



Mercury Study Concerns Submitted to Belfast Planning Board

by John Kruger

Because environmental monitoring can be very technical and complex to explain, trust in reporting is very important. Sometimes just little details can seem overwhelming yet can distort an understanding of a concern.

At the most recent planning board meeting Nordic provided a one page table of mercury results from the proposed dredge site for the intake pipe. This one table was only a summary and provided little detail on the manner that these results were produced. From this one table a number of observations can be made. Concentrations of Mercury were considerably lower than anticipated. Most results were so low that it made the whole idea of looking for mercury to feel ridiculous. Looking more closely, many of the mercury results were listed at 0.00055 ppm at 2 significant figures on an analysis with a reporting limit between 0.01 to 0.02 ppm seems unrealistic. Imagine reporting results at less than 100 times reporting limit. Laboratories report low results as “less than RL”. Also interesting is that most of the results were actually less than what is considered a background concentration of mercury in Maine sediments. Expected background concentrations are 0.05-0.08 ppm (mg/kg).

Expectations by reviewers is that Nordic would comply with the Sampling and Analysis Plan for the Nordic Aquafarms Pipeline Corridor Dredging, Belfast and Northport, ME, File Number NAE-2019-01481, This plan mirrors the Penobscot River Mercury Study Method (PRMS), where specific analytical procedures are to be followed. While Upstream has not been provided the full report, an unofficial partial report has been made available. This report states on pg. 5 of the Chemical Analyses of a Proposed Dredged Sediment that Nordic allowed Method 3050B for digestion of the sediment for Hg analyses. That method is not approved for Hg analyses. It uses only nitric acid and hydrogen peroxide. Mercury in sulfide form is not accurately recovered unless aqua regia (a mixture of nitric and hydrochloric acid) is used for digestion.

Using Method 3050B for sediment digestion would likely lead to underreporting the Hg concentrations. Why is that important? The presence of sulfides in marine waters is considered normal. In addition, consider Delta Chemical in Searsport has been a large producer of aluminum sulfate and there are known deposits of sulfides in the Penobscot sediments below this facility. Multiple methods are listed and it is important that we know if aqua regia was used.

There is also no SRM standard analysis, this is a quality control sample required in the method. Such SRM samples typically would have sulfide contaminants as sulfides are normal in marine waters.

Given the short time frame, I was able to reach out to Ralph Turner, an expert in this area and asked that he provide a written response to accompany my concerns. Here is his response.

October 8, 2020

To: John Krueger

From: Ralph Turner, PhD, Cobble Hill, British Columbia CANADA

Subject: Comments on report by Nordic Aquafarms Inc supporting their application for land-based fish farm on Penobscot Bay, Maine

As per your request here are my comments on the subject report. I will focus mainly on the sampling and analytical components of the report. My area of expertise is mercury in all environmental media. My formal training has been in geology (Boston University, 1966) and chemical oceanography (Florida State University, MS 1970, PhD 1974). I was employed by Oak Ridge National Laboratory (ORNL) for 22 years where I conducted extensive research and development studies on mercury in the environment. In 1997 I left ORNL for a year long sabbatical appointment at EPA's Gulf Breeze, Florida research facility to explore use of microbial bioreporter technology for mercury and to edit a book (published 1999) entitled "Mercury Contaminated Sites: Characterization, Risk Assessment and Remediation". Following that appointment, I accepted a job at Frontier Geosciences in Seattle, Washington where I managed their mercury laboratory as well as conducted mercury-related investigations for industry and mining companies in both Canada and the United States. One of my clients at the time invited me to move to Canada to help clean-up a mercury-contaminated site in British Columbia. I formed a Canadian corporation, RT Geosciences Inc, to facilitate this effort which included management of the plant laboratory which supported all aspects of the site characterization and risk assessment. I continue to monitor the recovery of this site and hold contracts as a Subject Matter Expert for several other sites. In 2004 I was contracted to investigate mercury losses from the mercury-cell chloralkali plant on the Penobscot River and eventually joined the Penobscot Mercury Study. My contribution to that effort was two-fold: (1) assessment of current and historical releases of mercury from the plant and (2) assessment of tidal movement of mercury in Mendall Marsh. Both efforts resulted in peer-reviewed publications and added to the more than 50 other such mercury-related publications in my curricula vita.

Comments

Spatial coverage of sediment sampling: Adequate

Depth resolution of subsampling: The use of depth-integrated composites, while acceptable for application to cores from most areas, it would have been useful to run a few cores at depth intervals (e.g., 1-2 cm or even 5 cm) similar to those used by the PRMS to allow better comparison between the two studies. Often sedimentation rates can vary widely in tidally influenced depositional zones such that a given compositing interval represents very different period of deposition.

Sediment digestion method: Complete recovery of mercury in sediments requires the use of aqua regia to assure dissolution of mercury in the sulfide form (Jacobs and Keeney 1974). The study report gives EPA Method 7471 in one place as the analytical method applied but also states that EPA Method 3050B was used for digestion of sediment and Method 245.7 for analysis. Method 3050B does not employ aqua regia but uses a mixture of nitric acid and hydrogen peroxide to digest sediment and is specifically not approved for analysis of mercury because mercury is not recovered quantitatively. This reviewer suspects the analytical laboratory wished to conduct only one digestion to obtain solutions for both mercury (by atomic absorption spectroscopy, AAS) and other metals (by ICP-MS). Thus they followed

only the analytical portion of Method 7471 (which is very similar to Method 245.7 in using AAS). The high chloride content of aqua regia interferes with analysis by ICP-MS which is why alternate digestion methods are applied when analyzing elements other than mercury.

Quality Assurance: According to one appendix (supporting document) to the Nordic report, standard/certified reference materials were analyzed to verify quantitative recovery of target analytes, but Tables II-1 and Table II-5 indicate this was not actually performed. This reviewer is aware that CRMs for mercury in sediment are now difficult to acquire, at least in North America. Formerly NIST offered several such CRMs for mercury in river sediment but these seem no longer available. ERM-CC580 is an certified reference material for estuarine sediment and available from European vendor. Demonstration that mercury could be recovered quantitatively from Penobscot Bay sediment was critical to having any confidence in the Nordic Aquafarms data but seems not to have been so recognized and carried out.

Citations

Jacobs, L.W. and D.R. Keeney. 1974. Aqua regia for quantitative recovery of mercuric sulfide from sediments. *Environ. Sci. Technol.*, 8(3):267-268