



Janice K. Brewer  
Governor

# ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

1110 West Washington Street • Phoenix, Arizona 85007  
(602) 771-2300 • www.azdeq.gov



Henry R. Darwin  
Director

April 11, 2014

VRP 14:225

Mr. John Broderick  
Freeport-McMoRan Copper & Gold  
Sierrita Operations  
Post Office Box 527  
Green Valley, Arizona 85622-0527

**RE: Comments on Groundwater Investigation Report**  
Freeport Sierrita, Inc  
6200 W. Duval Mine Rd.  
Post Office Box 527  
Green Valley, Arizona 85622-0527  
VRP Site Code: 100073-03

Dear Mr. Broderick:

The Arizona Department of Environmental Quality (ADEQ) Waste Program's Division Voluntary Remediation Program Unit (VRP) has reviewed the document titled *Voluntary Remediation Program Groundwater Investigation Report* (Report) dated December 2013 and received by ADEQ on December 30, 2013. The report was submitted by ARCADIS on behalf of Freeport McMoRan Copper & Gold Sierrita Operations (Sierrita). Subsequent documentation needed to evaluate the report was requested by ADEQ on February 7, 2014 and received on February 28, 2014. Sierrita and ARCADIS met with VRP on March 19, 2014 in order to discuss the development and organization of the Report to aid in VRP's review.

The main purposes of the Report were to present results of the first phase of groundwater investigation work conducted from July 2008 through July 2009 and provide an update to the conceptual site model (CSM) with respect to uranium and other constituents of interest in groundwater. In the *VRP Investigation Work Plan* (Work Plan), dated April 2008, the focus of the groundwater investigation was to assess potential releases from former and current areas of operation and to refine the CSM for groundwater.

**The Report, at this stage of the groundwater investigation, cannot be approved in its entirety.** VRP has conducted a general review of the Report that did not include a detailed examination of the tables and figures associated with the sampling results. VRP does concur with Sierrita that the groundwater at the site has not been fully characterized as suggested in Section 6.5. VRP also

Southern Regional Office  
400 West Congress Street • Suite 433 • Tucson, AZ 85701  
(520) 628-6733

concur with the recommendations and data gaps presented there; however, VRP requests that Sierrita perform additional work as outlined in Comments 4, 6, 9, and 10. At this stage, VRP is unable to concur with Sierrita on the proposed background water quality until additional work is performed as outlined in Comments 4, 6, and 10.

Based on the complexity of this project and the amount of information necessary to make technically defensible decisions, VRP suggests, for subsequent submittals, that Sierrita divide and organize reports by the four investigation areas: Background, West, East, and Central. VRP also believes that this will streamline the review process.

**Comments:**

1. VRP notes that Sierrita has not established remediation levels for this site as stated in Section 6 on page 63. Please note that pursuant to Arizona Revised Statutes (A.R.S.) § 49-175, remediation levels are selected pursuant to A.R.S. § 49-175(B) or A.R.S. § 49-175(B)(1-4). It is the Volunteer's responsibility to provide adequate and defensible data to illustrate the applicability of the selected remediation levels and/or controls.
2. In a letter titled *Review of February 2, 2012 Response to Comments*, dated June 22, 2012, VRP stated that when the groundwater data was submitted for review, VRP would verify that the groundwater data was not skewed in the three quarters following the initial groundwater sampling event (refer to Comment 5b in the letter). VRP requests that Sierrita conduct this evaluation as part of the data review process.
3. VRP suggests that Sierrita include soil and sediment data into the site's conceptual site model and subsequent groundwater investigation.
4. VRP observed that the groundwater data presented in the Report was limited to that outlined in the *VRP Investigation Work Plan* (Work Plan), dated April 2008. Since 2009, the end of the Work Plan investigation period, Sierrita has conducted additional work that could provide valuable information for the groundwater investigation. Thus, VRP requests that Sierrita provide an all-inclusive data set for any and all groundwater wells installed before, during, and after the Work Plan period.
5. VRP recommends that a well inventory of the Green Valley area be conducted and provided to VRP to determine the location of any private domestic, agricultural wells and/or public supply wells. In addition, if present, sentinel, monitoring, and point of compliance wells should be included on the figures and the respective data should be submitted.

6. VRP requests that additional site-wide groundwater monitoring be conducted to provide a more complete data set of current groundwater conditions. VRP suggests that the monitoring events be conducted semi-annually in January and July, coinciding with the site's wet season.
  - a. With the additional monitoring data, VRP suggests contouring the groundwater elevations for the alluvial and basin fill aquifers in addition to the bedrock aquifer.
  - b. VRP also suggests that Sierrita utilize the additional data collected to re-assess aquifer characteristics calculated by URS such as: hydraulic conductivity and horizontal and vertical hydraulic gradients.
7. Page 18, Section 2.6.2.8 "Sump and Interceptor Trench System":
  - a. Please clarify if the 160 gallons per minute recovered by the LCRS is thought to be the entire volume of leakage from Raffinate Pond No. 2. If so, what is the evidence that supports that conclusion?
  - b. Please explain the nature of the "underflow" that is captured by such engineering controls as SX-Sump 1, SX-Sump 2, SX-Sump 3, Amargosa East Sump, Amargosa West Sump, and the interceptor trenches.
8. Page 49, Section 3.8.5 "Radionuclides" - Uranium:

Please provide specific documentation of the "previous investigations" discussed in this paragraph.

