Hutchinson
Environmental Sciences Ltd.

1-5 Chancery Lane, Bracebridge, ON P1L 2E3 | 705-645-0021
Suite 202 – 501 Krug Street, Kitchener, ON N2B 1L3 | 519-576-1711

Appendix B. 150114 2AM MEA0815 Preliminary AEM response to Technical Comments revised-ILAE

Note:

- Only the KIA technical comments and information requests have been appended.
- Only columns documenting resolutions reached during the January 9, 2015 WebEx and the January 14-15, 2015 Hearings have been documented.
- All other resolutions reached are outlined in Appendix A.

Authorities	TC #	Reference to Comments	Agree to TC	Additional information provided by AEM	Summary of the discussion with AEM and KIA on 01/09/2015 by Webex	Summary of the discussion during Technical Meeting on 01/14/2015	NWB notes
KIA	KIA-01	Main Supporting Document - Change in obtainable freshwater limit	Yes				
KIA	KIA-01-B	Main Supporting Document - Change in obtainable freshwater limit (p.22)	Yes				
KIA	KIA-02	Water Licence Renewal Application pp. 23-28	Yes				
KIA	KIA-03	Main Supporting Document - Altered License Condition - Water License Part D, Item 11	Yes				
KIA	KIA-04	Main Supporting Document - Altered License Condition - Water License Part E, Item 8	Yes				
KIA	KIA-05	Main Supporting Document - Altered License Condition - Water License Part F, Item 2 and 3	Yes (resolved 01/09/2014)	KIA acknowledges that a combined strategy of implementing MMER requirements (including EEM) and CCME water quality guidelines will ensure protection of the environment. MMER discharge limits (and the effluent discharge limits in Part F of the current licence) were developed in consideration of water quality guidelines, but include assumptions regarding dilution/mixing in the receiving environment. As noted by the KIA, the protectiveness of effluent discharge limits on a site-specific basis depends on local applicability of the mixing/dilution assumptions, which is determined through receiving environment monitoring (e.g., EEM receiving environment water chemistry and biological monitoring, and CREMP receiving water chemistry and biological monitoring). Receiving environment monitoring results are generally compared to CCME water quality guidelines (or other jurisdictions when CCME WQGs are not available). AEM's monitoring strategy for cyanide is consistent with this approach. Application of a CCME water quality guideline directly as a discharge limit would be overly conservative and inconsistent with the derivation of the discharge limits for other substances listed in Part F of the current licence.	During our discussion an agreement was reached between the KIA and AEM. AEM agreed to continue monitoring free cyanide in the receiving environment and would add in it's adaptive management plans to add free cyanide in the discharge monitoring if triggers for free cyanide were exceeded.		
KIA	KIA-06	Main Supporting Document - Altered License Condition - Water License Part F, Item 3 and 23	Yes				
KIA	KIA-07	Main Supporting Document - Altered License Condition - Water License Part I, Item 7	Yes				
KIA	KIA-28	Main Supporting Document - Altered License Condition - Water License Part H, Item 3	Yes				
KIA	KIA-08	Main Supporting Document - Altered License Condition - Water License Part I, Item 18	Yes				

