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December 18, 2009

Rebecca L. Harvey
United States Environmental Protection Agency
Underground Injection Control Branch
Region 5
Attention Mail Code WU-16J
77 West Jackson Boulevard
Chicago, Illinois, 60604-3590

Re: **Response to Memorandum Dated September 4, 2009 from Ann Maest (Stratus Consulting Inc.) and Robert Prucha (Integrated Hydro Systems) to Rebecca Harvey (U.S. EPA Region 5)**

Dear Ms. Harvey,

I am writing in response to a letter dated September 4th, 2009 from Joseph M. Polito providing an unsolicited response to Kennecott's April 28, 2009 letter to EPA. Attached with Mr. Polito's letter is a memorandum, dated September 4, 2009, prepared by Ann Maest of Stratus Consulting Inc. and Robert Prucha of Integrated Hydro Systems ("Stratus Memorandum") which is the technical basis Mr. Polito uses in his assertion that EPA should require Kennecott to obtain a UIC permit for backfilling and operation of KEMC's proposed underground mine. This letter responds to the Stratus Memorandum and the legal analysis framing that Memorandum that was also included in the Polito letter.

Simply put, the Stratus Memorandum regurgitates a myriad of false allegations and unfounded theories that were all debunked in a lengthy contested case hearing addressing Kennecott's mine permit and groundwater discharge permit before a State of Michigan administrative law judge ("ALJ"). Indeed, the Stratus Memorandum is the epitome of "junk" science: its assumptions and modeling inputs are not tethered to any of the enormous of wealth of actual data from the field at the mine site: they are simply manipulations designed to arrive at a pre-determined outcome.

Kennecott's response to the allegations in the Stratus Memorandum follow below. Each allegation is quoted and rebutted in turn. As a useful reference, KEMC's April 28, 2009 letter to EPA is also enclosed (Attachment 1) as well as the State Office of Administrative Hearings and Rules Proposal for Decision ("PFD") (Attachment 2).

A. Response to Technical Assertions in Stratus Memorandum.

1. Stratus Memorandum allegations regarding bedrock characterization:

- KEMC attempts to divide the bedrock aquifer into upper and lower units, based on poorly characterized differences in water quality, hydraulic testing and groundwater flow conditions.
- KEMC defines the lower bedrock zone as 300 feet below the top of the bedrock aquifer and below based on minimal information from one borehole.
- KEMS's characterization of geology, hydraulics, and water quality of the bedrock formation is poor and does not support the delineation into upper and lower zones.
- …blasting would likely increase the hydrologic connection between the zones and bring more saline water and contaminants into the upper zone.
- Further evaluation of mine inflows using the KEMC FEFLOW model (stratus Consulting, 2009) as the basis showed that a more realistic range of groundwater flow is from 280 gpm to 3000 gpm and could be as high as 4000 gpm based on an evaluation of inflows to the mines in the Marquette Iron Mining District.
- Based on existing information, including information from KEMC's geologists, we (Stratus) continue to believe that the bedrock and glacial aquifers and the Salmon-Trout River act as an interconnected hydrologic system.
    - The bedrock aquifer is hydrologically linked to the unconsolidated aquifer.
- KBIC's conceptual model predicts, more realistically, that water will flow downgradient and contaminate the USDW after mining ceases (Figure 3).
    - After mining, as pre-mining gradients are re-established, groundwater in the mine would flow outward and upward along faults and fractures and the brecciated portion of the dike into the upper bedrock, the glacial aquifer and the river.

KEMC Response: The bedrock characterization at Eagle has been thorough and complete.

