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Operator of the EKATI Diamond Mine

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December 16, 2011

Independent Environmental Monitoring Agency
#203, 5006 – 50th Avenue
P.O. Box 1192
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Attention: Mr. Bill Ross, Chair

Re. Water Quality Benchmark and Objective for Nitrate

As part of our on-going conversation about nitrate management at the EKATI mine, BHP Billiton is pleased to provide the following information.

The Monitoring Agency is aware of BHP Billiton's identification of nitrate as a potential water quality risk in the receiving environment downstream of the Long Lake Containment Facility (LLCF) and its on-going adaptive management responses to that risk. These activities have been discussed and reported on numerous occasions. The subject of this letter is the receiving water quality benchmark for nitrate that BHP Billiton currently works with, and the work that BHP Billiton is undertaking to develop a site-specific water quality objective (SSWQO).

The benchmark that BHP Billiton currently works with is the Ideal Performance Standard (IPS) that was published by Environment Canada in 2008. The IPS is preferred over the current interim water quality guideline (WQG) published by the Canadian Council of Ministers of the Environment (CCME) because it is more recent, taking into account up to date toxicity studies, and because it follows the current CCME methodology for deriving a water quality guideline.

BHP Billiton is aware that in 2011 the CCME circulated, for public comment, a draft update to its WQG for nitrate; however it would be inappropriate to adopt a draft guideline that is undergoing review and possible change. As regards the review of the 2011 draft CCME WQG, BHP Billiton supports information that was provided to CCME that is indicative of a toxicity-modifying relationship between nitrate and hardness.

The Monitoring Agency has raised the question of whether the IPS is appropriate for use at the EKATI mine because a chronic (sub-lethal) endpoint for lake trout (from a 2006 paper produced by Rescan Environmental Services for BHP Billiton) falls outside of the 95% statistical envelope used in the derivation process. The Monitoring Agency has pointed to a *Protection Clause* in the CCME documentation as possibly affecting use of the IPS at the EKATI mine.

The technical reports for the 2008 Environment Canada IPS and the 2011 Draft CCME WQG for nitrate both reference the *Protection Clause* that is described in Part II, Section 3.1, Pages 5 and 6 (attached) of the 2007 CCME Protocol for Derivation of Water Quality Guidelines. The 2007 Protocol is the primary source document for guidance and rules on the derivation of water quality guidelines in Canada.

The *Protection Clause* applies equally to any water quality parameter for which a long-term water quality guideline has been derived. This clause ensures that the derivation is given a "reality check" prior to implementation. The Protection Clause provides several possible remedies if it is determined that the derived guideline value is not adequately protective in special circumstances where some toxicity endpoints fall outside of the 95% statistical envelope. The Protocol provides that:

1. if a no-effect or low-effect (sub-lethal) endpoint is lower than the proposed guideline for a COSEWIC-defined species at risk, then "that endpoint becomes the recommended guideline value";
2. if a moderate-effect or severe-effect endpoint is lower than the proposed guideline for a COSEWIC-defined species at risk, then "the guideline value shall be determined on a case-by-case basis (e.g., by using an appropriate safety factor)";
3. if a lethal-effects endpoint is lower than the proposed guideline for any species, then "that endpoint becomes the recommended guideline value";
4. if multiple endpoints for a single taxon are clustered around the 5^{th} percentile, then "best scientific judgment should be used … in determining the best path forward"; and
5. "in the regional or site-specific implementation, if it can be demonstrated that a data point below the recommended guideline is ... for an 'ecologically important' species, then jurisdictions may use that data point as the basis for deriving the applicable guideline value".

It is only point no. 5 above that is relevant to the discussion of nitrate in the aquatic environment at the EKATI mine. However, the complete list has been provided to highlight the very different wording used in the remedies for the various special circumstances. For example, the special circumstances addressed in point nos. 1, 2 and 3 are well-defined and, as a result, specific remedies are mandated. In comparison to point nos. 1 and 3 specifically, point no. 5 addresses a more subjective special circumstance and suggests a remedy that may be used, rather than mandating its use. Additionally, the possible remedy referred to in point 5 is different in that that it says that the special data point may be used in the derivation of the guideline value (i.e., the remedy does not say that the special data point should be used as the guideline value itself).

In this sense, the remedy outlined in point no. 5 has already been provided for in both the IPS and the CCME WQG derivations. In both cases, the authors chose to include the most sensitive endpoint for lake trout, representative of reduced growth rate. The authors each chose to not include a higher

sensitivity endpoint for lake trout representative of more serious effects. In this way the *Protection Clause* was satisfied within the derivation itself.

BHP Billiton believes that a site-specific water quality objective (SSWQO) for nitrate would be helpful for on-going management of risks at the EKATI mine and, to that end, plans the following:

1. Continue to use the Environment Canada 2008 IPS as the EKATI mine water quality benchmark on an interim basis; and
2. In respect of the additional toxicity data that has become available since the 2008 IPS and the 2011 CCME Draft WQG were derived, develop and adopt a SSWQO for nitrate.