Authorities	TC #	Reference to Comments	Agree to TC	Additional information provided by AEM	Summary of the discussion with AEM and KIA on 01/09/2015 by Webex	Summary of the discussion during Technical Meeting on 01/14/2015	NWB notes
KIA	KIA-29	Main Supporting Document - Altered License Condition - Water License Part J, Item 6	Yes				
KIA	KIA-09	Main Supporting Document - Trend of Increasing Parameter Concentrations in Near Field sites (Review Freshwater Aquatic Environment between 2010 and 2013).	Yes (resolved 01/09/2014)	Water quality was identified as a valued ecosystem component in the FEIS. Modelling was used in the FEIS as a tool to support the assessment of potential changes in water quality related to effluent discharge and to leaching from dike faces. The modeling was "completed to make tentative predictions of whole lake temporal changes in water quality in Third and Second Portage lakes over the mine life, assuming that all water quality parameters behaved conservatively in the lakes and are fully mixed." The use of "tentative" implies that the authors acknowledged the limitations of the approach. Furthermore, the assumption of complete instantaneous "fully mixed" does not preclude having higher concentrations Thus, it would be inappropriate to use the model results at face value as water quality benchmarks above which mitigation is required; they were never intended for this purpose. Rather, the appropriate comparison for actual water quality results is to the FEIS predictions of the magnitude of residual effects to water quality. The assessment criteria used in the FEIS for defining the predicted magnitude of impacts to receiving environment water quality were as follows (Physical EIA Report): o Very High – water quality concentrations > MMER o High – 10x CCME WQG < water quality concentrations < MMER o Medium – 1x CCME WQG < water quality concentrations < 10x CCME WQG o Low – water quality concentrations < 1x CCME WQG o Negligible – water quality concentrations similar to baseline The FEIS predicted "low" (rather than "negligible") magnitude for residual effects of effluent discharge to Third Portage, Second Portage and Wally lakes, leading to a "low" significance characterization. This characterization was based on the model results that predicted mining-related changes to water quality for most parameters relative to baseline conditions, but that the degree of change would generally not exceed CCME WQGs (except for cadmium concentrations, which did exceed the CCME WQG, but was qualified after consideration of a range of evidence). As KIA points out, the CREMP water quality results are elevated relative to baseline, but do not generally exceed CCME WQGs. Both these results are consistent with FEIS predictions and support AEM's position that the observed changes to water quality are consistent with the FEIS and do not warrant mitigation. That said, these trends all continue to be monitored and assessed as per the Management Response Plan (Section 4 of the AEMP [2012]).	During our discussion an agreement was reached between the KIA and AEM. AEM will continue evaluating the CREMP data against pre-established triggers and thresholds; AEM will complete a more detailed review of the CREMP data against the FEIS predictions and evaluate it in the annual report submission.		
KIA	KIA-10	Main Supporting Document - Wally Lake Reference Site (Main Supporting Document, CREMP Stations and Control/Impact Designations)	Yes				
KIA	KIA-11	Main Supporting Document - Data Quality Objectives (CREMP QA/QC, Appendix B5 - QA/QC plan)	Yes				
KIA	KIA-12	Main Supporting Document - Hold Times (CREMP QA/QC)	Yes				
KIA	KIA-13	Main Supporting Document - Decision Making Criteria (CREMP Data Evaluation Criteria)	Yes (resolved 01/09/2014)	This IR relates to using the yearly mean water quality concentrations when formally applying trigger values for decision-making purposes in the CREMP. As discussed in our previous response, the CREMP trigger/threshold comparison process does include screening of the results of each event to ensure that relevant short-term changes are not overlooked. Temporal trends are also examined graphically on time series plots, providing another opportunity to "flag" cases where seasonal trigger excursions are evident. This strategy was presented in the 2010 AEMP/CREMP workshops in which KIA was a participant (as noted in our previous response). As for statistical power of the CREMP, the previous response was generalized and warrants further clarification. As noted by KIA, statistical power to detect significant increases in a water quality parameter in a single event varies considerably across parameters. The CREMP Design Document (see Appendix A of that document) included a detailed review of water quality data to date. The selection of parameters for inclusion in the power analyses was based on frequency of detection in the baseline data, on having a defined threshold (e.g., CCME WQG or an aquatic life guideline from another jurisdiction) and on covering a range of parameter types (e.g., metals and nutrients). For example, out of 120 samples, the highest number detected for total metals was for manganese (114), followed by aluminum (85); the next highest was cadmium (7) and 16 metals had all samples below their respective detection limits. Both total aluminum and total manganese also had proposed thresholds. As for "low" and "good" power, these terms were used subjectively in the last response; the CREMP Design Document notes that power was considered "high" at 80% or higher (p. 20). More discussion of power analysis will be provided for KIA-IR-19.	During our discussion there was an agreement reached between the KIA and AEM. AEM will provide additional analysis to the KIA during the technical meetings on Jan 14/15 th.		

