cause methylmercury levels to be above normal levels than model predictions, due to the fact that it is a sub-Arctic fjord environment? It was discussed that freshwater environments and fjords have been extensively studied, but not in the combination of this new research.

This is a relatively small reservoir with a total surface area of 101 square kilometres. The residence time for water to pass through the reservoir is approximately 10 days.

The Smallwood reservoir flooded 2,500 square kilometres and Muskrat Falls will flood 41 square kilometres.

If water flushes quickly through the reservoir, it is predicted that the methylmercury concentrations in fish will be less.

The methylmercury levels found in fish samples collected in the Smallwood reservoir are similar to natural lakes in the area. As a result of the background levels being high in fish the consumption advisory remains in place.

Final Participant Remarks – Round #3: Learning and Advice

The Schartup et al. (2015) study informs the work directed by Nalcor but it does not change the HHRAP. As a result of this original research, an additional sampling site further downstream will be added as adaptive management measure to improve monitoring programs.

Nalcor will take the work by Schartup et al. (2015) under consideration and if there is an effect they need to know what that effect is. It is understood that the difference from a methylmercury perspective is minimal so the contribution is quite low.

The DFO review of the Schartup et al. (2015) study has not recommended substantial changes to the sampling program but did provide advice on possible changes to sampling and reporting which will improve upon existing program. DFO is pleased to receive additional views on sample size or other information that could make the Aquatic Environmental Effects Monitoring Program more effective.

DFO is considering an additional monitoring site further out into Lake Melville.

References

Schartup, A.T., Balcom, P.H., Soerensen, A.L., Gosnell, K.J., Calder, R.S.D., Mason, R.P., and E.M. Sunderland. 2015. Freshwater discharges drive high levels of methylmercury in Arctic marine biota. *Proceedings of the National Academy of Sciences of the USA (PNAS)*. 2015, 112: 11,789-11,794.

DFO. 2016. Review of Mercury Bioaccumulation in the Biota of Lake Melville. DFO Can. Sci. Advis. Sec. Sci. Resp. 2016/015.

Nalcor (Nalcor Energy). 2015. Human Health Risk Assessment Plan (Revision B4). February 25, 2015. Doc. No. LCP-PT-MD-0000-EV-PL-0026-01.

Annex A

Workshop Agenda

10:00	Opening/Welcome	ENVC Minister
	<ul style="list-style-type: none"> • Workshop origins, objectives and themes 	
10:10	Review of Workshop Process and Agenda	Bruce Gilbert
	<ul style="list-style-type: none"> • Review workshop process and agenda and facilitator/recorder roles 	
10:15	Participant Introductions	<i>all participants</i>
	<ul style="list-style-type: none"> • Each person will have 2 minutes to share info on: their personal/professional background; the organization they represent; and their interest in and/or connection to this topic 	
10:40	Opening Comments	Martin Goebel
	<ul style="list-style-type: none"> • The Department of Environment and Conservation will discuss their role re: this topic and how they will use information gathered 	
10:50	Participant Remarks - Round #1: Sharing Broad Perspectives	<i>all participants</i>
	<ul style="list-style-type: none"> • Each participant will have approximately 5 minutes to share their broad or ‘big picture’ perspective on the workshop theme addressing topics such as: hopes they have for the workshop; key issues and concerns related to the theme; questions they have/hope to have answered; what they want the Department to consider before making decisions; one or more practical things that could be done to change the dynamic/discourse surrounding this theme. 	
12:00 pm	General Discussion - Round #1: Comparing/Contrasting Perspectives	<i>all participants</i>
	<ul style="list-style-type: none"> • Participants will briefly discuss the following questions: Are 	

there any themes emerging here for you? What if anything do people appear to have in common? What information gaps are evident? What are the disagreements? Have you changed your view of the position or perspective of any others because of the presentations? Has your own perspective on the issue changed in any way?

