

Snap Lake Environmental Monitoring Agency
Science Panel

MEMORANDUM

To: Core Group, Snap Lake Environmental Monitoring Agency
Subject: **Technical Reviews of DeBeers Monitoring Plans**
Date: April 28, 2005

1. INTRODUCTION

This report summarizes the key findings of the Science Panel in our review of several documents recently prepared by DeBeers and submitted to the MVLWB for their review and approval. Reviews were conducted by Colin Macdonald, Peri Mehling, Don Macdonald, and Tony Pearse. The complete individual reviews are attached, as follows:

- Wildlife effects monitoring;
- Aquatic effects monitoring;
- Sampling for dissolved solids in Snap Lake;
- Groundwater sampling;
- Adaptive management plan; and,
- Quality assurance & quality control.

Before commenting on the individual reports listed above, the following section provides some general comments about monitoring programs so that our comments can be seen in the proper context.

1.1 GENERAL COMMENTS ABOUT MONITORING PROGRAMS

First, the main purpose of any monitoring program is to provide the information for managers to know when something is going wrong so that they can take corrective action. For a monitoring program to be useful in environmental protection, it must be coupled to some kind of action that can be taken by managers to fix a problem once it is detected.

Without a management response, monitoring becomes little more than an academic exercise.

Second, the monitoring program must also be able to discriminate between changes that are caused naturally and those that are caused by the project. If it cannot do this, then it will be useless.

Third, the starting conditions of the environment, prior to disturbance by the project, must be adequately characterized. Where the baseline conditions are not fully described, additional studies may need to be conducted so that project monitoring will be effective.

Fourth, most monitoring programs require a control situation to compare monitoring results to. A control is a sampling station in an area that will not be affected by the project, so that natural changes can be observed without any interference from the project.

Finally, monitoring programs must contain all the following elements to be workable:

- A hypothesis about the kind of change that could be expected from the project;
- A statement of objectives about what monitoring is required to prove or disprove the hypothesis;
- A description of indicators that can be measured so as to disprove or support the hypothesis;
- A description of the sampling procedures (i.e., location of stations, frequency of sampling, etc.);
- A description of the approach used to analyze the collected data;
- An evaluation of the quality of the data and the robustness of the analytic approach to use, along with an identification of the limits of confidence in the results;
- An identified threshold, or trigger, that will cause a management response to be taken when needed; and,
- a description of the management response (i.e., mitigation measure) that will be taken once the threshold is reached.

In reviewing DeBeers' monitoring plans, therefore, the Science Panel used the list above as a checklist in order to ensure that the plans were complete and that sufficient detail was present on each of these elements so that they could be meaningfully evaluated.

2. WILDLIFE EFFECTS MONITORING PROGRAM

2.1 GENERAL COMMENTS

The stated purpose of the *Wildlife Effects Monitoring Program* is to:

- Verify the EA predictions;
- Provide information to managers in order to mitigate disturbance to wildlife and wildlife habitat, including migratory birds and their nesting areas, species at risk, and caribou;
- Determine the effectiveness of mitigation measures implemented;
- Consider, and incorporate where possible, traditional knowledge;
- Establish action levels or triggers for early warning signs to implement adaptive management and mitigation measures where appropriate;
- Provide opportunities for the involvement and active participation of aboriginal parties in the implementation of the *WEMP*;
- Design studies and data collection techniques that are consistent with, and will contribute to, understanding and managing regional cumulative effects; and,
- Develop and review the *WEMP* in collaboration with the Government of the Northwest Territories Department of Renewable Resources and Economic Development.

Our review shows that the proposed programs and studies lack sufficient detail for proper evaluation. Many of these objectives will not be easily achieved with this program. Numbers of stations and samples are so low that trends will be very difficult to detect, and the effect of the mine virtually impossible to detect in a scientific manner.

Track counts and surveys for caribou, grizzly bear, wolverine, wolves will provide little information on whether the mine is having an impact on the species. De Beers recognizes this problem with the grizzly bear (too few to make a reasonable statistical assessment) but, in fact, the same case can be made for the other species as well. If caribou are tracked near the mine for five years and they then migrate through a different route for two years, will the mine change any operating procedures so as to mitigate the effects? There are no management options outlined if numbers increase or decrease significantly.

The current plans probably will not provide data to allow adequate hypothesis testing to trigger adaptive management policies as described in the *Environmental Agreement*.

Upland breeding birds, waterfowl and foxes have been dropped from the list of valued ecosystem components used in the EA, so there will be no way to verify the original impact predictions.

The dust monitoring program may not have a strong enough statistical basis to be able to determine if adverse impacts from dust could be occurring.

Additional comments and recommendations are provided in the technical review by Colin Macdonald.

3. WATER RELATED DOCUMENTS

The following six water-related reports were reviewed by the Science Panel:

1. TDS Sampling Plan;
2. Groundwater Monitoring Program;
3. Water Management Plan;
4. Aquatic Effects Monitoring Program (AEMP);
5. QA/QC Plan; and,
6. Adaptive Management Plan.

