

TECHNICAL MEMORANDUM

To: Brian Rakvica (NDEP)
From: Ranajit Sahu (BRC)
cc: Jim Najima (NDEP)
Mark Jones (ERM)
Date: March 25, 2009
Subject: Technical Memorandum – Resolution of Various Analytical Program Issues, BMI Common Areas (Eastside) Site, Clark County, Nevada

Introduction

The objective of this Technical Memorandum is to provide information on several issues that have been noted for the current analytical program being used for environmental investigations conducted by BRC at the BMI Common Areas in Clark County, Nevada. Specifically, this Technical Memorandum provides information on the following:

- Elevated thorium-228 activities;
- Elevated detection limits for arsenic in groundwater; and
- Elevated detection limits for perchlorate in groundwater.

Each of these issues and their resolution is discussed below.

Elevated Thorium-228 Activities

This issue pertains to the fact that in several recent datasets, it was observed that the thorium-228 activity exceeded the background activity and did not align with the activities of other radionuclides in the natural thorium decay chain. This was investigated thoroughly by the staff of GEL Laboratories. GEL did indeed find in their review of the data that the thorium-228 activity in these samples is above what would be expected for the natural thorium decay when compared to the activities of the other radionuclides reported in this decay chain. The activities are elevated by less than one picocurie per gram in most samples. When investigating the potential for the laboratory to contribute to the elevated thorium-228 activities, each of the steps in the analytical procedures was examined.

The samples from the BMI complex are analyzed for both isotopic uranium and isotopic thorium by GEL. The extraction and separation of these isotopes have been done sequentially by the laboratory with the tracer for each analysis added prior to the separation. The tracers used are thorium-229 and uranium-232. Uranium-232 decays to thorium-228 in the tracer solution. Barium sulfate is routinely added to the tracer solution to precipitate any thorium-228 that may be in the solution. GEL concluded that the barium sulfate did not completely remove the

thorium-228 in the tracer solution used for these analyses. Thus, the elevated thorium-228 reported results on a non-uniform basis. To prevent this from occurring with samples that are currently being processed by the laboratory, effective January 10, 2009 GEL has discontinued sequentially processing the uranium and thorium analyses. The lab will continue to work towards determining why the uranium-232 tracer with barium sulfate does not remove thorium-228 prior to uranium analysis. Once this tracer issue has been completely resolved, the lab will begin preparing samples for uranium and thorium analysis together.

Elevated Detection Limits for Arsenic in Groundwater

It has been noted that in all groundwater monitoring events for the project, arsenic reporting detection limits (RDLs) are frequently elevated, that is, greater than either human health-based levels or the U.S. Environmental Protection Agency (USEPA) maximum contaminant level (MCL) for arsenic of 10 µg/L. Arsenic RDLs have ranged from 2 µg/L to 10,000 µg/L, with a mean RDL of 200 µg/L and a median RDL of 40 µg/L in Eastside groundwater monitoring events. Recently, a new generation of Inductively Coupled Plasma/Mass Spectrometer (ICP/MS) to determine trace metals in environmental samples has become available. This latest instrument employs collision cell technology to reduce matrix interferences that can cause inaccurate results. For example, samples that contain high chlorides can be difficult to analyze with ICP/MS because they form polyatomic ions that can mimic target metals such as arsenic in the detector. The collision cell technology uses kinetic energy discrimination to remove these interferences, making the analysis more rugged and reliable. In addition, the software used to process the data applies correction equations that also help to minimize the impact of the sample matrix. Typically, sample dilution is used as a means of minimizing the negative impact of matrix interference; however, this causes the increased detection limits that have been observed. BRC recently conducted limited sampling and analysis using this technology. Samples were collected on March 16, 2009 from monitoring wells AA-9, AA-20, and AA-22. The table below presents the preliminary results of this investigation.

Analyte	Units	AA-9-GW	AA-20-GW	AA-22-GW	RDL	Previous RDL Range for These Wells
Antimony	µg/L	0.41 J	0.86 J	0.38 J	0.30	14 to 154
Arsenic	µg/L	84.2	178	44.6	0.95	39 to 154
Chromium	µg/L	101	957	38.8	0.68	60 to 240
Selenium	µg/L	31.2	33.9	9.1	0.99	100 to 400

As can be seen from these results, the RDLs for arsenic are much lower than what was reported previously. Also, as shown, this technology can also be applied to other metals on the current BRC analyte list with a similar reduction in RDLs.

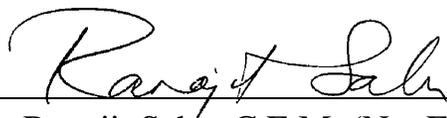
Elevated Detection Limits for Perchlorate in Groundwater

It has also been noted that in all groundwater monitoring events for the project, perchlorate RDLs are frequently elevated, that is, greater than either human health-based levels or the USEPA Drinking Water Equivalent Level for perchlorate of 24.5 µg/L. Perchlorate RDLs have ranged from approximate 0.34 µg/L to 40,000 µg/L, with a mean RDL of 258 µg/L and a median RDL of 143 µg/L in Eastside groundwater monitoring events. Similar to arsenic, these elevated RDLs for perchlorate are primarily a result of samples that require dilution due to matrix interference. GEL Laboratories has indicated that they could attempt to perform the perchlorate analysis utilizing LC/MS/MS instead of ion chromatography (314.0). The LC/MS/MS method would only look for the mass fragments associated with perchlorate so the unknown interference should not pose an issue.

Summary

In summary, BRC has identified several steps that have been, and that can be taken to address many of the issues that have been noted for the current analytical program. BRC will continue to have discussions with NDEP and the laboratories, as well as monitor USEPA methods for addressing any further issues. BRC will also track the various sampling activities and analyses being conducted at the BMI site by others and identify addition/better laboratory methods in order to achieve lower detection limits, where appropriate. BRC welcomes NDEP input in this regard.

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and to the best of my knowledge comply with all applicable federal, state and local statutes, regulations and ordinances. I hereby certify that all laboratory analytical data was generated by a laboratory certified by the NDEP for each constituent and media presented herein.



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BRC Project Manager

March 25, 2009

Date