FREEPORT-McMoRan

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January 2, 2015

Via Certified Mail # 7013 1090 0000 3213 4134
Return Receipt Requested

Ms. Danielle Taber
Project Manager
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Arizona Department of Environmental Quality
1110 W. Washington St.
Phoenix, AZ 85007

Re: Response to Comments, Voluntary Remediation Program Baseline Human Health Risk Assessment Work Plan, Freeport-McMoRan Sierrita Mine Green Valley, Arizona; Site Code: 100073-03

Dear Ms. Taber:

This letter has been prepared in response to the Arizona Department Environmental Quality (ADEQ) November 18, 2014 letter (Letter) regarding Freeport-McMoRan Sierrita Inc.'s (Sierrita) Voluntary Remediation Program Baseline Human Health Risk Assessment Work Plan (Work Plan) submitted to ADEQ in February 2013. Comments from the Letter are reproduced below in italics, followed by Sierrita's response to each comment. In this response to comments, Sierrita proposes to revise the Work Plan to address comments made by ADEQ. Concurrence from ADEQ on the proposed revisions is requested prior to submitting the revised Work Plan to streamline future review and approval process.

Required Information

1. *Any work plan submitted to VRP is required to be developed in accordance with A.R.S. § 49-175. Being that this Work Plan is a general-overview of the methodology and assumptions for a forthcoming human health risk assessment, VRP is waiving the requirements cited in A.R.S. § 49-175(A) in accordance with A.R.S. § 49-175(C).*

   VRP is still requiring Sierrita to demonstrate that the outcome of the Work Plan will result in compliance with A.R.S. § 49-175(B)

Sierrita Response: Comment noted. Sierrita acknowledges that ADEQ waives A.R.S. § 49-175(A) in accordance with A.R.S. § 49-175(C).

General Comments

VRP requests for Sierrita to provide additional explanation and/or discussion on the comments provided herein in order to strengthen and lend more credibility to the Work Plan itself and the subsequent risk assessment report.

1. Section 1, page 1, last bullet:

A revised final VRP Soil and Sediment Characterization Report and an addendum report (addressing radionuclides) as well as a groundwater investigation report were submitted by Sierrita in 2013 and 2014. It may be useful to revisit the Work Plan in light of these new documents. In particular, the current Work Plan does not address the planned approach or methods for radionuclide risk assessment.

Sierrita Response: Sierrita will provide, in the revised Work Plan, an update on activities and project status to date. Radionuclide approach and methods for the risk assessment will be described in greater detail in the revised Work Plan.

2. Section 1, page 2, paragraph 1:

Three receptor groups are identified for evaluation in the Work Plan: an onsite outdoor commercial/industrial worker, a future onsite construction worker, and a future onsite child/adult resident. Although the evaluation of these receptor groups would be protective of likely current and future land uses, an evaluation of a recreational or trespasser receptor group may prove useful in making risk management decisions.

Sierrita Response: Sierrita will include an evaluation of a trespasser receptor group in a future land use scenario. Currently, the Sierrita Mine is privately owned and operated, and access to the Site is strictly controlled as it is an operating facility. Under these conditions, the Site is not accessible by the public. Therefore, a recreational or trespasser scenario under current land use conditions is not practical for making risk management decisions.

3. Section 1, page 2, last sentence:

The last sentence before Section 1.1 provides the primary objective of the risk assessment. This statement could be made at the beginning of Section 1 to better orient the reader and provide clarity on the purpose of the assessment.

Sierrita Response: Sierrita will include the primary Work Plan objective in Section 1 of the revised Work Plan to assist reader with orientation and clarity.