3.1 GENERAL COMMENTS

At a general level, the programs proposed are reasonable. However, they lack sufficient detail for proper evaluation and are inadequate as stand-alone documents. In most cases where monitoring programs are designed to verify predictions made during the environmental assessment, the predicted values will have to be extracted from the original *Environmental Assessment Report* since they are not provided in the plans. The predictions should have been included in each of the plans.

Where triggers are proposed for corrective action, the proposed mitigative actions are typically more study and review of the programs, as opposed to effective mitigation to fix the problem. For example, elevated TDS triggers a study to determine if an impact is really occurring but no mitigation measures are proposed.

3.2 TOTAL DISSOLVED SOLIDS (TDS) SAMPLING PLAN

The environmental assessment identified dissolved ions in the groundwater as being one of the more significant issues requiring attention when DeBeers pumps its mine water into Snap Lake. It was uncertain how discharged mine water into the lake would behave, and what the concentrations of potential contaminants would be as they moved out into the lake from the discharge pipe. The water licence therefore requires a *TDS Sampling Plan* to be implemented which will measure the distribution and movement of key mine water components (total dissolved solids, calcium and chloride) in Snap Lake.

Our review found that the *TDS Sampling Plan* lacked sufficient detail to be a stand-alone monitoring plan.

The number of sampling stations and sampling frequencies are not appropriate, and more information is needed to justify the sampling design. In addition, more sampling stations may need to be added for the purposes of the mass load model that is being developed by DeBeers. Furthermore, other documents need to be referenced in order to understand what numerical values would be considered as action targets or thresholds for the program. Finally, the mitigative measures that will be taken to address elevated levels of dissolved solids in Snap Lake are not described.

Specific, additional comments are provided in the reviews by Peri Mehling (pp.3-7) and Don Macdonald (pp.19-20).

3.3 GROUNDWATER MONITORING PROGRAM

The concept proposed in this report for collecting ground water data is acceptable, but the described program is deficient since there no effective mitigation strategies are specified for any events where groundwater quality results in predicted threshold exceedances in Snap Lake. While triggers are identified for action, the proposed action consists of further study and evaluation, not measures to fix the problem. For example, the critical threshold of 350 mg/L for dissolved solids (TDS) in Snap Lake is specified as a trigger for action if forecasted, but no actual mitigation is proposed. Similarly, if seepage from the water management pond or the North Pile exceeds EA predictions (the specified trigger for

action), no effective mitigation is proposed. This program, therefore, does not provide “a means for management of groundwater quantities within the range of the EAR predictions”, as required by the *Water Licence*.

In addition, the proposed program cannot distinguish between mine water originating from ancient groundwater in the rocks and fresh recharge water from Snap Lake. Since the environmental assessment predicted the quantity and quality of each of these sources, it will not be possible to verify the EA predictions (a stated objective of the monitoring plan) since the program monitors only the combined inflows.

A contingency for adding sampling stations underground in the event of increasing contaminant trends in underground water quality is proposed but no details are provided, such as what values would trigger this action. In our view, more underground stations need to be established at the outset to provide the data needed to assess conditions relative to EAR predictions. Similarly, sampling of the North Pile is proposed as a means of tracking seepage water quality from the waste rock, but the necessary details such as location of sampling, number of stations, frequency of sampling, or what parameters will be measured are not provided. Stations at various depths in addition to the SNP sites will be critical for estimating trends and the influence of the two groundwater sources, and should not be considered contingencies dependent on trends.

It is proposed to use the monitoring data in revising the mass loading model used to predict water quality. More details concerning the application of this model are required, particularly with respect to what things should be used for the comparison of predicted and measured values.

The technical reviews by Don Macdonald (pp.6-9) and Peri Mehling (pp.7-9) list other deficiencies and make a number of recommendations for fixing these.

3.4 WATER MANAGEMENT PLAN

The *Water Licence* requires DeBeers to have a *Water Management Plan* which describes how water will be used and managed on the site, the hydraulic design of water management structures, monthly water balances, and the monitoring plans for each

component of the system. Our review has found that there are no details for any of these elements and, consequently, the *Plan* does not satisfy the requirements of the *Licence*. Furthermore, few details are provided about the water treatment plant or the diffuser system for the end-of-pipe discharge into Snap Lake.

See reports by Peri Mehling (pp.9-11) and Don Macdonald (pp.16-19) for more additional comments.

3.5 AQUATIC EFFECTS MONITORING PROGRAM

The *AEMP* requires that DeBeers conduct several different types of monitoring. It also requires some additional baseline work to be conducted in the first year in order to fill data gaps which existed at the EA stage but will need to be filled for the monitoring programs to work effectively. Essentially, in order to monitor changes once the project has begun, a good picture of the starting point, or baseline, for each environmental parameter being monitored is required.

Our review has found that both the monitoring programs and the associated baseline studies to be conducted generally lack sufficient detail for us to understand whether or not they will function as proposed. More details and description for all of the programs are required in order to evaluate them.

A common problem for the *AEMP* and the special studies is that the design does not include use of a reference lake. The lack of a reference lake is that it becomes more difficult to assess changes in Snap Lake over time and determine if they are natural or project-related. We understand that DeBeers is aware of this problem, and is now in the process of identifying a suitable reference lake for the *AEMP*.

