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re: Diamond Mine Wildlife Effects Monitoring Workshop and Next Steps

We would like to thank the diamond mines and Government of the NWT for the workshop on diamond mine wildlife effects monitoring programs held on September 22-23, 2009. While this was a helpful session in considering possible changes to wildlife monitoring at the diamond mines, more attention might have been focused on the objectives of the programs in light of what we know today.

Our Agencies have supported wildlife monitoring programs based on a framework following the logical sequence from impact predictions to monitoring objectives to testable hypotheses (and alternate hypotheses) leading to methods designed to test the hypotheses. The attachment applies the framework to caribou disturbance as it may relate to mining activities to provide an example of how such an approach could be used. We attach this submission in the hope that it can serve as the basis for further progress on reviewing and refining the programs.

We also urge an approach to ensure that Aboriginal knowledge is a greater part of monitoring. We suggest that components based on Aboriginal knowledge and skills be built into monitoring programs such as caribou behaviour and dust monitoring to ensure that the use of different bodies of knowledge is complementary. EMAB is in the final stages of developing a proposal for TK camps around Lac de Gras to monitor caribou and fish. SLEMA has developed a proposal to monitor dust fall and caribou at the Snap Lake

mine using TK. We trust both proposals will be given serious consideration as a means of addressing current gaps.

Our Agencies are prepared to offer further assistance in moving the review of the wildlife monitoring programs forward. Smaller technical workshops should be convened to cover manageable topics to allow more in-depth and complete discussion. Caribou, grizzly bear, and wolverine appear to be the species of greatest concern at present and should be set as priorities.

As noted in the summary from the September workshop, a detailed technical workshop could be held in January 2010 to further discuss issues raised at the September workshop, the results of the smaller technical workshops and our suggestions in this letter and attachment.

We look forward to working with you to improve wildlife monitoring and your responses to our suggestions.

Sincerely,

Bill Ross	Doug Crossley	Rachel Crapeau
IEMA	EMAB	SLEMA

cc. IEMA Society Members
EMAB members
Parties to the Environmental Agreement for the Diavik Diamond Project
Lindsey Cymbalisty, INAC

Diamond Mines Wildlife Monitoring Programs: Proposed Movement Forward

Introduction

Following the NWT Diamond Mine Monitoring Workshop held in N'dilo on September 22-23, 2009 there was considerable uncertainty about future wildlife monitoring. The purpose of this submission is to propose a systematic approach that the Independent Environmental Monitoring Agency, Environmental Monitoring Advisory Board, and Snap Lake Environmental Monitoring Agency believe should be used in reviewing the programs, and to provide some examples of how this approach may be used.

Much has been learned from monitoring programs conducted at the three NWT diamond mines over the past 13 years. Some of this information has confirmed original impact predictions, while other predictions have proven to be inaccurate. In addition, some observed effects were not addressed in the original predictions. We propose that some impact statements and objectives for the monitoring programs be revised by adding predictions that reflect our increased knowledge and focus on moving forward in understanding the processes at work and how best to address them.

We urge that the logical sequence from impact predictions through monitoring objectives and testable hypotheses (with alternate hypotheses) be strengthened as part of the current comprehensive review of the monitoring programs for the NWT diamond mines.

Objectives should test realistic hypotheses, and methodologies should be able to address objectives, document impacts and effects, and assess effectiveness of mitigative measures at the mines. All monitoring should contribute to understanding cumulative effects (as any residual effects feed into cumulative effects) because it has been demonstrated that mines and other human activities affect caribou and other species cumulatively. In suggesting hypothesis testing we are not attempting to make this monitoring an abstract exercise. Rather we would like to ensure that the information necessary for verifying predictions and the effectiveness of environmental mitigation and for management at the mines is obtained in a scientifically rigorous fashion.

We hope the wording of the sample prediction and objective provided here will start the discussions to collaboratively build on the previous monitoring and emphasize the link between impact predictions and hypotheses to test those predictions with the underlying purpose being to gain the understanding necessary to manage wildlife impacts. We provide a full example of a sequence of impact prediction, monitoring objective, testable hypotheses and methods that could be used for a component of caribou monitoring.

As noted in the summary from the September workshop, a detailed technical workshop should be held in the near future. The workshop would ensure objectives, hypotheses and methods follow logically from current predictions, develop additional predictions as appropriate, and further discuss issues raised in September and our suggestions. Smaller technical workshops could be convened to cover manageable topics to allow more in-

depth and complete discussion. Caribou, grizzly bear, and wolverine appear to be the species of greatest concern at present.

Caribou example

Discussions regarding caribou monitoring at the September workshop were wide-ranging, but did not have sufficient time to allow all meeting objectives to be discussed in detail. Participants provided a number of different options on how to address zone of influence (ZOI), alterations to movements, and behavioural responses to mine activity including roads and dust. Given the now greater understanding of caribou responses, including a larger than anticipated ZOI, we suggest that impact predictions, objectives and methodologies should be revised to reflect advances in our understanding of the system and impacts. We also suggest that the monitoring and mitigation be tied to the trends in the Bathurst herd, which currently is in a severe decline. By this we mean that during low caribou numbers monitoring could be scaled back (to reduce potential disturbance) and mitigation be heightened (to reduce potential impacts).

It is important not to lose sight of how much larger the ZOI is relative to the original impact predictions. The larger than expected size of the ZOI may reflect gaps in mitigation measures. The extent (shape and size of the ZOI) are also important to assessing the contribution of the mine's activities toward cumulative impacts.
The emphasis should now shift toward understanding the mechanisms (root causes) for the size of the ZOI: dust, noise, vibration, and visual stimuli were possible mechanisms raised at the workshop.