Authorities	TC #	Reference to Comments	Agree to TC	Additional information provided by AEM	Summary of the discussion with AEM and KIA on 01/09/2015 by Webex	Summary of the discussion during Technical Meeting on 01/14/2015	NWB notes
KIA	KIA-14	Main Supporting Document - Water Chemistry Discussion Criteria (CREMP Water Chemistry Discussion)	Yes (resolved 01/09/2014)	The only outstanding issue is with the third screening rule for CREMP water quality parameters. The intent of this rule was to be inclusive (e.g., including a parameter which may have only been detected at 2x the MDL), but not unnecessarily so (e.g., not including a parameter that was measured only at a far-field or reference area. That said, we understand that the rule does rely on professional opinion. Consequently, we propose to integrate KIA's suggested change to the third screening rule as follows: "parameters measured at >5x MDL at near-field sampling areas in at least one event." This wording addition will avoid inclusion of false-positive results triggers by anomalous results.	OK with this proposed change in rule 3- also look at a comparison of reference areas.		
KIA	KIA-15	Main Supporting Document - Elevated Sediment Concentrations: Zinc and Lead (CREMP Sediment Chemistry Discussion, Table 3.4-1)	Yes (resolved 01/09/2014)	KIA correctly points out that the lead trigger/threshold exceedance for sediment at WAL was not explicitly listed in the text. The lead exceedances at WAL were flagged in Table 3.4-1. The text addressed a category of results where triggers were exceeded and listed several examples in the "e.g.," section. All such cases were similar in that while the respective trigger was exceeded, the measured values for 2013 were consistent with baseline conditions for that sampling area. In hindsight, we agree with KIA that all such cases should be listed in the text as well. Triggers for sediment were developed separately for the Meadowbank Project Lakes and for Baker Lake, but further resolution (i.e., accounting for among-area variation with area-specific triggers) was not pursued. Furthermore, triggers for most sediment metals were set using Method B (i.e., 95% percentile of baseline data), so in the absence of any mine-related inputs we would expect trigger exceedances 5% of the time across areas. Given these limitations, cases where triggers are exceeded are scrutinized relative to baseline conditions. Cases apparently inconsistent with baseline conditions (e.g., chromium at TPE [see next IR]) proceed to further assessment.	AEM agrees to implement adaptive managemetn to mitigate changes to sediment quality. In the future AEM will consider additional discussion in the annual report for parameters that are triggered and a rationale for relevant parameters.		
KIA	KIA-16	Main Supporting Document - Elevated Sediment Concentrations: chromium (CREMP Sediment	Yes (resolved 01/09/2014)		Fundamentally, this is the same request as KIA-15. AEM agrees to implement adaptive managemetn to mitigate changes to sediment quality. KIA looks forward to the review of the coring study and will provide timely feedback to AEM and ensure appropriate management actions are implemented in 2015.		
KIA	KIA-17	Main Supporting Document - Zooplankton Sampling (Appendix B2, Sampling Frequency)	Yes (resolved 01/09/2014)	AEM agrees with KIA's recent comments regarding periphyton; they provide further support to the decision to exclude periphyton as a routine monitoring tool in the CREMP. In regards to zooplankton, KIA has requested a discussion on statistically detectable effect sizes over different timeframes and that zooplankton sampling be continued as part of the CREMP. The CREMP Design Document (Appendix E) included an analysis of effects to study power of various effect sizes (20% and 50%), before years (2, 3 and 4)), reference areas (one and two), after years (1, 2 and 3), replication (5, 10 and 20), and alpha levels (0.05 and 0.1) for three metrics (wet biomass, dry biomass and total abundance) for near-field areas SP, TPE and TPN. This was a targeted study specifically conducted to quantitatively evaluate the utility of adding zooplankton to the CREMP (i.e., it had originally been excluded due to high variability in early baseline studies). The metric with the highest power across these scenarios was dry biomass; statistical power was generally only reasonable (i.e., higher than 0.5, which is 50% or lower rate for Type II false negative error) for the 50% effect size with a combined four years of data (i.e., two or three "before" [i.e., pre-impact] years combined with one to two "after" [i.e., post-impact] years) and