Lunch

1:30 pm **Participant Remarks -Round #2: Exploring Sub-Themes** *all participants*

- Participants will spend some time digging deeper into two sub-themes of interest to the group assembled : the Schartup et al. (2015) Study and Nalcor’s proposed HHRA Plan;
- Participants will have approximately 3 min (per sub-theme) to share their perspectives on each sub-theme (followed by a brief group discussion after each round of remarks) as follows:
 - Schartup et al. (2015) *Study: Participant Remarks*
 - What do you want to say about the Schartup et al. (2015) Study? Do you support it or have concerns related to it? Why?
 - Schartup et al. (2015) *Study: General discussion*
 - Based upon what has been stated, do you feel you need to say anything additional about the Schartup et al. (2015) Study or your perspective on it?
 - *HHRA Plan: Participant Remarks*
 - What do you want to say about the HHRA Plan? Do you support it or have concerns related to it? Why? What is your specific advice to the Department regarding how it should view/address the HHRA Plan?
 - *HHRA Plan: General discussion*
 - Based upon what has been stated, do you feel you need to say anything additional about the HHRA Plan or your perspective on it?

3:25 pm **Final Participant Remarks - Round #3: Learning and Advice** *all participants*

- Each participant will be given 3 minutes to make some closing remarks about what they may have learned during the

event and/or advice they may have for others with emphasis on: things they (may have) learned; things that may have surprised them; how their perspectives may have changed or evolved; any advice or ideas they may have for others in the room on the topic; anything in closing they would like to say to the Department or others before the session ends; whether or not they considered the workshop a useful exercise

4:05 pm

Closing Comments

Bruce Gilbert

- Facilitator will remind people: how the notes will be distributed; and to complete a short session evaluation

4:10 pm

Closing Comments from Department

Martin Goebel

- The Department of Environment and Conservation will thank people and make closing remarks

Annex B

Participants Biographies

NL Department of Environment and Conservation

Martin Goebel

Assistant Deputy Minister (Environment)

Martin Goebel, P.Eng, started his career with the Department of Environment and Conservation in October 1983. As ADM since 2009, Martin has worked on many projects including the environmental assessment of the Lower Churchill Power Development, environmental clean-up projects at Buchans and Hopedale and continues to lead water resources projects such as drinking water safety, waste water management and real-time water quality monitoring. Work in this area includes developing policy, budgeting, preparing cabinet papers, formulating legislation and representing the Department in public forums.

Martin represents the province on Federal/Provincial/Territorial committees including the Canadian Council of Ministers of Environment Environmental Planning and Protection Committee and the National Administrators Table of the F/P/T Hydrometric Surveys Program.

Bas Cleary

Director, Environmental Assessment

Bas Cleary began his career with the provincial government in 1987 and joined the Department of Environment and Lands with the Industrial Environmental Engineering Division. In 1992, he joined the Environmental Assessment (EA) Division and held various positions as Program Coordinator, Environmental Biologist and Manager of the Environmental Assessments. In 1995, Bas was appointed Director of the Environmental Assessment Division. He chaired several environmental assessments such as the Voisey's Bay Mine/Mill EA and played a key role in the review of the environmental assessment legislation leading to the development of the current *Environmental Protection Act 2002* and the associated *Environmental Assessment Regulations 2003*. He was appointed as Assistant Deputy Minister (Environment) from 2004 until 2007. Currently is the Director of the EA Division.

Bas graduated from the University of New Brunswick in 1983 from the Faculty of Forest Management with a B.Sc. Forestry (Hons) and a graduate from Memorial University in 1990 with a Master of Science Degree (Biology).

Paul Carter

Environmental Scientist

Paul Carter joined the Department of Environment and Conservation in 1990 and worked eight years working in the Water Resources Management Division in various positions with the Surface Water, Water Quality and Water Investigations before moving to his current position of Environmental Scientist with the Environmental Assessment Division. In 2008, Paul was

appointed to Chair the Assessment Committee for the Lower Churchill Hydroelectric Generation Project. For this role he has worked on the Terms of Reference for the Joint Review Panel, Guidelines for the Environmental Impact Statement, and Provincial Government response to the Report of the Joint Review Panel.

