BROWN AND CALDWELL

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Technical Memorandum

Technical Memorandum No. 1

Subject: Response to CH2MHill Technical Memo "Anaconda Copper Mine Field Oversight - Anaconda Evaporation Ponds Characterization" (dated October 20, 2008)

Date: October 23, 2008

To: Ms. Nadia Hollan Burke/USEPA Region IX

From: Chuck Zimmerman

Copy to: David Seter/USEPA Region IX

Roy Thun/Atlantic Richfield Company

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1. INTRODUCTION

This technical memorandum provides responses to potential field-related quality control issues identified by EPA's oversight representative (Ilke Dinkleman of CH2MHill) on October 8 and 9, 2008 during the implementation of the *Anaconda Evaporation Ponds Removal Action Characterization Work Plan* (Work Plan). Specific oversight observations addressed in this memorandum were provided to Brown and Caldwell as an attachment (CH2M Hill memo to EPA entitled *Anaconda Copper Mine Field Oversight – Anaconda Evaporation Ponds Characterization* dated October 20, 2008) to an e-mail transmittal from EPA dated October 22, 2008. Field activities that occurred during the oversight observations included drilling through pond sediments and soils to the shallow aquifer using a geoprobe drill rig, sample collection of shallow and deep soils within the vadose zone for various chemical and physical characteristics, and collection of shallow groundwater samples for chemical characterization.

This technical memorandum addresses the collection of groundwater grab sample as a field activity in the context of the *Anaconda Evaporation Ponds Removal Action Characterization Work Plan* and, potentially, in future remedial investigation activities under the Administrative Order for Remedial Investigation and Feasibility Study, EPA Docket No. 9-2007-0005. A number of the issues identified below, in Section 2, should be viewed in the context of the intended use of groundwater grab samples (Section 3 of this memorandum).

2. IDENTIFIED ISSUES AND RESPONSES

Issues Identified in the CH2M Hill Memorandum dated October 20, 2008:

Issue #1 (page 4). Gloves were not being routinely worn by drilling subcontractor staff. When handling core for soil samples or when handling the bailer for water samples, new gloves should be donned at each sample location according to SOP-11 and SOP-9.

> Response: Brown and Caldwell corrected this issue, from a health and safety perspective as well as a potential sample quality control perspective, and ensured that all field personnel (including the drilling staff) donned new and clean nitrile gloves at each sampling location. However, because of the limited contact with the water sample as it was discharged from the bailer to the sample container, the potential for the sample to be compromised is not considered to be significant.

Issue #2 (page 4). It is recommended that groundwater samples be collected and filtered right at the sample location to minimize potential chemistry changes prior to preservation and potential contamination from other sources. SOP-9 indicates that that samples can be obtained by filling a non-preserved sample receptacle and then transferring the liquid through an in-line filter into a preserved sample receptacles using a peristaltic pump, however, use of 10 separate non-preserved containers raises questions about homogeneity and sample integrity.

> Response: Brown and Caldwell acknowledges that the samples were not filtered immediately after collection in the field, but were filtered several hours later in the field office where the samples could be handled in a clean environment with less risk of impact from wind blown dust. Additionally, the samples contained significant quantities of fine silt and sediment that, if allowed to settle for several hours, allowed for more efficient filtering of the sample (e.g. without settling, the samples would have required numerous filters to achieve the required sample volume). Subsequent conversation with Brown and Caldwell's chemist, Mr. Greg Cole, indicates that the parameters most likely to be affected by delayed filtration and preservation include iron and manganese, which tend to oxidize and precipitate immediately upon exposure to atmospheric oxygen. In addition, other metals may be removed from solution by sorption onto the precipitates and subsequently removed during filtration.
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> Although it is possible that the analytical results for select metals may be biased on the low side, Brown and Caldwell believes it was more important to collect samples in laboratory-certified clean containers and used multiple 1-liter bottles as opposed to one large container. Blending of the samples was completed during the filtering and transfer of the field samples into the preserved sample containers by blending portions of each 1-L field sample into multiple preserved bottles, effectively creating a final blended sample. This approach to collecting groundwater grab samples, discussed in more detail below, is: 1) similar to the approach used during the initial characterization of the Process Areas; and 2) suitable for their intended purpose.

Issue #3 (page 4). The pond sediment (i.e., the "Red Dust" calcines) at the finger ponds may be greater in depth than originally proposed. The Work Plan had estimated a maximum depth of pond sediment of 6 feet. However, one boring contained 11 feet of pond sediment.

> Response: This is an accurate account, and Brown and Caldwell confirms that one location within Finger Pond #5 (OU4-FEP-48) intersected an 11-foot section of red pond sediments. However, this does not affect the implementation of the work plan as additional sediment samples were collected at this location as the plan required.

Issue #4 (page 2). Acid included for sample preservation in the TOC sample bottle was discarded at the borehole prior to sample collection. It is not clear why the Brown and Caldwell staff discarded the acid, however, the TOC samples were not preserved at the time of sample collection. Justification for this approach should be provided by Brown and Caldwell.