The bedrock hydrogeological characterization at Eagle has been thoroughly conducted during multiple phases of investigations using a weight-of-evidence approach that included data and analyses from over two years of investigation data and analyses. This information included:

a. Regional hydrological studies including watershed water balance and baseline conditions flow modeling indicating insignificant contributions of bedrock flow systems to watershed water balance.
b. Site specific intrusive investigations from rock coring programs for geotechnical and hydrogeological data collection.
c. Geophysical logging of holes to investigate for evidence of significant groundwater flow (heat pulse flow logging)
d. Multiple slug tests and pumping tests of specific flow anomalies identified in geophysical logging, including a long term bedrock formation pumping test.
e. Water quality characterization of bedrock samples compared to quaternary aquifer samples including multiple level bedrock water quality sampling and continuous piezometric data collection around and within the ore body.

f. Water supply well search and regional geological literature search
g. Measurement of bedrock hydraulic gradients

These data were extensively analyzed by a multi-disciplinary team of scientists and engineers to develop the predictive inflow model based on, and calibrated to these field data. Unlike Kennecott's work, Drs. Maest and Prucha's conceptual models of flow (identified in Figure 3 as "KBIC conceptual flow model after mining") are not substantiated by any of the data listed above.

Accordingly, the ALJ concluded the following about Kennecott's bedrock characterization:

"Kennecott's characterization of bedrock hydrology began with a thorough investigation of bedrock characteristics" ... using "nine boreholes extending through several thousand feet of rock in, through, and around the ore body and the decline to the ore body" (PFD, p. 55).

"Golder [Kennecott consultant] chose the location of these boreholes and angled them through bedrock in the area of the mine to intersect all major geological "features" in the bedrock (i.e., zones of rock that based on Kennecott's geotechnical logging process, had zones of cracks or fissures in them) especially including potentially "conductive features," which would have greater potential to conduct water within the bedrock" (PFD, p. 55).

"Golder's initial results established that the rock in and around the ore body and eventually the crown pillar generally qualifies as low conductivity rock to very low conductivity rock. One area of moderate conductivity was identified within rock that will be mined as part of the ore body. Golders initial field work established that the upper bedrock (i.e. bedrock extending to approximately 90 meters below surface) was more conductive than the lower bedrock. Kennecott's Part 632 permit confines mining to the lower bedrock formation." (PFD, p. 55).

"Golder then performed a second phase bedrock investigation. The primary focus of this investigation was to determine whether there was a vertical gradient (i.e. water moving up through the lower bedrock to the upper bedrock). Another important aspect of this investigation was to conduct a "transient" (i.e. seven day) pump test of the moderately conductive feature in the ore body to simulate mine dewatering and determine what actual conductivity of the rock was on a larger side. The results of this second phase investigation demonstrated to them that there are negligible, if any, vertical gradients apparent in the bedrock. It was also found that the water chemistry in the upper and lower bedrock is distinctly different, with lower bedrock water having higher dissolved solids levels." (PFD, p. 55 and 56).

"In addition the transient pump test in the lower bedrock showed no impact on water levels in the upper bedrock and glacial aquifer, further confirming a lack of vertical connection or interconnection between the groundwater in the mine workings and the groundwater in the upper bedrock and glacial aquifer." (PFD, p. 56).

The ALJ then went on to address the many deficiencies in KBIC "expert" Dr. Prucha's predictions:

"Dr Prucha and Dr. Karasaki conceded that the bulk of the rock comprising the ore body and surrounding the mine is tight and relatively impermeable" and also that "Petitioners' [Dr Prucha's] alternative hypothesis of much higher inflows are not supported by the actual data developed in the field by Kennecott's investigations" (PFD, p. 115).

As stated by the State Office of Administrative Hearings and Rules Proposal for Decision (State of Michigan, 2009):

"The record establishes, however that these assumptions to support [KBIC's] alternative hypothesis of much higher inflows are not supported by the actual data developed in the field by Kennecott's investigations and so I find as a Matter of Fact. For example there is no evidence of the large fault positioned by Dr. Prucha running through the area of the mine. " (PFD, p. 115)

"Finally, there is no evidence based on data in the field that these structures, even if they existed to the extent hypothesized by Petitioners, are vertically oriented in such a manner as to create a hydrogeological "drain" from the lower bedrock where mine openings will be, through upper bedrock to the glacial aquifer." (PFD, p. 115)