Paul holds a B.Sc. in Physical Geography, B.Sc. (Honours) specializing in Hydrology, and M.A.Sc. Environmental Engineering and Applied Science from Memorial University of Newfoundland.

NL Department of Health and Community Services

David Allison

Chief Medical Officer of Health

Dr. David Allison MD, FRCPC, is Chief Medical Officer of Health for the province. David has served in public health roles New Brunswick, Alberta and Saskatchewan since 1982. He is also a member of the Emergency Response Unit (ERU) roster of the Canadian Red Cross and has completed short deployments in Haiti (2010), Sierra Leone (2012) and Nepal (2015).

David is a past co-chair of Immunize Canada and has been involved in environmental health research as an investigator assessing concerns about environmental lead in St. John's, NL. As a clinical associate professor in the Division of Community Health and Humanities of the Faculty of Medicine at Memorial University, he has been involved with teaching of medical students and supervision of MPH students undertaking practicums.

Darryl Johnson

Director Environmental Health

Darryl Johnson has worked at various levels of the provincial and federal public service in the public health field over the past 24 years, including seven years in Happy Valley-Goose Bay in the 1990's. Darryl is currently Director of Environmental Health in the Population Health Branch of the Department of Health and Community Services and has provincial responsibility for health protection programming, legislation, standards and policy in areas such as food safety, private wastewater treatment, drinking and recreational water quality, tobacco control and smoke-free environments, health hazard investigations and enteric illness outbreak prevention and control. Darryl is also the Department's screening representative for projects registered under the provincial environmental assessment process.

Darryl has a B.Sc. (Biology) from Memorial University, a Diploma of Technology (Environmental Health) from the British Columbia Institute of Technology, an M.Sc. (Public Health) from the University of London and the postgraduate Diploma of the London School of Hygiene and Tropical Medicine. Darryl is also a Certified Public Health Inspector, a member of the Newfoundland and Labrador Branch of the Canadian Institute of Public Health Inspectors (CIPHI) and former member of the National Executive Council of CIPHI.

Janice Fitzgerald**Public Health**

Janice Fitzgerald is a family physician in St. John's, NL and current Master of Public Health Student at Memorial University. She is a Clinical Assistant Professor with MUN Medical School, teaching Phase I and II medical students.

Janice received a BSc (Biology) in 1990 from MUN and completed her MD in 1994. She completed her Family Medicine residency at Dalhousie University in 1996. She has practiced family medicine in both rural and urban NL for the past 20 years.

Claudia Sabru**Regional Medical Officer of Health**

Dr. Claudia Sarbu recently joined Eastern Health in St. John's as a Regional Medical Officer of Health.

Claudia received her MD in Romania in 1994 and practiced there 4 years as a family physician. After immigrating to Canada, she studied nursing sciences and worked as a Public Health Nurse for 5 years. This experience was invaluable in broadening her understanding of the public health system in Ontario and the issues faced by its frontline workers. This led Dr. Sarbu to the decision to pursue Public Health and Preventive Medicine through the residency program at the University of Ottawa.

Fisheries and Oceans Canada**Michelle Roberge****Team Leader Fisheries Protection Program**

Michelle Roberge is currently the Team Leader, Triage and Planning of the Fisheries Protection Program - Regulatory Review, responsible for reviewing project proposals to determine whether or not they require regulatory review under the *Fisheries Act* and *Species at Risk Act*, as well as management of habitat occurrences and requests for Fisheries Protection Program engagement in federal or provincial/territorial environmental assessment processes. Previously, Michelle was responsible for the assessment, mitigation, and monitoring of impacts on freshwater fish habitat, including the Lower Churchill Hydroelectric Generation Project.

Michelle received an Order-In-Council appointment and was a member for four years of the Inuvialuit Fisheries Joint Management Committee established under the Inuvialuit lands claim for the western Arctic.

Michelle holds a B.Sc. in Biology and Chemistry and an M.Sc. in Limnology and Fish Biology.

