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Henry R. Darwin
Director

October 07, 2011

VRP 12:117

Mr. John Broderick
Freeport-McMoRan Copper & Gold
Sierrita Operations
6200 West Duval Mine Road
Green Valley, Arizona 85641

RE: Review of *Final Voluntary Remediation Program (VRP) Soil and Sediment Characterization Report*
Freeport Sierrita Mine
Green Valley, Arizona; Site Code: 100073-03

Dear Mr. Broderick:

The Arizona Department of Environmental Quality (ADEQ) Voluntary Remediation Program (VRP) has completed its review of the *Final Voluntary Remediation Program (VRP) Soil and Sediment Characterization Report* (Report), dated April 6, 2011, prepared by URS Corporation (URS) on behalf of Freeport-McMoran Copper and Gold – Sierrita Operations (Sierrita), for the Freeport Sierrita Mine (“Site”).

As discussed during the Site visit on June 29, 2011, and as described in Sierrita’s subsequent meeting summary letter dated August 11, 2011, the VRP is submitting comments on the above referenced document on all portions of the report with the exception of Section 4.0 “Results Evaluation”. Sierrita has requested to “defer any no further action determinations” until a site-specific risk assessment has been performed.

The VRP has the following comments:

1. General Comments –

- a. The VRP appreciates the response provided by Sierrita in their letter regarding Action Item No. 1: communications between Ms. Joey Pace of ADEQ and Mr. Ned Hall of Sierrita. These communications allowed for field work to be conducted (and completed, as with the soil characterization) prior to the November 26, 2008 approval of the Work Plan. Please note that it is not the general practice of ADEQ to approve the starting of fieldwork when a project-specific Quality Assurance Project Plan

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(QAPP) and/or Sampling and Analysis Plan (SAP) have not been received, reviewed, nor approved.

- b. The VRP also appreciates the response provided by Sierrita in their letter regarding Action Item No. 2: communication with ADEQ regarding Work Plan changes. Please note that although a Work Plan may be written to provide flexibility for deviations in the form of additions or subtractions based on professional judgment or field conditions, it is always best to communicate those deviations to your ADEQ Project Manager as it ensures a continual project dialogue and enhances collaboration among the various parties.
 - c. Based on the characterization work completed to date, does Sierrita plan to update the geologic cross-sections provided in the *Voluntary Remediation Program (VRP) Investigation Work Plan (Work Plan)*? The VRP suggests that these be provided with the subsequent site-wide groundwater characterization report.
2. Page 1-1, Section 1.0 – “...submitted an application to enter into the VRP on June 16, 2007.”

Please note that our records and Sierrita’s Work Plan state that the application was submitted on June 19, 2007.

3. Page 1-1, Section 1.0 – “*The Voluntary Remediation Program (VRP) Investigation Work Plan (Work Plan) was submitted to ADEQ in April 2008 and an Addendum – Quality Assurance Project Plan was submitted to ADEQ in September 2008. The Work Plan and Addendum were approved by ADEQ on November 26, 2008. Implementation of soil and sediment characterization commenced in June 2008 and was completed in November 2008. Groundwater characterization was also performed between July 2008 and July 2009.*”

See general comment a. Please note that the *Addendum to Sampling & Analysis Plan (SAP) & Quality Assurance Project Plan (QAPP) Voluntary Remediation Program* was not received by ADEQ until November 20, 2008.

4. Page 1-1 through 1-2, Section 1.1 – “Characterization Objectives and Scope”

See general comment 1.b.

5. Page 2-4 through 2-5, Section 2.5 – “Sample Analyses”

The VRP requests that analytical method numbers are provided within the text of this section.

The VRP reviewed the Arizona Department of Health Services (ADHS) analytical method certifications of the project laboratories.

- a. ACZ Laboratories, Inc: Since ACZ is certified by ADHS to analyze Uranium by EPA Method 200.8, please clarify as to why Sierrita chose to have Uranium analyzed by EPA Method 6020, a parameter that is not specifically covered by ACZ's EPA 6020 certification (see Table 1)?

Table 1: ACZ Laboratories ADHS Certifications

Parameter	EPA Method	Cert Date
URANIUM	EPA 200.8	4/13/2005
ALUMINUM	EPA 6020	4/12/2004
ANTIMONY	EPA 6020	2/24/1997
ARSENIC	EPA 6020	2/24/1997
BARIUM	EPA 6020	2/24/1997
BERYLLIUM	EPA 6020	2/24/1997
CADMIUM	EPA 6020	2/24/1997
CHROMIUM, TOTAL	EPA 6020	2/24/1997
COPPER	EPA 6020	2/24/1997
LEAD	EPA 6020	2/24/1997
MANGANESE	EPA 6020	2/24/1997
NICKEL	EPA 6020	2/24/1997
SILVER	EPA 6020	2/24/1997
THALLIUM	EPA 6020	2/24/1997
ZINC	EPA 6020	2/24/1997

See Table 3 for a list of Uranium analysis certifications offered by ADHS.