> Response: Brown and Caldwell discarded the HCl acid preservative from the sample bottles for total organic content (TOC) analysis. Based on previous experience with bailed groundwater grab samples collected in the Process Areas in 2004 and 2005, the high sediment content of these samples adversely reacts with the acid preservative creating gas bubbles in the sample container. The samples are collected in amber bottles with a Teflon-lined septum cap and are to be shipped to the lab with zero head space. The analytical laboratory for the Site (TestAmerica, Irvine) was contacted for guidance, and their recommendation that the samples should be shipped without preservative and the lab would add the preservative upon receipt was followed for the groundwater grab samples from the evaporation ponds.

Additional Issues Identified Via Telephone Communication From Nadia Hollan Burke to Chuck Zimmerman (October 22, 2008):

Brown and Caldwell used a peristaltic pump with silicone tubing to collect the water sample at a location in the north central portion of the Unlined Evaporation Pond (OU4-UEP-08). Silicone tubing may adversely impact the sample quality and it is recommended that Teflon tubing be used instead.

> Response: Brown and Caldwell used an approximate 30-foot length of silicone tubing to collect the groundwater sample at this location, as well as at one additional location (OU4-UEP-09). The use of silicone tubing is most likely to affect analytes with high vapor pressure such as VOCs or analytes that may oxidize easily as oxygen is able to diffuse through silicone tubing (Neal Wilson, "Soil Water and Groundwater Sampling, 1995). It is possible that the use of silicone tubing may have allowed oxidation of iron and manganese that did not occur with the use of the bailer. However, most metals and other analytes would not be affected and the peristaltic pump with the silicone tubing was used only at locations where bailing was not feasible. As discussed below in Section 3, this approach does not affect the use of the groundwater grab samples.

Drillers were handling soil cores without the use of disposable nitrile gloves which could potentially impact the sample quality by causing cross-contamination.

> Response: The drillers only handled the outside of the disposable plastic core sleeve as it was extracted from the core barrel. The core sleeves were then cut open by either the drill crew of Brown and Caldwell staff and the exposed soil sample was handled only by Brown and Caldwell staff for logging and placement in sample containers. A clean pair of disposable nitrile gloves was used for the handling of soil samples.

3. GROUNDWATER GRAB SAMPLES

As stated in the Work Plan, the primary data quality objective (DQO) for groundwater characterization was to preliminarily characterize water quality beneath and immediately surrounding the inactive Anaconda evaporation ponds to determine the potential need for, and locations of, additional monitor wells. Similarly, water quality data have been collected in the Process Areas Operable Unit (OU-3) and Site-Wide Groundwater Operable Unit (OU-1) to support decisions regarding well placement.

During the OU-3 and OU-1 investigations, decisions regarding monitor well locations and/or well screen placements were based largely on field measurements of pH, specific conductance and sulfate in groundwater grab samples (OU-3) and zonal groundwater samples (OU-1) because these constituents are considered to be indicative of mine-related groundwater and are relatively non-reactive (i.e., unaffected by potential changes in oxidation state due to sampling methodology). OU-3 data for pH, specific conductance and sulfate in groundwater grab samples exhibited a distribution that was consistent with historic process operations and correlated with nearby monitor well data. For OU-1, including the two phases of hydrogeologic framework assessment investigations, a comparison of sample collection methodologies indicated that field-measured values for pH, specific conductivity and sulfate before and after low-flow, minimal drawdown purging were consistent (i.e., less than 10 percent relative percent difference). Thus, measurement of these parameters in non-purged groundwater samples adequately supported decisions regarding well placement (the Work Plan mentioned purging, which was not intended for these groundwater grab samples). Based on this Site-specific knowledge regarding sampling methodologies, the use of pH, specific conductivity and sulfate (and other non-reactive constituents) in groundwater grab samples is acceptable for supporting decisions regarding monitor well placement and preliminary groundwater quality characterization.

In addition, samples collected with grab sampling devices (e.g., a bailer) may exhibit variable accuracy and precision for chemically reactive constituents (e.g., metals) where positive and negative bias in analyte quantification may occur from redox changes during sample collection and for VOCs due to degassing losses. Analytical results for these reactive constituents are considered semi-quantitative information that may be useful for assessing the presence/absence of individual constituents and semi-quantitatively identifying hot spots in groundwater as recommended in "Groundwater Sampling and Monitoring With Direct Push Technologies" (EPA, 2005).

Furthermore, EPA guidance (2005) notes that sample volume issues can be particularly relevant to collecting samples with direct push technologies (DPT), especially in fine-grained formations where very low inflow rates extend sample collection time and/or larger volumes are needed for certain sample analyses. Both of these conditions can result in unnecessarily long sample collection times that conflict with one of the key advantages of DPT, which is to achieve a faster sampling capability that helps to provide more data, thereby improving site decision making. This situation occurred during implementation of the Work Plan, with some DPT locations requiring as much as seven hours of purging to obtain the sample volume needed for analysis. Given that decisions regarding well placement rely largely on data that can be obtained by groundwater grab sampling, purging times were reduced at locations where inflow rates were low. This practical response to difficult field sampling conditions is not expected to adversely affect decisions regarding the potential need for, and locations of, additional monitor wells.

In summary, the grab sampling methods used to date for the characterization of groundwater underlying the area of the Anaconda evaporation ponds has achieved the objectives described in the Work Plan.