Robin Anderson
Research Scientist

Dr. Robin Anderson is a Research Scientist in the Ecological Sciences Section and has developed and carried out research projects in quantitative aquatic ecology for over 35 years. Robin came to Newfoundland in 1991 after holding faculty positions at the University of Quebec at Montreal and at the University of Maryland.

Robin's research program examines and models the effects of human activity on aquatic habitats, including substantial research in mercury impacts on fish following reservoir creation, evaluating risks to ecosystems, and integrating spatial patterns and processes in food web and environmental studies. She has provided expert testimony and scientific advice on the potential and observed environmental impacts of human activity on fish and fish habitat including major environmental assessments of mines, hydroelectric projects and offshore oil development, environmental effects monitoring (EEM) programs and site decommissioning proposals.

Robin holds a B.Sc. in Biology from Université Laval, an M.Sc. in Biology from Université Laval, and a Ph.D. in Biology from McGill University.

Health Canada

Gregory Kaminski
Senior Environmental Health Assessment Specialist

Gregory Kaminski works as a Senior Environmental Health Assessment Specialist in the Healthy Environments and Consumer Safety Branch. He has over 25 years of experience in the areas of environmental and human health risk assessment. He worked for Inuit-owned Makivik corporation as a wildlife biologist, assessed effects of pulp and paper mill effluents on fish and biota when working as a consultant on cycle 1 Environmental Effects Monitoring required by the federal regulation, and developed computer models for Hydro Quebec in the areas of utility pole treatment, storage sites and accidental spills into terrestrial and aquatic environments.

Gregory joined the federal government in 2001. At the Pest Management Regulatory Agency he helped to assess human and ecological risks linked to the application and registration of pesticides. As the head of the office of Environmental Effects Monitoring for Pulp and Paper with Environment Canada, he helped to re-design the regulation for that sector and developed regulations for the mining sector. In 2010 Greg moved to Health Canada where he works on assessing effects of proposed development projects on human health.

Gregory holds a B.Sc. and an M.Sc. from McGill University.

Nalcor Energy

Jackie Wells

EA Commitments / Environmental Effects Monitoring Programs Lead

Jackie Wells is an Environmental Effects Monitoring Lead for the Lower Churchill Project, responsible for environmental effects monitoring programs for the Labrador – Island Transmission Link and the Lower Churchill Hydroelectric Generation Facility. These programs ensure our environmental commitments are being met and environmental protection measures are mitigating the effects of the project on various environmental components. Some of the key programs include: Labrador caribou, Newfoundland caribou, furbearers, methylmercury, human health risk assessment, Newfoundland marten, avifauna, and listed plants. She has 15 years experience in the environmental sector including environmental research, education and environmental assessment.

Jackie holds a B.Sc. (Biology), a B.Ed. and an M.Sc. (Biology) degrees from Memorial University of Newfoundland.

Peter Madden

Regulatory Compliance Lead

Peter Madden is the Regulatory Compliance Lead for the Lower Churchill Project. His primary responsibilities with include implementation of the LCP EMS, regulatory stakeholder management, project environmental effects monitoring and mitigation programs. He has 10 years experience in environmental research, environmental assessment, and environmental and regulatory compliance.

Peter holds a B.Sc. (Hons) in Behavioural Neuroscience, an M.A.Sc. in Environmental Engineering, an M.B.A, and Masters Certificate in Project Management.

Marion Organ

Environmental Services Manager

Marion Organ is currently the Environmental Services Manager with Nalcor Energy. She currently sits on the Canadian Hydro Power's Regulatory Policy Working Group.

Previously, Marion was the Environmental and Regulatory Compliance Manager with Nalcor Energy's Lower Churchill Project, and was responsible for the Environmental Management System, Environmental Engineering and Environmental Effects Monitoring Programs for the LCP. She first joined the project in March 2007, and over a seven year period was an integral part of the team throughout environmental assessments for the Lower Churchill Hydroelectric Generation Project and the Labrador-Island Transmission Link. As part of her role she was directly responsible for managing the environment and regulatory compliance aspects of the project. Marion continues to support and work with LCP in her new role in overseeing Nalcor Energy's broader Corporate Environmental Management Programs.