"Neither do any of the data from the field support the hypothesis that, even if there was a fault or significant geological features in the area, they are conductive of water, or interconnected to one another. In this connection, the record indicates Kennecott consultant Golder performed flow logging and packer testing along a number of boreholes, and this testing showed that they are not conductive. In fact, the seven day pump test Golder performed to simulate mine dewatering activity produced no measurable impact in the water levels in the upper bedrock of the glacial aquifer, which is clearly indicative of little or no vertical orientation of geologic features in bedrock in the area." (PFD, p. 115 and 116)

"The record indicates that Dr. Prucha's reliance on reports of water inflows at old iron mines in the iron range is also misplaced, since the ore bodies at those mines are of a completely different nature than the hard rock ore body at Eagle. In fact the literature testified to by Dr. Prucha actually provides further confirmation of Golder's conclusions about the very low conductivity and permeability of the Eagle rock mass. Specifically this literature concluded that faults in the area of the UP are generally proven to be non-conductive features." (PFD, p. 116)

"Based on the record I further find that Dr. Prucha's criticisms of the mine inflow modeling performed by Golder are dubious." (PFD, p. 116)

"In sum, the record shows that Dr. Prucha's alternative modeling of mine inflows and drawdown within the bedrock essentially boiled down to his changing model inputs and drawdown to reflect his assumptions about faults, connectivity, etc. (addressed above) which are not supported by actual data collected from the field. Therefore, I find his assumptions are not reasonable and do not give rise to a reasonable range of modeling." (PFD, p. 116)

<u>2. Stratus Memorandum allegations regarding bedrock aquifer and USDW</u>:

- The bedrock aquifer qualifies as a USDW based on the fact that it could provide a sufficient quantity of water for a public drinking water system.

KEMC Response: The bedrock at Eagle is not an aquifer and significant discharge rates from bedrock wells at Eagle are unsustainable.

Bedrock formations at Eagle (metasedimentary country rock, peridotite intrusion, or ore body) are not used for public or private water supply in the region for any purpose. The saturated hydraulic conductivity of the bedrock units(10^{-05} to 10^{-03} ft/d) are 5 to 7 orders of magnitude lower than the overlying quaternary aquifers (hydraulic conductivity of 7 – 130 ft/d). All practical definitions of aquifers (e.g. Freeze & Cherry, 1979) do not indicate the bedrock is considered to be an aquifer in this hydrogeological setting. This literature categorizes formations generally into one of three categories: “aquitards,” “aquicludes” and “aquifers.” In terms of hydraulic conductivity, formations with conductivities of 10^{-5} cm/s and lower do not qualify as an “aquifer.”

As stated in KEMC’s letter dated April 28, 2009 to EPA, it is important to understand that the bedrock formation comprising and surrounding the mine does not qualify as an “aquifer” or an “underground source of drinking water” as defined in UIC regulations, EPA guidance interpreting these regulations (which is not law and cannot bind the agency in this case) or under broadly accepted application of these terms in the technical literature or well-drilling industry. “Aquifer” is defined in 40 C.F.R. § 143.3 as a “geological formation. . .capable of yielding a significant amount of water.” “Underground source of drinking water” (“USDW”) means an aquifer that has a sufficient quantity of groundwater to supply a public water system – i.e., a system of pipes or other conveyances with at least 15 service connections or regularly serving at least 25 individuals. 40 C.F.R. § 143.3; 42 U.S.C. § 300f.4(A).

UIC regulations do not specify what “significant” water yields are for determining formations that qualify as “aquifers.” And using the more broadly accepted understanding of the term, there is no question that both the lower and upper bedrock formations fail to qualify as aquifers and, therefore, a USDW. Hydraulic conductivities in the lower bedrock (i.e. 300 feet from the top of the bedrock and below) where the mine will be range as low as 10^{-9}cm/s and overall, the bulk matrix hydraulic conductivity of the bedrock is estimated to be about 5×10^{-8} cm/s. The lower bedrock bulk hydraulic conductivity is in the range specified by liners listed in the State of Michigan’s Department of Environmental Quality Part 22 rules and the bedrock is much thicker than 40 or 60 mil of PVC or HDPE.

