

Danyel Soulier

From: Connor Newman [REDACTED]
Sent: Wednesday, November 27, 2019 4:07 PM
To: Jeryl Gardner
Subject: Re: Fw: OU-1 docs

Hi Jeryl,

Nice to hear from you. Things are going very well here, and I hope the same is true for you.

I had not heard of Al Waibel but I did a quick search online and found some work of his in Geothermal Resources Council transactions. So it seems like he likely has a good handle on this sort of stuff. I took a look through the memo and have the following thoughts:

1. You inquired about his references. While what he cites are reasonable investigations and are generally applicable, they are somewhat outdated. Most of the citations are from the 2000's and earlier, and only one is later than 2010. This isn't a major flaw or anything, it just shows that he might not be completely up to date on geothermal geochemistry investigations going on in the Great Basin.
2. In terms of his overall conclusion that the conceptual model is speculative, I could not agree more. This was the same conclusion I came to back when I reviewed the predecessor to this GTM (at least that's what I think it was, I reviewed some document similar to how this one sounds). The lines of evidence they bring up certainly *could* explain the groundwater geochemistry, but they are not the most likely explanation. Many conceptual models are theoretically possible, but the best conceptual model is parsimonious in that it requires no large leaps of faith. This whole geothermal anomaly conceptual model requires some inventive reasoning to believe it is the most parsimonious explanation.
3. In regards to the use of statistics, namely PCA, in my experience PCA is somewhat difficult to get right. There are about 4 or 5 steps involved in a good PCA (initial data evaluation for determination of normality, substitution of non-detects, rescaling, centering, etc.). If these are not done in the right order or one step is skipped altogether the whole thing is garbage, and can actually give interpretations that are quite wrong. I do have a lot of respect for Jim Chatham, but I wonder if he was the one who did everything? In my experience PCA is not something that should be farmed out to the inexperienced. I found that out for myself in grad school when I missed one of the steps and my whole statistical analysis had to be redone! I would search their references section for some of the papers found below (or similar ones), which would be a good sign they did things correct:

<https://onlinelibrary.wiley.com/doi/abs/10.1002/env.966>

<https://www.sciencedirect.com/science/article/pii/S0375674213001866?via%3Dihub>

<https://www.sciencedirect.com/science/article/pii/S0167947312000941?via%3Dihub>

<https://www.sciencedirect.com/science/article/pii/S0098300411002056?via%3Dihub>

If you are interested I can send you PDFs of any of these as I have them all, but just not access to them right now.

4. I agree with his general comment #2, that even if this geothermal system was present, it does not mean it could not be overprinted by impacts from the mine.

Those were the things I thought really deserved a mention, but overall Al Weibel's review seems sound. You are correct that I probably don't have the time right now to look through the whole GTM, but I do remain interested in the goings on at NDEP and with several sites in particular (Anaconda being one of them). Given that general interest, maybe you could send the FTP site link over? Maybe when I've got a couple hours on a plane sometime I can give it a look through.

Have a great Thanksgiving, hope to see you soon sometime when I'm back in Nevada. I think I'll be coming out to snowboard sometime this spring as my pass works at Squaw/Alpine.

-Connor

On Sat, Nov 23, 2019 at 10:14 AM Jeryl Gardner <JGARDNER@ndep.nv.gov> wrote:

Hey Connor,

How are you doing?

I hope Denver and the USGS are treating you well.

I have a brief favor to ask, that hopefully will not take much of your time.

You recall the conversations and presentations/discussions we have had with Jim Chatham, regarding a relic hydrogeothermal system in the vicinity of the Yerington Anaconda Mine Site. He has expanded his theory significantly with additional PCA and SI work, but it still appears questionable, or at best non-provable, that (even if) this feature existed, it could have controlled the transport of mine COIs to the degree they are postulating.

The Atlantic Richfield Company (ARC) recently submitted a Revised Draft RI Report, which is currently under review by NDEP and its consultants. ARC has essentially concluded in this version of the RI, that MIW extent is limited to just a few hundred feet north of the site boundary. They rest their MIW extent hypothesis on 5 lines of evidence (LOE), and the Geothermal Tech Memo (GTM), now a Final document included as an appendix in the RI, is their highest tier LOE.

