

Technical Advisory Panel (TAP) review comments on “Giant Mine Phase 4 Environmental Effects Monitoring Final Interpretative Report”, June 2013 submission

The following comments and recommendations are based on the review of the report by members of a Technical Advisory Panel (TAP). The TAP for the facility includes representatives from Environment Canada, Mackenzie Valley Land and Water Board and Government of Northwest Territories.

General Comments

1. The Phase 5 study included a Magnitude and Geographic Extent study for confirmed effects in slimy sculpin and ninespine stickleback, and partial Investigation of Cause (IOC) for confirmed benthos effects for which Magnitude and Extent were known. The Phase 5 fish survey confirmed further effects in sculpin. Cause was marginally addressed in the partial IOC for benthos.
2. An IOC study in Phase 5 is recommended as the path forward most consistent with the regulations (see Metal Mining Effluent Regulations (MMER) Schedule 5, S. 19). Note that the cause(s) of all confirmed effects are to be investigated through IOC studies. Since multiple effects may have the same cause, the facility may address overall response patterns, provided there is a scientific rationale for this approach.
3. Throughout the report there appear to be errors in the summaries of effects as previously reported in Interpretative Reports and addenda, and also inconsistencies between the results reported in the tables versus text. The facility is recommended to carefully review previous data analyses (and re-analyses) and ensure accurate summaries of biological monitoring results are provided.
4. Based on effects reported in the Phase 2 and 3 interpretative reports and addenda, and the Phase 4 interpretative report, effects in the following endpoints appear to have been confirmed and should be investigated in Phase 5: slimy sculpin - age, weight at age, relative liver weight and condition; ninespine stickleback - length, weight, length frequency; benthic invertebrate community - Bray Curtis Index.
5. The MMER require that a study design be submitted at least 6 months before a biological monitoring study is conducted (Schedule 5, subsection 19(1)). Study designs for IOC should include include a summary of previous monitoring results, and a detailed description of what field and laboratory studies will be used to determine the cause of the effect (Schedule 5, ss. 19(2)). It may be possible to use existing data and studies for some lines of evidence. The TAP notes that some existing information, including liver triglycerides, glycogen and protein levels in sculpin, and archived tissues, could contribute to the IOC.

Supporting water and sediment quality

6. P. 29 and Appendix B. The facility is to be commended for the excellent summary of supporting water and sediment quality information.

Ninespine stickleback survey

7. P. 67-70. **Limited statistical analyses were conducted on the ninespine stickleback data with a stated rationale of uneven samples sizes among areas, and lack of adult fish at the exposure areas. Sample sizes of juvenile stickleback are adequate to allow for comparisons of weight, length and condition among the near-field, far-field 2 and Tartan Rapids reference area. Please provide statistical analyses as required under the MMER (see Schedule 5, S. 16).**
8. P. 69-71. Stickleback data have been grouped using pre-determined size classes for young-of-year (YOY), juvenile and adult. The length-frequency data in Figure 6-10, however, appear bi-modal. Discuss whether the data should be analysed as two size classes (YOY and adult). If so, sample sizes available for the analysis of the younger class (i.e., comment 7) would be larger.

Slimy sculpin survey

9. P. 72-73. There are differences in the number of sculpin reported in Table 6-10 and 6-11. Clarify the discrepancies, and if a sub-sample of fish were used, indicate the selection process.
10. P. 79 & 81. Sculpin sample sizes in the far fields were low. It would be valuable for comparison to also run the exposure versus reference analyses with pooled far field data, particularly for assessing magnitude and extent of effects for female sculpin. The TAP requests these analyses be provided in the next interpretative report.
11. P. 81, Table 6-18. It appears that exposure versus reference comparisons were done using pooled reference data. Please confirm.
12. P. 81, Table 6-18. Weight at age analyses within size classes were performed using combined data for male and female sculpin. Please perform and provide these analyses with fish separated by sex. Weight at age is a previously confirmed effect (female sculpin Phase 2 (see response to TAP comments on Phase 2 interpretative report) and Phase 3 (statistical interaction with fish larger at age 1, smaller at age 2; see page 94)) and as such it is particularly relevant to understand the nature of effects in this endpoint. If assumptions of ANCOVA are not met, an alternate statistical method should be used.
13. P. 81, Table 6-18. The rationale, methods and approach to bonferroni corrections, power analysis and use of the overall p is not entirely clear from the report. This information should be clearly detailed in future reports.