Using a nomographic approach developed by the U.S. Dept. of Interior Water and Power Resources Service (1977) this corresponds to a predicted well yield (specific capacity) of about 0.0001 gpm/ft, which is considered infeasible even for low yield domestic supply needs. According to the 1977 DOI report, well yields below 0.01 gpm/ft. are considered poor to infeasible for domestic supply rates. Even upper bedrock (top of bedrock to 300 feet depth) has a bulk hydraulic conductivity of only 2×10^{-6} cm/s, still an order of magnitude below what could be considered an “aquifer” in the technical literature. The data shows clearly that hydraulic conductivity and secondary porosity decrease significantly with depth into the bedrock.

In addition to insufficient water yields, background water quality in the bedrock – particularly the lower bedrock - effectively precludes use of this formation as a USDW as a practical matter. This water already exceeds primary drinking water MCLs for arsenic and secondary drinking water MCLs for chloride, iron, manganese, and TDS, further disqualifying it as a potential USDW as a practical matter. This water is also alkaline, moderately saline, reducing, and very hard. The water is dominated by sodium and chloride concentrations of 1000 mg/l and 2000 mg/l respectively. For all these reasons, there is no supply use within this type of bedrock formation near the mine site (based on a 75 square mile search area).

In fact the State of Michigan's bedrock aquifer map contained as part of the educational materials provided with the water withdrawl assessment tool is in complete agreement with the site specific assessment that was completed by Golder. The bedrock in the vicinity of the mine is designated as a non-aquifer bedrock type:

(http://www.miwwat.org/wateruse/documents/WWAT.pdf)

The ALJ also concluded that the bedrock is not a "usable" aquifer under Michigan law:

"Because Kennecott's backfilling and reflooding operations: (1) are authorized under the part 632 permit; (2) consist of backfill materials that automatically qualify as inert under Part 115; and (3) will occur in an unusable aquifer, and because the Part 632 permit imposes requirements to protect the upper glacial aquifer to minimize the risks of any impacts from backfill and reflooding, DEQ implicitly concluded that the backfill and reflooding would not be "injurious"…" (PFD, P. 170).

In sum then, the short term and longer term pumping tests performed at all Eagle test holes indicated that dewatering of the boreholes occurred and test pumping rates (less than 2 gpm) were not sustainable as long term pumping would dewater any test borehole at such rates. It would take the construction of an underground void space the size of an underground mine (at least 200,000 cubic meters, excluding stopes) to produce flows of a quantity that would be sustainable and sufficient to supply a public drinking water system. (Of course, this water would still not be usable from a quality perspective). Construction of such a public drinking water system is absurd and cost prohibitive, especially given the abundance of viable sources of public water supply sources available in the shallow glacial aquifer. No drinking water supply system in the state of Michigan has been constructed in this manner.

3. Stratus Memorandum allegation regarding Eagle's utility water use and dewatering:

- The (Stratus) review found that the proposed Eagle project operations deviate from standard practice at most hardrock mines requiring dewatering.
- Mines in Nevada are dewatered using wells outside of the underground mine rather than sumps inside the mine.
- Every mine we can think of with operations below the pre-mining water table uses dewatering wells outside of the underground workings to dewater the mine
- Kennecott Eagle's proposed backfilling is similar to other stoping operations in the western United States, but its plan for dewatering and utility water usage is unique.

KEMC Response: Dewatering of the Eagle mine workings cannot be effectively performed from bedrock pumping wells outside the mine workings.

As demonstrated by test pumping, the bedrock is far too impermeable to be effectively dewatered by direct bedrock pumping from outside the mine workings. Any bedrock pumping well placed outside the mine workings would not likely have any impact on the actual mine infows. The flow models are all constructed such that in order to produce 75 gpm from mine workings, water must be allowed to flow from the overlying Quaternary system via vertical seepage mechanisms through the low conductivity upper bedrock and not through the bedrock itself.