- b. ALS Laboratory Group (formerly Paragon Laboratories): Please note that ALS received their certifications for total and isotopic Radium from ADHS after the soil and groundwater characterization work was completed (see Table 2). This does impact the usability of the data collected and analyzed prior to 1/15/2009 in a No Further Action determination.

Table 2: ALS Laboratory Group ADHS Certifications

Parameter	EPA Method	Cert Date
ALPHA-EMITTING RADIUM ISOTOPES	EPA 9315	1/15/2009
TOTAL RADIUM	EPA 903.0	1/15/2009
RADIUM 226	EPA 903.1	1/15/2009
RADIUM 228	EPA 9320	1/15/2009

Please note that ADHS offers the following certifications to laboratories for Uranium and Radium analyses:

Table 3: Available ADHS Certifications (not all inclusive)

Parameter	Methods
GROSS ALPHA	“Gross Alpha”, 7110B, 7110C, R-1120-76, 900, 00-01, 00-02
URANIUM	200.8, 7500-U B, D5174-91, R-1180-76, R-1181-76, R-1182-76, 908, 908.1, U-02, U-04, 00-07, “Uranium”, D5174-97 02
ALPHA-EMITTING RADIUM ISOTOPES	EPA 9315
RADIUM 226	“Radon Emanation, Precipitation Method”, 7500-Ra B, 7500-Ra C, R-1140-76, R-1141-76, 903, 903.1, Ra-05, Ra-03, Ra-04, “Radium 226”, “Gamma-ray HPGE or Ge(Li)”
RADIUM 228	“Radium 228”, 7500-Ra D, R-1142-76, 904, Ra-05, 9320
RADIUM, TOTAL	7500-Ra B, 903

6. Page 2-5, Section 2.6 – “Work Plan Deviations”

See general comment b.

7. Page 2-16, Section 2.10.2 – “...from soil borings at 3 judgmental (JS) sample locations”

The Work Plan text stated that the above referenced samples were designated as “soil samples” however; the corresponding figure (Figure 4-3) displayed the proposed sample locations as “judgmental soil samples”. As shown above, the Report states in text (and figures) that the samples were “judgmental soil samples”. Please provide clarification and correct as appropriate.

8. Page 2-19 through 2-20, Section 2.11.3 – “*Judgmental samples were also collected from boring EM-JS-01 at depth intervals of 0 to 1 and 1 to 3 ft bgs. This location was sampled based on previous soil sampling results (HGC 2008) where concentrations of arsenic, molybdenum, and antimony were detected above their respective nr-SRLs.*”

“One judgmental soil boring (EM-JS-01) was added in the Former Esperanza Mill subarea based on field observation of surface soil staining.”

The VRP requests clarification as to why the sample location EM-JS-01 was added.

9. Page 2-20, Section 2.11.4.1 – “*Ten random soil borings in the Former Esperanza Mill subarea were advanced to the underlying granodiorite bedrock.*”

Please note that Section 2.11.3 states that nine random soil borings were utilized to characterize the Former Esperanza Mill. Please clarify and correct as appropriate.

10. Page 2-23, Section 2.12.3 – “*...from 11 soil borings at judgmental (JS) sample locations.*”

The Work Plan text stated that the above referenced samples were designated as “soil samples” however; the corresponding figure (Figure 4-4) displayed the proposed sample locations as “judgmental soil samples”. As shown above, the Report states in text (and figures) that the samples were “judgmental soil samples”. Please provide clarification and correct as appropriate.

11. Page 2-26, Section 2.13.3 – “*8 sediment samples (including 4 duplicates) from soil borings at 2 sediment (SD) locations*”.

The Work Plan text stated that the above referenced samples were designated as “judgmental sediment samples” however; the corresponding figure (Figure 4-4) displayed the proposed sample locations as “sediment samples”. As shown above, the Report states in text (and figures) that the samples were “sediment samples”. Please provide clarification and correct as appropriate.

12. Page 2-34, Section 2.15.3 – “*Both soil borings were advanced to 20 ft bgs. The sample depth intervals ranged from 0 to 1 to 15 to 17 ft bgs.*”

Was bedrock encountered in the two judgmental soil borings within the Former Rhenium Ponds Subarea? If so, please provide what depths and what type.

13. Page 2-34, Section 2.15.4.2 – “*In addition, one composite soil sample was collected in 2005.*”

The data related to the composite soil sample is not contained within the Report’s table nor figures. Please provide clarification and correct as appropriate.