4. Section 1.2, page 3, sixth bullet:

Consideration of two recent EPA white papers on probabilistic risk assessment may be useful. These are available on-line at:
http://www.epa.gov/raf/prawhitepaper/pdf/raf-pra-faq-final.pdf http://www.epa.goviraf/prawhitepaper/pdf/raf-pra-white-paper-final.pdf

Sierrita Response: Sierrita will include the option of conducting a probabilistic risk assessment if warranted. Sierrita will provide a general proposed approach in the revised Work Plan; if a probabilistic approach is determined to be needed, specific input parameters for probabilistic calculations will be provided to ADEQ for review prior to finalizing the BHHRA.

5. Section 1.2, page 3, eighth bullet:

Please note that ProUCL version 5.0 is now available on-line at: http://www.epa.gov/osp/hstl/tsc/software.htm

Sierrita Response: Sierrita will use the most current version of ProUCL in BHHRA calculations and will revise the Work Plan to include this statement.

6. Sections 2.3.1 through 2.3.3, pages 6 through 8:

For the onsite commercial/industrial worker receptor group, please describe the work force that is active at the following locations:

a. former CLEAR Plant
b. Crystal Plant
c. former Esperanza Mill
d. former Rhenium Ponds

Please include how many people are employed there, what activities they are involved in, what is their work schedule, and what their tenure in each area is. Are there site-specific exposure assumptions that could be developed for the evaluation of receptors at these locations?

Sierrita Response: Details regarding the exposure parameters used, including any site-specific information that was relevant to determine those parameters, will be provided in the BHHRA report. A conceptual site model (CSM) will be provided in the revised Work Plan that generally describes worker exposure conditions, including exposure pathways and receptors.

7. Section 2.3.3, page 8:

What is the current state of the re-vegetated pond area?

Sierrita Response: As stated in the Work Plan, the Rhenium ponds were backfilled with tailings and capped with growth medium and revegetated. Voluntary growth of vegetation has occurred in this pond area.

8. Section 2.4:

Please specify how the information provided in this section supports the assessment of human health risks and informs risk management decisions?

Sierrita Response: Section 2.4 provided an overview of site conditions based on current data at the time. This section will be updated to provide information about the Site as relevant to the BHHRA.

9. Section 3.0:

The discussion of previous investigations and analytical results would benefit from an evaluation of the usefulness of the data that has been developed to date, particularly for a health risk assessment prepared to support regulatory closure. What assurance can Sierrita provide that all appropriate locations have been. investigated and that the investigations upon which the risk assessment will be based have adequately

addressed the nature and extent of releases associated with industrial and mining activities? What is the likelihood that something important for assessing human health risk was overlooked?

Sierrita Response: The revised Work Plan will include an updated summary and description of the investigation status to date for the VRP. Assurance in regard to appropriateness of locations, adequacy of site characterization, and comprehensiveness of the data collection to date will be addressed in the revised Work Plan. Sierrita will refer to the Site Investigation Manual, including the CSM checklist, to address the VRP investigation to date.

10. Section 3.0, page 10, paragraph 2:

Antimony, arsenic, copper, and lead are identified as Chemicals of Potential Concern (COPCs). Will only COPCs be evaluated in the risk assessment? The purpose of identifying the COPCs in this section of the Work Plan is not clear.

Sierrita Response: Section 3.0 describes the conclusions from previous investigations. Please note that the description of previous investigations was prepared prior to when most of the reports for groundwater and soil were completed. Therefore, this section of the Work Plan will be updated to reflect the activities to date for the site. Paragraph 2 on page 10 specifically summarizes the conclusions made from the Soil and Sediment Characterization Report (SSCR; [URS 2012]), which had identified COPCs based on the assessment in the report. COPC selection for the BHHRA is discussed in Section 4.3.

11. Section 3.0, page 10, paragraph 2:

A sentence reads, "For sites (underline added) where the 95 percent upper confidence value exceeded the nr-SRL, the parameter was tentatively identified as a COPC."

Did Sierrita mean, "Chemicals with a 95 percent upper confidence value that exceeds the nr-SRL will be tentatively identified as a COPC?" If so, please modify accordingly.

Sierrita Response: Sierrita will revise this statement.