The notion that Kennecott's dewatering mechanisms and utility water use differ from standard practice at most mines is completely false. Hardrock mines in the US with operations below the pre-mining water table routinely and commonly dewater from within the mine workings, both open pit and underground. It is false to make the statement that every mine with operations below the pre-mining water table uses dewatering wells outside of the underground workings to dewater the mine. One such example, the Green's Creek underground mine in Alaska, dewaters through the use of sumps and pumps within the underground workings and does not dewater from wells outside the mine. Although some mines may dewater using wells outside the mine workings because the geology and hydrogeology allows for such an activity to be effective, it is still routine and common practice for hardrock mines to dewater from within the mine workings, including the mines in Nevada. Utility water at hardrock mines (open pit and underground) is routinely and commonly used for dust control on roads, material piles and during drilling and blasting.

4. Stratus Memorandum allegation regarding additional water wells in the bedrock aquifer:

- A well survey conducted for KBIC by Wittman Hydro Planning Associates Inc.[1] identifies additional water wells nearby but outside the area surveyed by Kennecott in the bedrock aquifer (Honigman Miller Schwartz and Cohn, 2006).

KEMC Response: There are no additional water wells nearby the area surveys by Kennecott completed in the same bedrock formation as the underground mine.

As referenced in Honigman Miller Schwartz and Cohn (2006), Appendix C of KEMC's groundwater discharge permit application does identify bedrock water wells in the area surveyed by KEMC. However, there is only 1 well in upper bedrock and it is not located in the same bedrock formation as the upper or lower bedrock units defined by the Eagle underground mine. The well is located greater than 2 miles from the Eagle mine site and is completed in Archaen northern complex igneous/metamorphic bedrock (granite and gneissic), older than 2.5 billion years. In contrast the bedrock geology of the Eagle mine is contained within diabase dikes (peridotite and gabbro) , which are iron-rich igneous rocks from magma intrusions into the surrounding, older Michigamme Formation (metasedimentary bedrock) roughly 2 billions years old. The intrusive rocks (peridotite and gabbro) which comprise the Eagle underground mine are about 1.1 billion years in age. Since the bedrock geology of the eagle underground mine is completely different than the "near by well" the hydrogeologic characteristics would also be expected to differ.

[1] Tellingly, KBIC declined to have the theories and allegations of the Wittman firm tested in litigation by opting to forego introducing this survey or Mr. Wittman's testimony into evidence in the contested case.

5. Stratus Memorandum allegations and/or clarification required regarding KEMC plans to "Inject" water and 'Emplace" Materials:

- No chemical analysis of the fly ash (alone or in combination with cement) have been conducted.
- The Eagle project proposes to backfill a mixture of cement, flyash, development rock and aggregate into mined out portions of a subsurface mine.
- No tests were conducted to evaluate the potential for the backfill mixture to (cement, aggregate, fly ash, development rock) to leach contaminants under different conditions in the underground mine.
- The mine permit application does not explicitly state how the development rock will be moved from the surface development rock facility into the underground mine (Clarification).
- Using more realistic higher concentrations for water in the backfilled mining after mining, drinking water contaminants will exceed health-based standards and advisories by over 1 to 15,000 times as shown in Table 2.
- The potential for migration of contaminants from the mine, and the emplacement of backfill into USDWs begins as soon as blasting operations begin and intensifies as full mine operations begin, including circulation of utility water and other water through the mine, and the emplacement of backfill into the mine.

KEMC Response: Information is available, clarification is required and the Maest and Prucha memorandum incorrectly overestimated the concentration of water quality parameters in the backfilled mine.

Contrary to the Stratus assertions, fly ash chemical analysis is contained within Appendix C of the Kennecott Eagle Minerals Air Use Permit Application (February 2006).