14. Page 3-1, Section 3.3 – “*Field Duplicate Sample Evaluation*”

The VRP understands that 12 duplicate samples were collected out of 200 soil and sediment samples during the 2008 characterization. This total number is in line with the Work Plan and QAPP requirement of one duplicate sample for every 20 regular field samples. However, it has been noted by the VRP that a majority of the field duplicates were collected within the same subarea and within a two day period in August. Ideally, the field duplicates should have been collected regularly, such as one field duplicate for every 20 regular field samples, throughout the field characterization activities that occurred from June through November.

The VRP also noted that the Relative Percent Difference (RPD) calculated for each field duplicate was not properly evaluated. The Report text states “Results of the RPD calculations for sediment and judgmental soil samples are plotted in Figure 3-1 for each of the COI metals as well as an overall average RPD for each matrix. In general, the sediment (23.0%) and soil (23.1%) had similar RPDs and are considered acceptable.” Averaging RPDs together to

determine a matrix specific RPD is not a suitable way to evaluate the precision and accuracy of field and laboratory activities. Preferably, the regular field sample should have been evaluated based upon the calculated RPD for each detected analyte and the acceptance criteria established either in the QAPP or regulatory guidance.

For example:

Sample pair OD-JS-03-01-03 and OD-JS-03-01-03D

Acceptance Criteria

Per QAPP Table 7, a RPD limit was not specified for metals analysis, therefore the evaluation defaults to regulatory guidance.

For inorganics in soil:

- $\pm 35\%$ RPD for sample values greater than 5 times the Reporting Limit (RL); or
- the absolute value of the difference between the sample and duplicate should be less than the RL for sample values that are less than 5 times the RL.

Table 4: Example of Relative Percent Difference Calculation and Associated Qualification

Analyte:	Regular Field Sample Result:	Field Duplicate Sample Result	RPD (%)	Qualification Required?
Antimony	0.4	0.3	28.6	No
Arsenic	6.4	2.9	75.3	Yes* - "R8" or "J"
Barium	114	87.4	26.4	No
Beryllium	<1	<1	Not Calculated	Not Applicable
Cadmium	<2	<2	Not Calculated	Not Applicable
Chromium	5.0	7.0	33.3	No
Cobalt	6.0	9.0	40	Yes* - "R8" or "J"
Copper	1,510	1,800	17.5	No
Lead	10.6	14.9	33.7	No
Manganese	230	186	21.2	No
Mercury	<0.2	<0.2	Not Calculated	Not Applicable
Molybdenum	74	74	<1.0	No
Nickel	6.0	6.0	<1.0	No
Selenium	0.72	0.78	8.0	No
Thallium	0.23	0.22	4.4	No
Uranium	3.31	3.89	16.1	No
Zinc	71	76	6.8	No

*Detected levels were greater than 5 times the RL, therefore VRP did not perform the absolute value evaluation

R8 = Sample RPD exceeded acceptance limit

J = estimated value

The VRP noticed that most of the field duplicates pairs were not properly evaluated during the data verification/validation process contained in Appendix C. One Appendix C report (L71473) states "The field duplicate pairs OD-JS-03-1-3/ OD-JS-03-1-3D... ..met the applicable evaluation criteria. Data qualification was not required." However, you can see

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from Table 4 that data qualification was/is required. Other field duplicate pairs either have a similar statement or were not evaluated at all.

The VRP requests that the field duplicate evaluation be re-performed according to the information provided here and applicable guidance documents. The data should then be modified to contain the data qualifiers.

Please note the following:

Per US EPA Region 9, data collected for site characterization should have 80 percent of the data evaluated at Tier 1, 10 percent at Tier 2, and 10 percent at Tier 3. A site that is pursuing a No Further Action should have 100 percent of the data evaluated at Tier 2 (US EPA, 2001). To date, Sierrita appears to have evaluated 100% of their data at Tier 1a and 10% at Tier 3. Even though the Sierrita's data evaluation appears to be in line with what was outlined in the ADEQ approved QAPP, there is a *potential* impact to the usability of the data in a No Further Action determination.

15. Tables –

Table 2-6: the arsenic value for EM-U25-05-05.5 is missing.

Please submit, for VRP approval, a revised *Final Voluntary Remediation Program (VRP) Soil and Sediment Characterization Report* incorporating the comments contained in this letter and along with an updated/modified Section 4.0 "Results Evaluation". If you have any questions, please contact me by electronic mail at dt3@azdeq.gov or by telephone at (602) 771-4414.

Respectfully,



Danielle Taber, Project Manager
Voluntary Remediation Program

cc: Stuart Brown, Freeport-McMoRan Copper & Gold, Senior Director – Remediation Projects
Martha G. Mottley, Freeport-McMoRan Copper & Gold – Sierrita Operations, Chief Environmental Engineer

References:

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