12. Section 3.0, pages 10 and 11:

Please include a description of the groundwater monitoring program as it specifically relates to a risk assessment objective. How will/does the groundwater monitoring program affect the risk assessment? As currently written, the connection between the groundwater monitoring program and the assessment of health risks is not clear.

Sierrita Response: Section 3.0 describes the conclusions from previous investigations. Please note that the description of previous investigations was prepared prior to when most of the reports for groundwater and soil were completed. Therefore, this section of the Work Plan will be updated to reflect the activities to date for the Site, which includes a discussion on the connection between surface soil and groundwater. The scope of the BHHRA is to address surface soil; as such, groundwater exposure will not be assessed in the BHHRA. The potential exposure pathway that involves leaching of COPCs from soil to groundwater was partially addressed in the SSCR, and summarized in the Data Gaps Work Plan submitted to ADEQ in November 2014.

Supplemental data collection was proposed to address potential antimony exposure pathway from soil to groundwater.

13. Section 4.1, page 12, paragraph 1:

This paragraph indicated that only "relevant" data reported in HGC (2008) and URS (2011) will be used to prepare the risk assessment. Are there other data available but that will not be used in the risk assessment? If so, please explain why not.

Sierrita Response: Generally speaking, soil data may be collected at the Site for other activities or programs that are not under the VRP, as the Sierrita mine site is an operating site. For clarity, Sierrita will revise the statement to simply identify data sources which it will use for the BHHRA.

14. Section 4.2, pages 12 and 13:

How will the spatial and temporal elements and sample size and density be evaluated? What are the criteria for deciding data are acceptable for use in the risk assessment?

Sierrita Response: The components of the data usability assessment summarized in Section 4.2 are consistent with USEPA (1989, 1992a) risk assessment guidance. The spatial and temporal elements and sample size and density will be evaluated following these guidance documents. As stated in the response to comment 9, appropriateness of locations, adequacy of site characterization, and comprehensiveness of the data collection to date will be addressed in the revised Work Plan.

15. Section 4.2, page 13, last bullet:

It is not clear how the range of detected concentrations will inform the evaluation of detection limits. Detection limits should be evaluated with respect to concentrations of health concern, e.g., soil remediation levels. It is unclear what the evaluation of reporting limits with respect to the range of detected concentrations is useful for.

Sierrita Response: The intent of this statement in the Work Plan is to evaluate uncertainties for cases where samples have a variable detection limit for a constituent. This statement will be revised for clarity or removed in the revised Work Plan.

16. Section 4.2.1, page 13: The term constituent of interest (COI) is introduced here. How are COIs related to COPCs?

Sierrita Response: COIs were identified in the VRP Work Plan (URS 2010) and include all the chemical constituents that are evaluated in the VRP. Of these, COPCs will be selected as described in Section 4.3, and evaluated in the BHHRA specifically. Sierrita will revise the Work Plan to clarify the distinction between COI and COPC.

17. Section 4.2.1, page 13:

Please provide additional detail on how chromatograms will be used to assess chemical concentrations for cases when "it is not practical to achieve method detection limits (MDLs) lower than screening levels, or matrix

interference from elevated concentrations of some constituents of interest (COIs) at specific locations may raise the MDLs of other COIs analyzed using the same analytical method."

Sierrita Response: MDLs may be raised in several cases, such as where gas chromatography/mass spectroscopy signals eluting within the established retention time have a signal to noise ratio in excess of 2.5 but do not meet ion abundance ratio criteria, or where interference from other constituents may raise the MDL. In these cases, the result is typically qualified by the laboratory. In risk calculations, the elevated MDL will be treated as described elsewhere in the Work Plan, however such cases will be identified and addressed in the uncertainty section, either qualitatively or, if needed, quantitatively, for consideration as to interpretation of risk calculations.

18. Section 4.2.2, page 14:

As noted in comment #5, version 5.0 of ProUCL is now available.