In addition, the Stratus Memorandum incorrectly describe backfill as a mixture of "cement, flyash, development rock and aggregate." KEMC's letter to EPA dated April 28, 2009 describes backfill accurately. Primary stopes will be filled with cemented rock fill (CRF), a mixture of aggregate, Portland cement, and a small amount of water. Secondary stopes will be filled with a mixture of development rock and limestone. Since KEMC's backfill will not be a mixture of cement, flyash, development rock and aggregate, as such no tests were conducted to evaluate the potential for that mixture to leach contaminants.

Although the mine permit application does not explicitly state how development rock will be moved underground, KEMC's April 28, 2009 letter explicitly describes that development rock backfill is delivered to the backfill areas underground with underground trucks and these trucks dump the development rock into the stopes.

In regards to the Stratus predictions that drinking water contaminants will exceed health-based standards and advisories by over 1 to 15,000 times as shown in Table 2, it is important to note that Dr. Maest largely overestimated these numbers by incorrectly assuming that no ARD mitigation and control measures will be utilized and/or such mitigation will not be effective, that disseminated ore would not be mined by Kennecott, and that Kennecott would leave significant amounts of high grade ore in the mine or in the TDRSA. Additionally, Dr. Maest further overestimated the numbers by selecting test results only from the most reactive sample of rock as opposed to looking at the longer term results for all samples. Dr. Maest also increased her predicted water quality numbers by including additional, incremental metal leaching from water percolating through the crown pillar of the mine and more sulfide bearing material subject to the ARD reaction. In addition, Dr. Maest adjusted the concentrations of Kennecott's water quality predictions upward by using a much smaller particle size, resulting in more surface area of reactive rock. Finally, Dr. Maest then compounded all of these multiple errors by failing to apply solubility controls to her predictive analysis, a fundamental error that results in concentrations that are a geochemical impossibility.

The ALJ correctly rejected all of Dr. Maest's manipulations on pages 80-85 of the PFD. Specifically, the ALJ found that:

Regarding the disseminated ore **"Dr. Maest's assumption that this potential source of ARD contamination would be present either in the mine or in the TDRSA in any significant amounts is not a reasonable assumption."**

Regarding the significant amount of high grade ore left in the mine or TDRSA **"Dr. Maest's assumptions in this regard is not justified, and there is no reasonable basis to upwardly adjust KEMC's ARD-related predictions of water quality."**

Regarding the selection of test result from the most reactive sample of rock **"that rock standing alone is not an accurate representation of the overall composition of the rock…"**

Regarding water percolating through the crown pillar **"the record establishes that it is impossible for atmospheric oxygen in any significant amounts to penetrate the crown pillar and facilitate the reaction Dr. Maest theorizes. I further find the record also establishes that KEMC (through its consultant Mr. Logsdon) had already conservatively incorporated the possibility of a much larger ARD-generating rock mass surrounding the mine than would actually occur during actual mine operations, by assuming a surface area of reactive rock 100 times the geometric surface area of the mine."**

Regarding mitigation and control measures and generally all assumptions made by Dr. Maest in prediction of water quality from the backfilled mine **"the record establishes that neither Drs. Maest nor Coleman consider geochemical "solubility controls" in formulating their predictions of metal concentrations, which would act to prevent the concentrations predicted by Dr. Maest from occurring." And "Most importantly, I further find the testimony from all of the geochemical experts establishes that Petitioners' experts did not account for the effects of the mitigation measures planned by Kennecott and required by the Part 632 permit."**

It is also interesting to note that the Stratus Consulting estimated mine inflows range from 280 gpm to as high as 4000 gpm, yet in their estimates of water quality in the backfilled mine, they purposefully chose to use Kennecott's low flow estimated mine inflow of 75 gpm. If the Stratus Consulting inflows are used, there would be a 1-2 order of magnitude decrease in the concentration of water quality constituents they predicted. The Stratus estimation methodology is further biased by all their assumptions, which are clearly used to create a wholly unrealistic and high estimate of water quality concentrations in the backfilled mine.

