In May of 2014, water and algae samples from a variety of estuary and river sites were collected in Churchill, Manitoba by a team of researchers from Trent University in Peterborough, ON. The samples were then processed in Dr. Celine Guéguen’s lab in the Chemistry Department at Trent University for a variety of different experiments to determine various water contaminants such as cadmium and vanadium as well as understanding optical and molecular weight properties of dissolved organic matter (DOM). Samples of algae from the water samples were digested in the lab and used to determine intracellular (inside the cell) cadmium and vanadium concentrations and compared to extracellular (outside of the cell) concentrations for the PhD research of Vaughn Mangal. Other students in the lab, Yu Zhu and Yong-Xiang Shi, also deployed diffusive gradient in thin films (DGT) samplers to assess the biologically available fraction of metal. The preliminary results suggest that there is decreasing cadmium and vanadium concentrations extracellularly moving inland from the coast (estuary sites to river sites) in Churchill, Manitoba. A research team returned in the spring of 2015 to continue the DGT sampling and CNSC research staff continue to deploy the DGT samplers in Goose Creek through the fall and winter season to further explore the importance of metals levels in the Churchill River area throughout the year.

In addition to this work, specialized titrations using a fluorescent tag were conducted to determine thiol concentrations (thiols are organosulfur compounds that are present in natural systems). These tags can be quantified and help differentiate thiols from other DOM in natural samples. This results of this work were published in a recent February 2015 article in the Journal of Analytical and Bioanalytical Chemistry by Vaughn Mangal and Celine Guéguen – “Examining concentrations and molecular weights of thiols in microorganism cultures and in Churchill River (Manitoba) using a fluorescent-labeling method coupled to asymmetrical flow field-flow fractionation” (DOI 10.1007/s00216-015-8599-0).

Reliable interpretation of metal levels measured by diffusive gradients in thin film (DGT) requires a sound understanding of the diffusion properties of dissolved organic matter (DOM), the main ligand of metals in natural waters. The present study determined that the molecular weight of DOM and conductivity are the main factors controlling the diffusion of freshly collected estuarine DOM across the DGT diffusive gel. For more info you can also take a look at the recent paper from Balch and Guéguen (2015) – “Determination of diffusion coefficients of dissolved organic matter in the Churchill River estuary system, Hudson Bay (Canada)” in Environmental Chemistry (DOI 10.1071/EN14182).

Visit Dr. Guéguen’s webpage at http://people.trentu.ca/~celinegueguen/index.html