As shown by Boulanger et al. (2009, submitted), the aerial survey data provide more precise results at a more appropriate scale than the past satellite collar data, primarily a result of low sample size of collared animals within the ZOI of the mines. The newer GPS collars may provide useful, small-scale data that may become appropriate for some analyses.

Fieldwork to provide more data to determine a behavioural ZOI (proportion of time spend feeding, bedded, walking, etc.) should be expanded to obtain adequate sample sizes and distribution from mine infrastructure. The behavioural ZOI (the distance where animal activity is altered) may be far smaller than the distributional/occupancy ZOI (the distance where occurrence of animals is altered), and impact predictions and objectives (e.g., whether the dominant behaviour of caribou groups varies with distance from a mine) could be altered to fit. Examples of methodologies to consider include non-intrusive methods such as video surveillance and motion-activated cameras.

Sample impact prediction

1. The mine(s) exerts a zone of influence (ZOI: the probability of caribou occurrence, or caribou distribution relative to distance from mine development) within which the probability of caribou occurrence changes in response to phase of mine activity (e.g., construction, pit mining, underground mining).

Sample objective

1. Determine if the extent of the ZOI is related to mine phase and activities (e.g., construction, shift from open pit to underground, changes in the use of the Misery Road, changes in the number of trucks in operation).

Suggested hypotheses for Objective 1

Null hypothesis: The extent of the ZOI does not change with changes in mine activities as represented by phase of mine development.

Alternative hypothesis (1): The extent of the ZOI will vary with changes in mine activities as represented by phase of mine development.

Alternative hypothesis (2): The extent of the ZOI differs among four quadrants around the mine site (This alternate hypothesis is to examine if dust and mine activity [noise, visual stimuli, etc.] are interacting factors).

Similar impact predictions, objectives and hypotheses could be constructed to examine behavioural aspects of the influence of mines on caribou feeding, resting, etc., as animal behaviour can work in a multiplicative manner with relative distribution to increase or decrease impacts on caribou. Impacts to broad changes in movement patterns through the mine areas could also be examined (deflections of migration, filter effects of roads and infrastructure, etc.).

Suggested methodology

The existing aerial survey design was adequate to assess relative distribution of caribou (Golder 2008; Boulanger et al. 2009, submitted), and enable hypothesis testing. Surveys have been conducted annually for a number of years at all mines, which have provided a good base of data. However, we suggest that annual surveys are no longer necessary, as there appears to be little gain of additional information at this stage, and changes to the ZOI are not expected to happen quickly. Surveys may induce some measure of disturbance, which at this point in the population cycle (bottom of a significant decline) may be harmful. Therefore, a pause of 2–3 years beginning in 2010 could be considered.

We propose that ZOI should be determined after large changes in mine activity. The number of years in between pulses of surveys would then depend on the phase of the mine(s). A composite mine plan for future operations would help determine future monitoring. Changes from one phase to the next may occur when a majority of activity changes (e.g., most of the development is underground, a large increase in truck traffic for several years). ZOI should also be determined after changes in caribou cycle (herd growth), and possibly environmental conditions, but these temporal scales may be too long to contemplate at present.

Data already collected can be used to examine changes in ZOI with the mine activities. In addition, retrospective analysis of the data should be used in a power analysis to

determine survey effort to detect changes relative to annual variation in the ZOI. Determination of a ZOI with comparatively tight confidence limits requires sufficient data for the period in question. These data are based in large part on the number of transect cells (1-2 km segments) that are occupied by caribou on surveys (J. Boulanger, pers. comm.). Low sample sizes of occupied cells produce weak results, and require more years of data to strengthen. Surveys every second year will likely extend the time needed to determine the ZOI, may wash out differences between phases of mine development, and may provide biased data if natural changes in the ecology of caribou mimic a 2-year cycle. Similarly, in years when surveys are conducted, cutting back from weekly to bi-weekly surveys will cut samples size in half, again requiring more years of surveys to provide a robust ZOI estimate. As such, we are strongly opposed to any change to bi-weekly surveys in years when surveys are conducted. If surveys are to be conducted, they should be conducted to provide robust data that can address objectives.

We suggest that a pulse of a minimum of 3 years of surveys may be adequate to determine the ZOI, but analysis of the power of the data after 3 years should be conducted to make sure it is adequate, and a 4^{th} or 5^{th} year should be added if necessary (adaptive monitoring). With diminished caribou numbers, the number of cells that caribou occupy must be sufficient for the analysis. However, a power analysis should be conducted to determine the optimal timing of surveys, and the percent change in ZOI that could be detected.

It may also be a good idea to conduct 1–2 surveys if there is a sudden influx of a large number of animals (thousands) into the vicinities of the mines, to provide an instantaneous abundance estimate of animals within the study area in order to determine what proportion of the herd may be exposed to mine activities. An estimate of the abundance of caribou within mine study areas during these periods could be tied to cumulative effects assessment. Criteria should be developed when to kick in these short pulses of surveys (e.g., a sudden influx of thousands of caribou). These criteria would primarily be based on wildlife sightings from the ground.

As pointed out in Boulanger et al. (2009, submitted), footprints and activity from both Ekati and Diavik must be considered in analysis of ZOI of the Lac de Gras area because of the adjacency of the mines and resulting confounding overlap in ZOIs.
Dust and lichen monitoring should be conducted regularly and especially after any significant changes in mine operations, as this may tie in with caribou distribution and relative occurrence.