Dr. Maest's allegations that the potential contamination from the mine from utility water and the emplacement of backfill begins as soon as blasting operations begin and intensifies as full mining operations begin are not substantiated by any data. For this to happen, utility water and mine inflows contacting backfill would have to flow opposite to the gradient and direction of water flow (into the mine and pumped out), then overcome significant geologic and hydrogeologic barriers to flow through minimally jointed and poorly connected bedrock with bulk hydraulic conductivity of 5×10^{-8} cm/sec and into a bedrock unit where any available pore space already contains higher density saline water.

As described in KEMC's April 28, 2009 letter, utility water will eventually mix with mine inflow water, including any water derived from contact with backfill, within the mine and be collected in sumps for treatment at the WWTP. The underground mine essentially act as a sink and as such utility water and mine inflows, including contact water with backfill, flows into the mine sumps during operations and not out of the mine through the bedrock. Therefore utility water and mine water inflows during operations is essentially a closed loop water recycling system. There is no disposal or storage of wastewater within the mine itself during mine operations; all water entering the mine is pumped to the surface and treated, with a small amount recycled for use as utility water. Mine dewatering takes more water out of the mine than is going in.

And once again, the ALJ rejected the Stratus arguments on this issue:

"In reality, this utility water is cycled through a closed-loop fashion. There is no discharge of utility water. Because water will be continuously recycled and reused, with no loss to the ground or groundwater, there is no discharge…" PFD, p. 169

"Because Kennecott's backfilling and reflooding operations: (1) are authorized under the Part 632 permit; (2) consist of backfill materials that automatically qualify as inert under Part 115; and (3) will occur in an unusable aquifer, and because the Part 632 permit imposes requirements to protect the upper glacial aquifer to minimize the risks of any impacts from backfill and reflooding, DEQ implicitly concluded that the backfill and reflooding would not be "injurious"…"PFD, p. 170.

6. Stratus Memorandum allegation that monitoring and contingency systems are inadequate to protect USDW

- The mine cannot guarantee containment of these fluids in the underground mine during mining, because pipes conveying the materials and fluids can breach
- Groundwater flow is controlled by fractures and faults in the bedrock aquifer and hydraulic control by dewatering is notoriously difficult to control in such a system

- Only Quaternary alluvium (glacial) aquifer wells will be used for water quality monitoring. Clearly this proposed montoring system is inadequate for determining water levels in the bedrock aquifer, the direction of groundwater flow, whether or not a capture zone is funcitions around the operating mine, and wheather contaminatns from the underground mine are migrating iinto the bedrock or even into the unconsolidated USDWs

KEMC Response: The monitoring requirements and contingency plan requirements specified under the State of Michigan Part 632 Mining Permit (MP 01 2007) and Part 31 Groundwater Discharge Permit (GW1810162) are comprehensive and include all monitoring of all parts of the hydrological system, mine workings, treatment, containment, and storage systems.

Section L of the Part 632 Mining permit, and Sections 2, 3, and 4 of the Part 31 Groundwater Discharge Permit requires the following:

1. Monitoring of surface water and groundwater in non-contact water infiltration basins (NCWIB) and contact water basins
2. Continuous monitoring of wetland water levels, quaternary aquifer water levels, bedrock water levels, mine dewatering (also bedrock) stream stage and discharge for 3 watersheds including a reference watershed.
3. Water quality sampling of all of the systems listed above
4. Continuous monitoring of mine dewatering (bedrock) discharge
5. Groundwater level and quality monitoring and sump collection water monitoring of temporary development rock storage area (TDRSA).
6. Water quality monitoring of treatment plant influent, effluent, and treated water infiltration.

These monitoring plans are comprehensive, recognize the hydrological connections between the mine operations and the water resources, and were developed based on factual site investigations and comprehensive predictive modeling of operational conditions.

Section M of the Part 632 Mine Permit includes a thorough description of contingency measures for the waste water treatment plant, including water in the bedrock workings, SPCC and PIPP plans for spill prevention, containment, control, and pollution incident prevention plans.