Our technical support contractor, Terraphase Engineering, recently hired a highly experienced geothermal system scientist, Al Weibel (do you know him, or know of him?) to evaluate the GTM and geothermal anomaly theory postulated by Jim Chatham/ARC.

If you have time, could you take a look at this geothermal system (GTM) evaluation by Weibel?

I am primarily interested in knowing if his reference citations, and ultimately his independent evaluation and conclusions are sound, from your perspective.

From my perspective, his evaluation and conclusions are based on solid evidence, and are undeniable, but my knowledge and experience in this arena are limited compared to yours.

The primary point he makes is that the geothermal anomaly hypothesis developed by Jim Chatham, is non-unique, and generalized, and cannot be proven conclusively. As I stated earlier, ARC uses the GTM as a cornerstone LOE for proof that MIW never did, doesn't and never will move further north than just a few hundred feet north of the mine site. Obviously, for ARC, this reduces their ultimate liability and responsibility for any potential groundwater treatment (or even monitoring).

This sets us up with a particularly poignant battle with ARC soon (week after next).

I just want to be sure as we go into battle, that our arguments and conclusions are solidly, scientifically-based.

If you get time, let me know your thoughts. I appreciate it. I doubt if you have time to dive deeper into this request, but if you are interested I can share the Final GTM with you also. It is quite large, but I have stored it on a SharePoint site we created for public access of all Anaconda documents. I can give you the public access credentials if you want. The request I make of you today would not require you to review the Final GTM or Draft RI Report, but it just may be of interest to you at some point, as you provided substantial input to Chatham.

I hope all is well with you, and that you are enjoying life and work in Denver.

Sounds like your winter has started out much better than ours.

Cheers!

Jeryl

Jeryl R. Gardner, P.E., C.E.M.
Supervisor, Abandoned Mine Lands Branch
Bureau of Corrective Actions, NDEP
775-687-9484
jgardner@ndep.nv.gov

From: Jeff Wallace <jeff.wallace@terraphase.com>
Sent: Friday, November 22, 2019 3:25 PM
To: Jeryl Gardner; Patrick Mohn
Cc: James Farrow; Peter Zawislanski; Don Malkemus
Subject: OU-1 docs

Hi Jeryl and Pat,

Over the weekend, we are going to mull over the revisions to the RI comment document, and then forward it to you on Monday instead of today as we had discussed.

Comments on the GTM provided by Al Waibel are attached.

Jeff Wallace, RG, LHg

Principal Geologist

Terraphase Engineering Inc.

610 SW Broadway, Suite 405 | Portland, Oregon 97205 | www.terrphase.com

phone: 503.889.0367 | cell: 503.320.8340 | fax: 510.380.6304

jeff.wallace@terrphase.com



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November 29, 2018

Jeryl R. Gardner, P.E., C.E.M.
Supervisor, Abandoned Mine Lands Branch
Bureau of Corrective Actions, NDEP
901 S. Stewart St., Ste. 4001
Carson City, NV 89701

sent via email to jgardner@ndep.nv.gov

Subject: Review of Draft Identification and Geochemical Characterization of a Geothermal System in Mason Valley, Nevada by Copper Environmental Consulting, Broadbent & Associates, Inc. and AECOM Dated October 2018

Dear Mr. Gardner:

Per your request, Terraphase Engineering Inc. (Terraphase) has prepared this technical evaluation of the *Draft Identification and Geochemical Characterization of a Geothermal System in Mason Valley, Nevada* ("the Report"), prepared by Copper Environmental Consulting, Broadbent & Associates, Inc., and AECOM for Atlantic Richfield Company (ARC).

OVERVIEW

Considerable effort has obviously been invested in the evaluation of the potential for a geothermal influence on groundwater quality downgradient of the ACMS. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

GENERAL COMMENTS

General Comment 1

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

General Comment 2

[REDACTED]

¹ The depth from the samples were collected is not specified in the Report. This information was shared by ARC consultants during a meeting on November 14, 2018.