an alpha of 0.1. As discussed in the CREMP Design Document submitted to NWB in 2012, the spatial and temporal constraints listed above led to the recommendation that zooplankton not be added to the program. That said, the tool was recognized as being potentially useful for targeted studies under certain conditions (e.g., in a gradient design along a stressor gradient). The exclusion of zooplankton in the CREMP does mean that the program cannot make inferences regarding their likely status. Temporal and spatial trends in receiving environment water quality, phytoplankton, benthic community, and fish (all components of the CREMP or EEM) can provide insights into the health of the pelagic ecosystem.	During our discussion there was an agreement reached between the KIA and AEM. As discussed in the CREMP Design Document submitted to NWB in 2012, the spatial and temporal constraints listed above led to the recommendation that zooplankton not be added to the program. That said, the tool was recognized as being potentially useful for targeted studies under certain conditions. The exclusion of zooplankton in the CREMP does mean that the program cannot make inferences regarding their likely status. Temporal and spatial trends in receiving environment water quality, phytoplankton, benthic community, and fish (all components of the CREMP or EEM) can provide insights into the health of the pelagic ecosystem.		
KIA	KIA-18	Main Supporting Document - Depth Samples (Appendix B2, Experimental Design)	Yes (resolved 01/09/2014)	AEM's agrees that stratification of the water column, particularly in winter, can occur in the absence of a matching conductivity profile. Given that the CREMP targets the upper zone of the water column for water sampling, the concern when stratification exists is that mine-related water (e.g., effluent) may be associated with a deeper layer, leading to a biased (low) surface water sample. Elevated conductivity (being much higher in mine-related source water like the Portage Attenuation Pond relative to the receiving environment) in deeper water, is a good indicator of the presence of incompletely mixed mine-related water that warrants sampling. Under ice, cryoconcentration often results in higher conductivity immediately under the ice (along with cooler water temperatures) relative to deeper water; this situation is not typically of concern and would not trigger sampling at depth.	During our discussion there was an agreement reached between the KIA and AEM. AEM recognizes that stratification may occur and that sampling at depth may be appropriate. This has already been incorporated into the CREMP by instructing field teams to take samples at depth when vertical profiling suggests the presence of stratification (e.g., abnormally high conductivity, low dissolved oxygen and temperature measurements during the open water / ice free seasons).		
KIA	KIA-19	Main Supporting Document - Statistical comparison of Biological Monitors (Appendix B2, Experimental Design)	Yes (resolved 01/09/2014)	As described in KIA-IR-17, KIA's assertion that an extended period of record would increase statistical power is consistent with the findings of the power analysis presented in Appendix E of the CREMP Design Document. The results showed that four years of data were needed to detect a 50% effect size for total dry biomass (alpha = 0.1) with confidence (beta ~ 0.1). Inferences at higher taxonomic resolution (e.g., to detect community composition shifts in biomass or abundance) would likely require more years of data. Regarding alpha values and statistical power, AEM considered both 0.05 and 0.1 in power analyses described in the CREMP Design Document. The former has been considered "the standard" (as KIA notes) in scientific investigations, but is often employed without consideration of statistical power. The latter is used in EEM (typically in two-tail tests), where there is a strong emphasis on balancing Type I and II error rates (i.e., alpha = beta = 0.1). This philosophy was also central to the approach used to optimize the study design in the CREMP. Application of KIA's request to move to alpha = 0.2 (we assume that KIA did not actually mean the 0.02 shown in the IR) would effectively raise the Type I error (false positive) rate to 1 in 5 (i.e., AEM could expect false positive results for 1 in 5 statistical tests conducted). This is an unacceptably high Type I error rate.	During our discussion there was an agreement reached between the KIA and AEM. Additional information will be presented in the technical meetings and will include examples of the management response framework.		

