**NON-TECHNICAL PROJECT ANNUAL SUMMARY**

**Project Title:** Metal loading and retention in Arctic tundra lakes during spring runoff

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**Project Location:** lakes near Iqaluit

**Timeframe:** May 2014 to October 2015

**Project Description:** Spring snowmelt is the most important hydrologic event of the year in Arctic landscapes. During this relatively short period in spring, inputs of water and waterborne contaminants such as mercury (Hg) and other trace metals to surface waters can exceed those occurring during the remainder of the year. Nevertheless, there is little research on the transport of metals to lakes during snowmelt periods in Arctic Canada. The main objective of this project is to quantify, using hydrological and water chemistry measurements, the relative contributions of mercury and other trace metals in snowmelt runoff to the water column and sediments of lakes in the vicinity of Iqaluit, NU. Metal pollution in lakes and rivers comes from local, regional and global atmospheric sources and is important to monitor over time, particular mercury, which sometimes reaches toxic levels in fish and wildlife.

Our field program was initiated in Spring 2014 to carefully measure the amount of snow stored on the landscape and the accumulated metal pollution that runs off the landscape during the spring melt period. During the 2014 field season (April to September) we successfully collected detailed field measurements at a single lake basin near Iqaluit, including extensive snow survey data, and frequent measurements of water quantity (stream flows and lake volumes) and quality (metal concentrations). Many logistical challenges were encountered and resolved with the help of the project team, and revised sampling strategies and locations were developed for the 2015 sampling season, which will focus on two lakes within a 10 km radius of Iqaluit. Our preliminary findings from 2014 demonstrate that certain metal concentrations, inlcuding mercury, are elevated in snowmelt as it leaves the snowpack, but that concentrations are somewhat reduced prior to entering streams and lakes due to contact with the soil. Water entering lakes during the melt period does not mix appreciably with lake water and mostly flows to the outflowing stream via a thin layer underneath the ice. In 2015, our goal is to further refine our monitoring efforts and develop a more complete understanding of how much snowmelt runoff serves to couple atmospheric sources of metal pollution to Arctic lakes, and eventually, marine ecosystems. We hope to extend this work in the near future to estimate metal fluxes to Frobisher Bay following a similar study design pending interest from the community.

All fieldwork for this project is being conducted in partnership with Nunavut Research Institute (NRI) and Nunavut Arctic College (NAC), and several current or recently graduated ETP students were trained in various field and laboratory activities over the course of the spring and summer field program in 2014. Ted Irniq (2013 ETP graduate), Joeffrey Okalik and Mathew Gardiner (current ETP students) were involved intensively from May until September 2014, and all 3 developed strong specialized skills related to physical and chemical limnology and snowmelt hydrology. These skill sets are not broadly covered in the current ETP curriculum, but are very useful for environmental monitoring practitioners. The students learned how to calibrate and use snow tubes to survey snow depth, density, and melt water equivalent in river catchments; calibration and use of water chemistry field sondes; use and maintenance of specialized water sampling devices; ultra clean techniques for trace metals sampling; and salt dilution gauging for stream discharge monitoring. Students also learned to fabricate and install snowmelt lysimeters, and to prepare and deploy thermistor strings to monitor lake thermal profiles. Students also learned to clean and prepare sampling equipment and to organize and maintain laboratory inventory. Sampling methods were refined with student feedback over the course of the spring/summer, and are being documented in a series of instructional manuals that will facilitate student training and involvement in the 2015 field season and beyond.

Our 2014 proposal included development and delivery of a snow hydrology short course in 2014. Due to timing constraints, this could not be fulfilled, but is currently being planned for April 2015 in combination with the ETP spring field camp at Crazy Lake. Instead of the 2014 field camp, M. Richardson participated in the fall contaminants workshop in October 2014. This included a lecture on physical environmental pathways of metal contaminants, complimenting the largely biological focus of the training workshop. A field exercise was also conducted in which ETP students learned the basics of streamflow discharge gauging using direct measurement as well as indirect tracer-based methods.

**Methodology:** Throughout the spring melt period, students and NRI staff will make frequentday trips to two local lakes by snowmobile (spring) or ATV (summer) to measure snow conditions and collect samples. Snow surveys will be conducted throughout the melt period to measure the depletion of the snowpack and estimate total runoff volumes to the study lakes. Hand-held samplers will be used to collect small amounts of water and sediments from the lakes through augered ice-holes. Small (hand-sized) automatic data recorders may be left at lakes during the open-water season to measure water temperature or stream discharge entering the lakes. The data recorders will be retrieved upon completion of the project. We will not collect fish from any of the lakes.

**Data and reporting:** Data from this project will be used by the Northern Contaminants Program to better understand metal cycling in the Arctic. Findings will be published in annual synopsis reports and scientific journals. This information will be made freely available to community organizations including the Amarok HTA. All project protocols are being carefully documented and compiled in a research manual which will be retained by NRI along with the specialized research equipment upon completion of the project. These resources will be used by NRI to support future research and training initiatives beyond the life of this two-year project.