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May 4, 2015

Attention: **Johanne Paradis**
Project Manager,
Contaminated and Legacy Sites Project Delivery
Department of National Defence
Government of Canada

Reference: Review of Hemmera's 2015 report, Soil Toxicity Testing and the Development of Site Specific Remediation Objectives for the Nanisivik Docksite

I have reviewed the above document, as well as its appendices, including Stantec's 2014 report, Ecotoxicity Assessment of Nanisivik Stockpiled Glacial Tills Contaminated Predominantly With F2. I have previously reviewed documents associated with development of the DQHHERA for this site, whereby I noted that the assessment as proposed was fundamentally sound, although I provided comments to DND that I felt would improve the study. I did not review the final document that was prepared at that time.

During the review process, I noted that there are a number of other documents that have been produced by the site operator (Nyrstar) on the Nunavut Water Board's website that are also associated with this site. I did not review these subsidiary documents.

I found the two reports, Hemmera 2015 and Stantec 2014, to be fundamentally sound and meet the requirements as originally stated in the DQHHERA proposal; however, I did note some shortcomings. The consultants have utilized Canadian Council of Ministers of the Environment (CCME)'s Canada-Wide Standards for Petroleum Hydrocarbons to develop these documents, modifying generic (matrix) criteria cited in the standards to develop site specific remediation objectives (SSRO's). This task is an appropriate use of the standards. I noted three issues or deficiencies in the development of these SSRO's as follows:

- Soils submitted for toxicity testing appear to have been exclusively collected from homogenized soil piles that were already undergoing active remediation in site landfarm. This indicates that both surface and subsurface soils were used. Typically, ecotoxicity assessments should be completed on surface soils only, prior to excavation, to maximize growth in the test organisms since these soils contain macronutrients and natural soil bacteria in the highest concentrations. Hence, study results will generally show greater response in the surrogates that will allow the assessors to separate toxicity response from deficiencies in macronutrients and soil bacteria (i.e. if surrogate species do not grow due to a lack of nitrogen, the assessors will not be able to measure toxicity response in these species). Regardless, I believe that the assessors were able to demonstrate a lack of toxicity response by using multiple surrogates.
- The consultants indicate that growth was greatest in soils with the highest F2 concentrations. In fact, growth response was often lower when plotted against the highest F2 concentrations

- compared to lower F2 concentrations (eg. *F. candida* survival; alfalfa shoot length; blue gramma grass root length; and northern wheatgrass root mass). While not definitive and clearly not toxic these levels could suggest that a toxic level may exist only slightly above the highest concentrations tested (407 mg/kg). As such, while the usage of 407 mg/kg as an SSRO for this is appropriate, it is important that this criteria be met.
- Finally, the consultant noted that F2 concentrations decreased substantially during transportation of the samples to the analytical laboratory. This suggests that natural attenuation of these soils is still occurring. Based on these results, I would urge Nyrstar to continue remedial work to meet the original soil remediation criteria (260 mg/kg) wherever possible.

Despite these deficiencies, I feel that the SSROs developed in these documents are appropriate to this site.

Should additional information become available which differs substantially from my understanding of the site conditions presented in these reports, I would be more than happy to update my assessment. I trust that my current review meets your needs. If you have any additional comments or needs please feel free to contact me.

Regards,

Chris Doupe
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Environmental Services, PWGSC