Authorities	TC #	Reference to Comments	Agree to TC	Additional information provided by AEM	Summary of the discussion with AEM and KIA on 01/09/2015 by Webex	Summary of the discussion during Technical Meeting on 01/14/2015	NWB notes
KIA	KIA-20	Lack of Event Monitoring Discussion (Appendix B6, Event Monitoring, Appendix B7 and Appendix B9)	Yes				
KIA	KIA-21	Monitoring Parameters (Appendix B6, Event Monitoring Water License, Schedule I, Monitoring Group)	Yes				
KIA	KIA-22	Iseepage not included under spill contingency plan (Appendix B9, What is a Spill?, Appendix B9, Materials and reportable (to regulatory authorities) spills	Yes				
KIA	KIA-30	RSF Design (Appendix B10 section 2.3, page 4)	Yes				
KIA	KIA-31	Waste Rock Storage Facilities (Appendix B14 section 3.3.6.3, page 61)	Yes				
KIA	KIA-23	Impact of violating obtainable freshwater limit (Appendix B17, 3.2.1 Water Management Plan and Water Balance)	Yes				
KIA	KIA-24	Modeling Results and Mitigation (Appendix B17, Water Quality Modeling Report, Appendix D – Water Quality Report)	Yes				

Authorities	TC #	Reference to Comments	Agree to TC	Additional information provided by AEM	Summary of the discussion with AEM and KIA on 01/09/2015 by Webex	Summary of the discussion during Technical Meeting on 01/14/2015	NWB notes
KIA	KIA-25	Seepage at ST-16 and Lake NP2 (Appendix 17, Appendix D – Water Quality Report)	Yes (resolved 01/14/2014)			AEM agrees to update the Freshet Action Plan to add mitigations measures (the Freshet Action Plan is part of the Water Management Plan): • Increase Tailings beaches on RF-1 and RF-2 in 2015; • Fines filters on RF-1 and RF-2 (completed); • Commence capping of the North Cell in the tailings storage facility (TSF); • Drain water to the TSF South Cell in 2015; • Install thermistors in RSF (in conjunction with closure assessment) between the TSF and Lake NP-2; • AEM will consider installation of piezometers in the RSF as part of the adaptive management if thermistor data indicates insufficient freeze back to cut off flow between the TSF and Lake NP-2; • Submit monitoring results as part of the Annual Report to the Nunavut Water Board; • Continue the current monitoring plan as stated in the Freshet Action Plan until five years of consecutive water quality results in Lake NP-2 meet CCME criteria for key parameters (free cyanide, nickel, copper); and for total and WAD cyanide until five years of consecutive water quality results are below accepted methods of detection limits (0.005 mg/L). • Continue the current mitigation strategy of pumping seepage to TSF and regular (weekly during the open water season, monthly outside of the open water season) inspections.	An updated Freshet Action Plan to be submitted with the revisionof of Water Management Plan within 60 days ofLicence issuance.
KIA	KIA-26	Depth sample collection for Dike Monitoring (Appendix B19)	Yes				
KIA	KIA-27	Anomalous Thermistor or Piezometer Reading Response (Appendix B20, 6.2.2 Anomalous Readings)	Yes				

Authorities	TC #	Reference to Comments	Agree to TC	Additional information provided by AEM	Summary of the discussion with AEM and KIA on 01/09/2015 by Webex	Summary of the discussion during Technical Meeting on 01/14/2015	NWB notes