Development of the SSWQO is underway and BHP Billiton hopes to complete and circulate a technical report by or around April 2012. If the CCME publishes an updated (final) WQG for nitrate prior to BHP Billiton's completion of the site-specific work, then BHP Billiton will adopt the updated CCME WQG as its interim water quality benchmark for the EKATI mine until the SSWQO is complete.

BHP Billiton appreciates the on-going interest expressed by the Monitoring Agency on this topic and views the conversation as indicative of a shared desire to adequately protect the environment. Please contact the undersigned at 669-6116 if you have any questions.

Sincerely,
BHP Billiton Canada Inc.

Eric Denholm, Superintendent – Traditional Knowledge and Permitting
EKATI Diamond Mine

c.c.: Wek'eezhii Land and Water Board, Ryan Fequet
Aboriginal Affairs and Northern Development Canada, Jason Brennan and Paul Green
Environment Canada, Lisa Lowman
Fisheries and Oceans Canada, Bruce Hanna

distributions, (e.g., that occur when different taxa or trophic levels have different sensitivities [as seen, for example, in selectively acting pesticides]) will reduce the ability of any model to adequately fit the data. The ability to reject or accept a model can be limited with small or large sample sizes, respectively.

Fulfillment of the Guiding Principle by Long-term Exposure Guideline

Using the SSD approach in the derivation of long-term exposure guidelines may raise the question whether the resulting guideline is fulfilling the guiding principle of protecting all species all the time.

In the SSD, the likelihood of a data point falling below a certain percentile on the y-axis is a function of sample size (i.e., the number of species and endpoints in the SSD in relation to the percentile). For example, with a data set of over 20 data points, at least one data point would fall below the 5th percentile. Therefore, setting the guideline at the 5th percentile alone could be interpreted as allowing for the impairment (and, theoretically, potential loss) of up to 5% of possible species, depending on the severity of the effects endpoints plotted. This issue is of particular relevance when plotting moderate- or severe-effect level data, but is less important when plotting low- or no-effect level data. Some proponents of the SSD approach argue that enough redundancy exists within aquatic communities to allow some loss (e.g., Posthuma et al., 2002). This in itself, however, is not considered acceptable to deem the resulting guideline as fulfilling the guiding principle.

Therefore, additional safeguards are taken in the development of the guideline when using the SSD approach:

- Data for all available species are plotted.
- The lowest acceptable endpoint for appropriate, different negative effects per species is plotted.
- No-effect data are preferentially and primarily plotted.
- There is the potential of invoking the protection clause (see below).

While the intercept of the 5th percentile to the fitted curve is often lower than the lowest observed low-effect toxicity value (especially for data sets with fewer than approximately 15 data points), the larger the data set, the higher the probability that a low-effect data point will fall below this value, thereby implying that this species may not be sufficiently protected (depending on the kind and severity of effect associated with this data point). Although the guideline is derived preferentially with a no-effect data set (which can include some effects data, especially at the upper part of the concentration range), the potential, therefore, exists that a low-effect or even a severe-effect endpoint may in fact be below the recommended guideline value. Consequently, in certain situations, the protection clause may be invoked.

Protection Clause

The protection clause is created to ensure that the guideline is fulfilling the guiding principles of CCME with respect to the intended level of protection. It applies only to the long-term exposure guideline and should only be invoked if there is a strong reason to question that the Type A long-term exposure guideline based on the 5th percentile intercept to the fitted curve is achieving the intended level of protection.

The protection clause may be invoked if an acceptable single (or, if applicable, geometric mean) no-effect or low-effect level endpoint (e.g., EC_x for growth, reproduction, survival, or behaviour) for a species at risk (as defined by the Committee on the Status of Endangered Wildlife in Canada [COSEWIC]) is lower than the proposed guideline (i.e., is below the 5th percentile intercept to the fitted curve), then that endpoint becomes the recommended guideline value. If this endpoint is a moderate- or severe-effect level endpoint for a species at risk (i.e., EC_x with $x \geq 50\%$, or a lethality endpoint [LC_x]), then the guideline value shall be determined on a case-by-case basis (e.g., by using an appropriate safety factor) (Chapman et al. 1998).

Similarly, if an acceptable single (or, if applicable, geometric mean) lethal-effects endpoint (i.e., LC_x, where $x \geq 15\%$) for any species is lower than the proposed guideline (i.e., is below the 5th percentile intercept to the fitted curve), then that endpoint becomes the recommended guideline value.

Furthermore, special consideration will be required if multiple endpoints for a single taxon (e.g., fish, invertebrates, or plant/algae) and/or an elevated number of secondary studies are clustered around the 5th percentile. Best scientific judgment should be used in deciding when this situation is present (e.g., due consideration should be given to the percentage of data points in question to the whole data set) and in

determining the best path forward to address this situation.

To allow for flexibility in the regional or site-specific implementation, if it can be demonstrated that a data point below the recommended guideline is for a species at risk within a given province/territory or region/site, for a species of commercial or recreational importance, or for an "ecologically important" species, then jurisdictions may use that data point as the basis for deriving the applicable guideline value.

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