In summary, the extensive data provided as part of Kennecott's State of Michigan Part 632 non-ferrous metallic mining permit application, the Part 22 groundwater discharge permit application permit application, the findings of fact summarized in the PFD and commonly known and understood mining practices demonstrate that:

- The bedrock characterization at Eagle has been thorough and complete.
- Confirms a lack of vertical connection or interconnection between the groundwater in the mine workings and the groundwater in the upper bedrock and glacial aquifer.
- The bedrock at Eagle is not an aquifer and significant discharge rates from bedrock wells at Eagle are unsustainable.

- The hypothesis of much higher inflows are not supported by the actual data developed in the field by Kennecott's investigations and without this unsubstantiated fault-flow theory it is simply impossible to produce flow rates and water quantities for possible potable supply that Drs Prucha and Maest wish to promote.
- Dewatering of the Eagle mine workings cannot be effectively performed from bedrock pumping wells outside the mine workings.
- Eagle project dewatering using sumps within the mine and utility water use is routine and common practice at hardrock mines.
- There are no additional water wells nearby the area surveys by Kennecott completed in the same bedrock formation as the underground mine.
- Maest and Prucha memorandum incorrectly overestimates the concentration of water quality parameters in the backfilled mine.
- During operations utility water and mine inflows will be collected in a closed recycle loop and there will be no injection of water into the bedrock.
- Monitoring and contingency plans required under the State of Michigan Part 632 and Part 31 permits require extensive monitoring of all hydrological systems, including bedrock, and contain contingency plans.

B. <u>Response to KBIC Legal Arguments</u>.

KBIC endeavors to establish – through analysis of UIC regulations and guidance – that mine shafts and workings are subject to UIC regulation, and that the cemented rock backfill is a "slurry" that therefore qualifies as a "fluid" under UIC regulations.

But KBIC's argument for potential regulation of mine shafts and other appurtenances in mines both misses and confuses the issue. Kennecott does not dispute that EPA guidance addresses use of *mine shafts and other appurtenances of mines* as wells. Kennecott addressed the same guidance in its April 28 letter to EPA. When and if such appurtenances, equipment or structures within a mine are utilized as wells for the emplacement of injection of fluids, they are potentially subject to UIC regulation. But what is also clear is that there is no preconstruction UIC authorization needed to build an underground mine itself simply on the theory that UIC regulated activity may be associated with some portion of the mine or mining activity at a later date. The UIC program has never been applied to mining in this matter.

With respect to KBIC's assertion that solid materials can be regulated with "fluids" under the UIC program – again, KBIC confuses and misses the issue. Injection of slurries and other material with relatively high solid content are subject to UIC regulations if they are capable of movement in an underground formation and thus endangering drinking water. But this analysis simply begs the question; it does not answer it. And KBIC's continuing insistence that the cemented rock backfill is a "slurry" is nonsense. As Kennecott described in detail in its April 28 letter and during our meeting with you on November 18, to call the backfill a fluid would simply obliterate the meaning of the term – even under the expansive definition of the concept advanced by KBIC. Cemented rock backfills look and feel like damp gravel – it does not "flow." It placed into stopes with dump trucks and physically compacted by heavy equipment driving on top of it. To maintain that this material (which can support the weight of heavy equipment *before* it cures) is a "slurry" or fluid is ludicrous. (One could make a much better case under the KBIC rationale for regulating the placement of concrete footings for buildings under UIC than the cemented rock backfill – but we are unaware that the program has ever been applied in so expansive a manner).

For all these reasons, Kennecott does not believe that construction and operation of the Kennecott's proposed underground mine and backfilling practice implicates the UIC Class V inventory requirements or its permitting provisions. Should you have any additional questions please don't hesitate to contact me at 906-486-1257.

Sincerely,

Vicky Peacey
HSE Manager

ATTACHMENT 1

KEMC's April 28, 2009 Letter to EPA