9. Page 58, Section 4.3.4 "Active Facilities in the Central Investigation Area", 1st paragraph:

VRP suggests installing groundwater monitoring wells alongside Amargosa Wash.

10. Page 67, Section 6.5 "Data Gaps and Recommendations for Further Data Collection":

VRP concurs with the recommendations and data gaps presented here. However, VRP requests that Sierrita also include the following:

- ◊ Monitoring wells south of the Sierrita Tailings Impoundment.
- ◊ Monitoring wells within, or adjacent to, the major washes.
- ◊ Install well pairs in alluvium and bedrock in areas where alluvium is present at the surface.

- ◆ Continue the investigation/analysis of background water quality:

VRP notes that Sierrita's background water quality analysis is the basis for most of the data analysis, preliminary conclusions, and proposed data gaps. With the data set currently presented in the Report, VRP does not concur with the proposed background water quality. VRP requests that Sierrita collect additional alluvial (if applicable), basin fill, bedrock, and groundwater samples from several areas that are not down-gradient or cross-gradient of current or historical mining operations and/or disturbed land areas. VRP suggests that Sierrita utilize analysis methods such as Piper and Stiff diagrams to aid in the background water quality investigation.

*Tables:*

11. Tables 6 and 7:

VRP requests that Sierrita provide an example for calculating vertical gradients and slug test results. This will assist VRP in confirming the method used and the outcome of the calculations.

12. Table 17:

VRP suggests that this table include a preliminary outcome/conclusion and recommendations column.

*Figures:*

13. Figure 2:

VRP requests that Figure 2 be updated to include current Sierrita property boundaries, an outline of each wash, delineation of each investigation area and respective operations, and an outline of lined canals, trenches, and washes.

14. Figure 3:

VRP suggests providing an updated surficial geology map such as the one contained in the slide deck from the March 19, 2014 meeting. For context, it would be useful to have the site features overlaid along with an updated legend.

15. Figures 5 and 6:

VRP would like to remind Sierrita of the commitment made in their February 22, 2012 letter titled *Voluntary Remediation Program - Soil and Sediment Characterization Report* in

regards to developing “updated geologic cross-sections” based upon new information obtained during any soil and groundwater work. As such, VRP recommends including at least two updated cross-sections (north-south and east-west, or best-fit based on well locations) for each of the investigation areas (background, west, central, and east). Please include applicable wells and respective information such as: total depth, screening interval, groundwater elevation, known faults, and a legend that matches the formations discussed in the report.

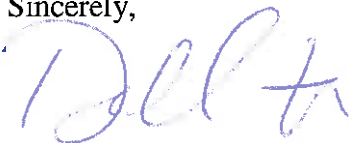
16. Figures 11 through 14:

VRP notes that the groundwater contours depicted on the potentiometric maps refer to wells MH-21, MW-2008-12, MW-2008-13, MH-17, MW-2008-14, MW-2008-15, and PZ-01 as “background wells”. VRP does not completely agree that these wells are adequate to provide a true representation of background water quality. Only MW-2008-12 is shown to be upgradient of Sierrita mining operations and/or disturbed ground. However, VRP notes that MW-2008-12 could be hydraulically downgradient of the Twin Buttes mine site and therefore may not actually represent true background.

As discussed in the conference call meeting held April 8, 2014, Sierrita may respond to this comment letter by submitting a brief response to comments letter/report addendum. VRP requests that this response be submitted **within 45 days from the date of this letter**. Comments from this letter that are to be addressed at a later date in subsequent deliverables, such as plans for conducting additional work related to data gaps, should be explained as such. This comment letter and Sierrita’s ‘brief response to comments letter/report addendum’ will close out the review of the Report.

VRP appreciates Sierrita’s continued efforts in characterizing this site. If you have any questions, please contact me by electronic mail at [dt3@azdeq.gov](mailto:dt3@azdeq.gov) or by telephone at (602) 771-4414.

Sincerely,



Danielle Taber, Project Manager  
Voluntary Remediation Program

cc: Stuart Brown, FMI, Senior Director – Remediation Projects  
Martha Mottley, FMI – Sierrita Operations, Chief Environmental Engineer  
Deborah Chismar, FMI – Sierrita Operations, Senior Environmental Specialist  
Katy Brantingham, ARCADIS, Project Manager  
John Patricki, ADEQ

