



Indian and Northern
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August 3, 2007

Sarah Baines
Regulatory Officer
Wek'eezhii Land and Water Board
#1 4905-48th Street
Yellowknife, NT X1A 3S3

Re: Comments – BHP's AEMP August Lake Sampling Request

Dear Ms. Baines:

Indian and Northern Affairs Canada-Water Resources Division (INAC-WRD) has reviewed BHP's Request and Supporting Information regarding August-only sampling as part of the revisions to the 2007-2009 AEMP Plan. INAC-WRD also retained the services of Barry Zajdlik, a specialist in environmental statistics, to review the request and supporting information - please see attached. General comments are below.

The parameters presented in BHP's report only represent a subset of the parameters of concern regarding BHP's operations. Specifically, no information is presented regarding metal concentrations and their variability during the summer sampling season to date; particularly those identified as increasing in Table 3.1-6 (p. 18) of the AEMP Re-evaluation and Proposed Program 2007-2009. Without the inclusion of these analyses it is difficult to make an informed decision regarding the suggested reduction in sampling proposed by BHP at this time.

Based on the information presented, it is unclear if trend analysis performed on August-only sampling for all parameters would yield the necessary information to make informed decisions on the future AEMP design and or changes/effects in the receiving environment. INAC-WRD notes that increases in six water quality parameters have been recorded downstream of BHP's operations to date; the majority of which were not predicted to increase in the original Environmental Assessment. A reduction to the program at this point should only be granted once all information and assessments are clear and clearly indicate, based on all available information, that a reduction would not jeopardize future assessments and trend detections.

INAC-WRD and our consultant, Barry Zajdlik, are available to review any additional information and or analyses BHP wishes to provide regarding the proposed reduction to their summer sampling program. Additional information on metals concentrations and statistical interpretations (as fully detailed in Mr Zajdlik's attached review) would be useful in our assessment. We are also available to discuss any above items or comments if required; inquiries in this regard can be made to Nathen Richea at richean@inac.gc.ca or at (867) 669-2657.

Sincerely,

Dr. Kathleen Racher
Manager
Water Resources Division

August 3, 2007

Mr. N Richea,
Bellanca Building, 3rd Floor
P.O. Box 1500
4914-50th St.
Yellowknife, NT X1A 2R3

Re: **BHP August – only sampling**

Dear Nathen:

Thank you for the opportunity to review the rationalization for August – only sampling by BHP. I am a firm believer in cost-effective sampling and have urged both regulators and proponents to avoid monitoring simply for the sake of monitoring. That being said, BHP has proposed reduction in open-water sampling of almost 70%; therefore a thorough rationalization must be provided.

Rescan sought to answer the question: Are “data from the August lake samples as representative as data collected in other months?” Rescan addressed this question using two approaches as described below.

1. Assessing correlation between samples across months using pairwise Pearson and Spearman rank correlations. While useful, only the correlations are presented and not the results of tests of significance of correlation. These tests tell us whether the estimated correlation is so strong that it is unlikely to have arisen by chance alone. BHP did not conduct these tests and the reader is left to speculate as to what a strong correlation is. The tests of significance should be presented along with associated p-values. Rescan should also discuss the implications of conducting many univariate tests on the interpretation of the suite of pair-wise comparisons. Finally Rescan should address the fact that the correlation tests used only capture monotonic relationships.
2. Fit a tobit model for each month and report the within-month residual variance estimate and associated confidence interval in order to determine in which month the residual variance is least. The assessment of within-month variance is a good idea. The fitted models should be presented to allow readers to understand the structure of models that were fit. Also model diagnostics such as assessments of model fit and tests of assumptions should be presented or referred to in order to ensure that the fitted models are indeed useful predictors of the data. (Tobit models are highly susceptible to heteroskedasticity¹ therefore the application to typically heteroskedastic water quality data should be cautious). Only then can the results of the models be usefully reviewed.

Tobit models are typically applied to right – censored data (which concentration data are not) to describe the relationship between the censored response and a set of independent variables. There are other variants of the tobit model that apply to left-censored or interval censored data. Rescan should also discuss why a tobit model was used to estimate within-month variances and not a tool that explicitly estimates these types of effects.

¹ This is due to the assumed relationship between the latent and observed variables.

One of the questions that Rescan did not address when determining whether “data from the August lake samples is as representative as data collected in other months” is whether there is a systematic shift in the mean or median analyte concentration across months. The maximum mean, (median, 75th percentile etc.) concentration is more important to regulators and stakeholder than the month in which variability is least. Within – month variability can be offset by sample size, but a measured low value within a month can only be adjusted upward or downward to another possibly higher month using historical data.

Rescan should augment their rationalization for August-only sampling with a comparison of within-month means, medians and likely 75th percentiles. If there are substantive changes in an analyte within the open-water season, the implication of using a single months sample on the AEMP should be discussed.

The final concern with the rationalization provided regards the analytes assessed. BHP has selected a subset (chloride, sulphate, TDS, and nitrate) of the parameters monitored during the summer, based upon increasing trends. BHP also selected ammonia since it is non-conservative in the receiving environment. The list of parameters selected to rationalize August-only sampling does not include any metals. As, Ba, Mo and Ni were identified as increasing in the recent AEMP re-evaluation (Table 3.1-6) conducted by Rescan. If increasing temporal trends are a suitable criterion for selecting parameters to investigate, one or more analyte in the metals class should be investigated.

Given the subjectivity in the interpretation of monotonic correlation analyses, concerns expressed with the tobit model used, the lack of investigation into shifts in analyte concentration in the open-water season and the choice of analytes used to investigate August-only sampling, August-only sampling should not occur at the present time.

Sincerely,

Barry Zajdlik
Principal