General comments for the both the special studies and the monitoring programs are provided below.

3.5.1 Special Studies Under the AEMP

At the time of the environmental assessment, the baseline conditions for a number of parameters that would be monitored as part of the *AEMP* were insufficiently characterized.

In recognition of this, the *Water Licence* specified that several ‘special studies’ were needed to complete the data baseline collection, as follows:

- Fish health;
- Benthic invertebrate community;
- Zooplankton & phytoplankton; and,
- Periphyton.

3.5.1.1 Fish Studies

A component of the *AEMP* is to monitor trace metal contamination in fish. The baseline data collected for this purpose does not provide a basis for doing this. In addition, some key potential contaminants are not included in the monitoring program. Furthermore, details of the sampling program for the baseline study are not provided. As a result it may not be possible to assess risks arising from consumption of Snap Lake fish, or to evaluate cumulative impacts.

3.5.1.2 Benthic Invertebrate Study

The proposed baseline study for the monitoring of benthic invertebrates (bugs in bottom sediment) is not adequate to describe natural variability throughout the study area, or over time. Consequently it will be unable to identify the causes of any observed changes.

3.5.1.3 Zooplankton & Phytoplankton Studies

The description of the monitoring proposed for zooplankton (microscopic freshwater animals) and phytoplankton (microscopic freshwater plants) is not sufficiently detailed, so that we cannot properly evaluate how effective the program will be. Both programs are to rely on detecting project-related change without the use of a reference lake and inadequate sample replication. Given the methods proposed, it will be difficult to determine biomass at each sample station, to assess spatial variability within the lake, and to discriminate between project-related effects and natural changes.

3.5.2 **Aquatic Effects Monitoring Programs**

The monitoring programs include:

- Water quality;

- Sediment quality;
- Fish health;
- Fish palatability;
- Benthic invertebrate community;
- Zooplankton & phytoplankton; and,
- Fish habitat

The above listed monitoring programs all lack sufficient detail to allow a proper evaluation as to whether they will be effective. The absence of a reference lake for evaluating data will impair interpretation of the results. The rationale for selecting the number and location of sampling stations within Snap Lake is not provided, so it is not possible to evaluate the adequacy of the program in terms of its spatial scope.

The *AEMP* also lacks certain monitoring provisions for periphyton and zooplankton. For example, community structure has not been included in the monitoring program. The collection methods do not fully describe how the samples are to be taken, and the number of samples collected at each station will not provide a basis for statistically evaluating differences between years.

The fish habitat monitoring program may not have sufficient sampling frequency to assess project-related effects. There is no explanation of how results will be incorporated into the *Adaptive Management Plan*.

As a result of these deficiencies, the *AEMP* is not acceptable as a stand-alone, implementable plan, and requires substantial upgrade in order to render it acceptable.

3.6 QA/QC PLAN

Comprehensive data collection programs require ways of ensuring that the data collected are of high quality, reliable, and consistently collected from year to year regardless of who is doing the collection. Protocols to protect data quality, called Quality Assurance/Quality Control procedures, are an essential elements of monitoring programs. Quality assurance procedures are measures taken to ensure that the data collected will be usable for data analysis, and include things such as staff training, laboratory analytic procedures, and office operations. Quality control is a subset of this, referring to the techniques uses to measure and assess data quality.

Our review has found that the *QA/QC Plan* does not provide sufficient information to properly evaluate sampling and lab techniques. For example, data quality objectives are not specified, and specific detection limits are not described. A number of other deficiencies have been described by Mehling and Macdonald in their technical reviews.

3.7 ADAPTIVE MANAGEMENT PLAN

The *Water Licence* requires DeBeers to submit an “adaptive management plan” to deal with the following issues relating to the quality and fate of the mine’s discharge of mine water into Snap Lake:

- Uncertainty in lake mixing and density stratification;
- Performance of the North Pile;
- Mitigation measures generally;
- Measures specifically to prevent discharges of high levels of TDS; and,
- Describe link with the *AEMP*.

In our view the *Adaptive Management Plan* is not acceptable in its present form.

First, many of the required details, such as the identification of specific thresholds for action or the size of the mixing zone, are not provided.

Second, no effective mitigation, which could fix problems as they arise, is proposed. Instead, ‘action’ focuses on checking data and reassessing risk, rather than implementing a solution. While such review might be of value, it is more critical to take corrective action if the predicted impacts and values accepted by the MVEIRB are exceeded.

The lack of mitigation measures is contrary to the MVEIRB decision report, which relied on remedial measures such as grouting of underground workings to reduce mine water inflows. How grouting will be managed is not clarified in the *Adaptive Management Plan*. Monitoring data from the *Surveillance Network Program* and the *AEMP* will apparently be used to evaluate the use of grouting, but how the data will be assessed and the results applied as a management tool is not discussed.

The *Adaptive Management Plan* indicates that the mine plan might have to be changed if there is an unmanageable increase in groundwater flow. How this measure is to be

accomplished is not specified.

Additional detailed comments are provided in the technical reviews by Tony Pearse and Peri Mehling.