Fish Survey Data Reassessment

14. P. 94. Table 7-2 presents analyses for Phase 2 and Phase 3 sculpin endpoints where slopes were non-parallel. Analyses are not presented for Phase 3 female liver at weight, even though this is an effect endpoint where results were not presented in the Phase 3 interpretative report due a significant interaction. Please provide these results.
15. P. 94. It is not clear in Table 7-2 why some analyses were performed using exposure versus reference A or B separately, and others using reference A and B combined. Please provide the rationale.
16. P. 95 and Table 7-4. The report indicates that female sculpin had a higher condition factor in the exposure compared to the reference for Phases 2 and 3. However, the Phase 3 report lists female condition as lower in the exposure (-7.96%; Tables 4.18. 4-23 of the Phase 3 report). Therefore, there appear to be confirmed effects in condition for both male and female sculpin between Phases 3 and 4. In all cases, exposure fish had lower condition factor than reference fish.
17. P. 96. An effect has been confirmed in male sculpin relative liver size between Phase 3 and 4. The report states that female relative was liver size not different between exposure and reference among years. However, this endpoint was not tested Phase 3, and is significantly greater in exposure fish (12.21%, see Table 6-18) in Phase 4.
18. P. 96. Regarding patterns of effects for sculpin based on this and previously submitted reports and addenda: age has been significantly lower in exposure males and/or females in all 3 phases (females Phase 2 (males could not be assessed), males and females Phase 3, males Phase 4), even though approaches to assessing age have changed among Phases. There have been growth differences (weight at age) for females and males in Phase 2, females in Phase 3, and further analysis is required for Phase 4. Condition factor was consistently lower for both male and female sculpin in the exposure area relative to those in the reference in Phases 3 and 4. An effect has also been confirmed in male sculpin relative liver size between Phase 3 and 4.

Benthic Investigation of Cause

19. P. 104. Phase 2: The report states that the relative proportion of mayflies was similar in the near-field and far-field, despite a large difference in the degree of effluent exposure. As noted in the Phase 2 interpretative report TAP review, based on Figure 5-5 of that report, the assemblage in the far-field consisted predominantly of mayflies, whereas Diptera were the largest component in the near-field, followed by a moderate fraction of mayflies.
20. P. 108. The summary for the invertebrate community does not summarize possible mine-related effects or mention the reoccurring pattern in the benthic assemblage composition of

a higher proportion of chironomids and lower proportion of mayflies in the near-field area relative to the reference area and far-field area.

21. P. 129-130. The benthic invertebrate studies for Giant Mine have been conducted using artificial substrates. Further consideration and discussion regarding potential biases associated with artificial substrates would be appropriate and it is recommended this be included in the next interpretative report.
22. P. 129-130, 132. **The report summarizes previous benthic survey results, and presents some additional correlative and ordination analyses. However, cause of effects is only marginally addressed. If the cause has not been determined, the interpretative report should have included an explanation of why and a description of any steps that must be taken in the next study to determine cause (MMER, Schedule 5, Section 21 (2)). Provide this information.**

Synopsis and Conclusions

23. P. 132. In the report it is suggested that the next phase of EEM be a return to periodic monitoring. This would not be consistent with the steps specified in the regulation, which indicate that where similar effects have been indicated and magnitude and geographic extent is known, the next study design should describe the studies that will be used to determine the cause of the effect. Please see MMER Schedule 5, Section 19 and the MMGD, Chapter 1, for further details. Chapter 1 also contains recommendations on level of effort for investigating effects in relation of the magnitude of the effects.

Minor comments and errors

- P. 63. Table 6-5. The reference areas for sculpin are listed as TR (Tartan Rapids) and HS (Horseshoe Bay) in the table, but should read Reference 1 and Reference 2.

References

Environment Canada, 2012. Metal Mining EEM Guidance Document (MMGD).