Sierrita Response: Sierrita will use the most current version of ProUCL in BHHRA calculations.

19. Section 4.2.3, page 14, first bullet:

Averaging a parent/duplicate pair is less health protective than including the higher concentration and discarding the lower concentration. Since a component of the Agency's mission is to be protective of human health, VRP requests that Sierrita include the higher concentration rather than averaging the results of the parent/duplicate pair.

Sierrita Response: It is unnecessarily conservative to discard a sample result because it is lower than a duplicate result. Both samples act to characterize the concentration of that media and an acknowledgement of the variability of environmental samples is inherent in the procedure. Parent/duplicate variations will be addressed in the uncertainty section of the report, including, if needed, a sensitivity analysis that involves discarding a lower duplicate sample rather than taking the average.

20. Section 4.2.3, page 14, second bullet:

The selection of the lower detection limit for a constituent when it was not detected in either sample of a parent/duplicate pair is less health protective than selecting the higher detection limit. Such a sample should be suspect anyway given that a parent/duplicate pair should have the same detection limit. As noted in comment #19, since a component of the Agency's mission is to be protective of human health, VRP requests Sierrita to select the higher detecting limit in cases such as these.

Sierrita Response: It is not reasonable to use the higher detection limit when the duplicate analysis for the sample indicated that the COI was not present at the lower detection limit. A higher detection limit is more typical when interference prevents quantification to the lower limit; thus, the higher detection limit, rather than the lower detection limit, would be more reasonably suspect. Therefore, Sierrita proposes using the lower detection limit in calculations of exposure concentrations.

21. Section 4.2.3, page 14, third bullet:

The ND in a parent/duplicate pair should be discarded and not incorporated into the data set as if it is an independent sample.

Sierrita Response: See response to comment #19.

22. Section 4.4.1, page 15, paragraph 1:

The United States Environmental Protection Agency is cited as recommending caution in the use of upper confidence limits (UCLs) for small datasets but no reference (citation) to that claim is provided.

Sierrita Response: The reference citation for the referenced sentence (restated below) is: USEPA. 2010. ProUCL Version 4.1.00 Technical Guide (Draft). EPA/600/R-07/041.U.S. Environmental Protection Agency, Office of Research and Development. May.

> *USEPA recommends caution in the use of UCLs for small datasets (e.g., <4 to 6 detects or 8 to 10 total samples) because the performance of the various methods may not be reliable in these cases.*

23. Section 4.4.1, page 15, paragraph 1:

The following statement should be cited: "Typically at least five detected concentrations and eight total samples are necessary to calculate UCLs on the mean concentration (e.g., 95% UCLs)."

Sierrita Response: The reference citation for the sentence is: USEPA. 2010. ProUCL Version 4.1.00 User's Guide. Prepared by Lockheed Martin Environmental Services for U.S. Environmental Protection Agency, Office of Research and Development. May.

24. Section 4.4.1, page 16, last paragraph:

Please identify and discuss the objective for calculating exposure point concentrations (EPCs) over 2-3 foot depth intervals.

Sierrita Response: Section 4.4.1 describes the depth intervals that will be identified to calculate EPCs. These include the 0 to 0.5 foot interval, 0 to 2 foot interval, and 0 to 15 foot interval. The rationale for calculating EPCs over multiple depth intervals is to capture the variable sampling depths of the soil data set, and to meet requirements of A.R.S. § 49-152, which identify up to 15 feet of soil as "surface soil". The Work Plan will be amended to include this objective. As stated in the referenced paragraph, the 0 to 15 ft bgs depth interval data set will be used to evaluate future unrestricted residential use of the property. The other depth interval data set that will be evaluated quantitatively in the BHHRA will be one of the two shallow depth intervals (i.e., either the 0 to 0.5 ft bgs data set or the 0 to 2 ft bgs data set), whichever contains the highest COPC EPCs. This is a conservative and reasonable approach.

25. Section 5.1:

Please revise this section to address radionuclide exposure based on the addendum to the VRP Soil and Sediment Characterization Report.