Marion is a graduate of Memorial University's civil engineering program and has her M.Sc. in Environmental Engineering from Memorial University.

Rob Willis

Senior Toxicologist & Risk Assessor Dillon Consulting

Rob Willis is the Senior Toxicologist and Risk Assessor for Dillon Consulting Limited and extensive experience and expertise in human health and ecological (terrestrial and aquatic) risk assessment (HHERA), toxicity-based benchmarks development, the development of HHERA guidance and approaches, chemicals management and priority setting, and various aspects of applied toxicology and environmental chemistry. Rob has evaluated mercury and methylmercury exposure and risk in a number of previous human health risk assessment (HHRA) studies in various regions of Canada. He is currently retained by Nalcor Energy as their HHRA subject matter expert for the Lower Churchill Hydroelectric Generation Project.

Rob frequently serves as an expert reviewer of risk assessment and toxicological documents prepared by others, is routinely invited to participate in federal risk assessment program guidance development, and serves (or has served) as an invited member on a number of provincial and regional technical committees that pertain to HHERA.

Rob holds an M.E.S. from Dalhousie University and a B.Sc. with an emphasis in environmental toxicology, from the University of Guelph. He is a Canadian Certified Environmental Practitioner (EP) in the areas of air quality protection, and human and environmental health and safety (since 2004), and a qualified person for risk assessment under Ontario Reg. 153/04.

Jim McCarthy

Senior Aquatic Lead, Lower Churchill Project

James McCarthy is an associate biologist and Certified Fisheries Professional with over twenty years of experience. Jim has been involved in a wide range of projects in Newfoundland and Labrador, Alaska, British Columbia and Nova Scotia for private organizations and government agencies. Projects have generally entailed the design and implementation of environmental assessments, aquatic offset plans, baseline studies, and environmental effects monitoring programs related to various human activities such as oil and gas, hydroelectric developments, mining/construction, and forest harvesting. His efforts in aquatic research and offset planning have focused on the identification of habitats sensitive to human disturbance for aquatic species.

Jim is a Ph.D. candidate at University of New Brunswick's Canadian Rivers Institute where a portion of his research will focus on potential ecosystem niche changes within and downstream of the Muskrat Falls reservoir and how they may affect mercury bioaccumulation and transport.

Reed Harris**President, Reed Harris Environmental Ltd**

Reed Harris, BSc. (Civ Eng), M. Eng., P. Eng., has over 30 years of experience in the environmental engineering field. Since 1988, Reed has specialized in the behaviour of mercury in aquatic and terrestrial ecosystems. He has developed and applied models of mercury cycling and bioaccumulation in freshwater, marine and terrestrial systems, and made predictions of fish mercury concentrations in connection with the Lower Churchill River Hydroelectric project.

NL Office of Public Engagement**Bruce Gilbert****Assistant Deputy Minister, Workshop Moderator**

Dr. Bruce Gilbert is an Assistant Deputy Minister in the Office of Public Engagement, a unique entity that works closely with Government of Newfoundland and Labrador departments and agencies to design and deliver quality engagement, partnerships and collaborations with citizens, community groups and stakeholders across NL. Bruce is currently the national President of the International Association for Public Participation - Canada (IAP2 Canada) and a Policy Expert for the Institute of Public Administration of Canada's Youth Leadership, Entrepreneurship, Access and Development (YouLead) project Nigeria. Previously, Bruce held senior positions with numerous non-governmental organizations in Newfoundland and Labrador, other parts of Canada, and in several other countries.

Bruce has a PhD (Interdisciplinary) from Dalhousie University and an M.Sc. from St. Francis Xavier University. He has also held a Faculty of Arts Postdoctoral Fellowship at Memorial University.

Susan Piercey**Manager Volunteer & Non-Profit Sector Engagement, Note Keeper**