[REDACTED]

[REDACTED]

General Comment 3

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

General Comment 4

[REDACTED]

[REDACTED]

General Comment 5

[REDACTED]

■ [REDACTED]

■ [REDACTED]

[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]

■ [REDACTED]

■ [REDACTED]

General Comment 6

[REDACTED]

[Redacted]

[Redacted]

General Comment 7

[Redacted]

■ [Redacted]

■ [Redacted]

■ [Redacted]

[Redacted]

General Comment 8

[Redacted]

[Redacted]

[Redacted]

General Comment 9

[REDACTED]

General Comment 10

[REDACTED]

General Comment 11

[REDACTED]

SPECIFIC COMMENTS

Introduction

Text on pages 2 and 3 of the report states that “*elevated temperatures north and west of the ACMS*” suggested the potential presence of a geothermal feature. [REDACTED]

[REDACTED]

Section 4 Geothermal Gradients

This section discusses vertical temperature gradients measured in three wells, shown on Figure 4-2. [REDACTED]

[REDACTED]

Section 5.1 Study Area Water Types

[REDACTED]

Figure 5-1: [REDACTED]

Figure 5-2: [REDACTED]

[REDACTED]

[REDACTED]

Figures 5-4 through 5-28

The Report should provide a detailed discussion and explanation of trends shown on Figures 5-4 through 5-28. [REDACTED]

[REDACTED]

- [REDACTED]

- A statement made in Section 5.3.2, based on results shown on Figure 5-11: *“The TDS-normalized data confirm that the boron present west and north of the mine boundary could not have originated from mine process waters.”* [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
- Section 5.3.4 discusses the fluoride distribution. Fluoride was identified as an indicator of geothermal activity. [REDACTED]
[REDACTED]
[REDACTED]
- A statement made in Section 5.3.5, based on the results shown on Figure 5-17: *“A pattern emerges from these TDS-normalized molybdenum concentrations that indicate a north-westerly trend in the bedrock near the step-over fault zone.”* [REDACTED]
[REDACTED]
- Section 5.4.1 briefly describes spatial trends in coffinite SI by zone, stating: *“coffinite follows the trend of defining the geothermal core signature emanating from the bedrock, moving upward to the northwest through the deep alluvial zones, with only a small signature remaining in the shallow alluvial zone directly above the step-over fault block.”* [REDACTED]
[REDACTED]
[REDACTED]

Other comments on Section 5 figures:

- Figures 5-19 through 5-28: [REDACTED]
[REDACTED]
[REDACTED]
- Figures 5-19 through 5-21, and 5-26: [REDACTED]
- [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
- Figures 5-30 through 5-38:
 - [REDACTED]
[REDACTED]
[REDACTED]

- [Redacted]
- [Redacted]
- [Redacted]

Section 6.1 Data Presentation and Exploratory Analyses

Section 6.1 states “...³⁴S is not significantly linked to any of the other analytes, nor would such association be expected.” [Redacted]

[Redacted]

Section 6.2.1 Multivariate Analysis

This section states that factor scores from the PCA “can be treated like analytical results.” [Redacted]

[Redacted]

Section 6.2.1.2 Factor Loadings

Factor loading is qualified as follows: “It must be noted, however, that these samples were collected from near the water table. They have likely been heavily impacted by evaporation, which could potentially mix or “smear” the signatures from one or more of the geothermal alteration sequences.” What does this mean? [Redacted]

[Redacted]

Figures 6-5 through 6-8

[Redacted]

- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]

- [REDACTED]

- [REDACTED]

Figures 7-1 through 7-4

[REDACTED]

Figure 7-5

This figure shows an overall summary of the PCA results and suggests the extent of mine-influenced water based on those results. The geothermal extent is based on +F1, +F2, and +F3. [REDACTED]

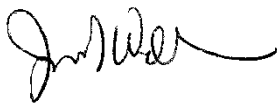
[REDACTED]

[REDACTED]

CLOSING

If you have any questions or comments regarding this document, please contact Jeff Wallace at 503-320-8340.

Sincerely,
For Terraphase Engineering Inc.



Jeff Wallace, RG, LHg
Principal Geologist



James Farrow, RG, LHg, CEM
Principal Hydrogeologist



Peter Zawislanski, PG, CHg
Principal Hydrogeologist