Sierrita Response: Radionuclide exposure will be addressed in the revised Work Plan.

26. Section 5.1.1, page 18, fourth bullet:

What is Sierrita considering a "significant" exposure pathway? Are there criteria that will be used to classify pathways as significant or insignificant? VRP recommends that exposure pathways be identified as "complete" or "incomplete" and risk or hazard should generally be quantified only for complete pathways.

Sierrita Response: Sierrita will revise the Work Plan to define exposure pathways as "complete" or "incomplete." If a complete or potentially complete exposure pathway cannot be quantified in the risk assessment, this exposure pathway will be identified and discussed in the uncertainty section.

27. Section 5.1.1.3.3, page 21:

The Arizona Administrative Code is incorrectly cited here. The correct citation is the Arizona Revised Statutes (A.R.S.).

Sierrita Response: Sierrita will correct this citation.

28. Section 5.1.1.3.3, page 21:

An ellipsis ("...") replaces a key passage in the restatement of A.R.S. § 49-152(C). This passage provides the context for A.R.S. § 49-152(C) and should not be left out if this restatement is to be included in the final Work Plan.

Sierrita Response: Sierrita will include the full passage.

29. Section 5.1.1.3.3, page 21:

The discussion of risk management strategies (discussion of A.R.S. § 49-152) appears out of place here since this is the exposure assessment section of the Work Plan.

Sierrita Response: Section 5.1.1.3 describes the objectives and rationale for each receptor population to be evaluated in the BHHRA. ADEQ has indicated, in comment letters on the SSCR, that evaluation of residential scenario is required to fully evaluate risk management strategies. Although it is extremely unlikely that the mining facility will be redeveloped for residential use, a future onsite child/adult resident will be evaluated for the site specifically to evaluate potential unrestricted future land use for the property. The excerpt provided in AAC R49-152(B,C) reiterates this requirement and also describes a key exposure parameter, depth of soil considered to be surface soil. Thus, the excerpt is included in the exposure section in the context of identifying the objectives and rationale for the identification of a residential receptor in the BHHRA.

30. Section 5.1.1.4, page 21: Refer to comment #26.

Sierrita Response: Please see response to comment #26.

31. Section 5.1.1.4.2, page 22:

How is water for industrial and personal use supplied to the site? What is the source of water for the site? How does Sierrita ensure that groundwater stays onsite?

Sierrita Response: Drinking water for the Sierrita Mine is obtained from the Community Water Company, a regulated water utility that obtains its supply from wells located to the east and northeast of the Site. There is no use of onsite groundwater for drinking water supply. The primary sources of water for industrial uses (e.g., mineral processing and mining operations) are the Canoa Ranch wellfield, located south of the Sierrita Mine, and a wellfield located immediately east of the Sierrita tailing impoundment; the latter wellfield was installed to control the migration of a sulfate plume that is regulated under the Mitigation Order. A minor amount of the water used for industrial purposes comes from various engineering controls as described in Section 4.2 of the Groundwater Investigation Report (ARCADIS 2013). Groundwater flow and movement in relation to the Site, including regional and Site hydrogeology, is described in Section 4.2 of the Groundwater Investigation Report. The scope of the BHHRA is to address soil and sediments (0 to 15 bgs); as such, groundwater exposure will not be assessed in the BHHRA. The potential exposure pathway that involves leaching of COPCs from soil and sediments to groundwater was addressed in the SSCR and summarized in the Data Gaps Work Plan submitted to ADEQ in November 2014.

32. Section 5.1.2:

Please provide a definition of the reasonable maximum exposure (RME).

Sierrita Response: Sierrita will provide the definition of RME.

33. Section 5.1.3.2.1 through 5.1.3.2.3, pages 23 through 26:

Please provide citations for exposure dose and concentration algorithms.

Sierrita Response: Stated in the last paragraph on page 22 of the Work Plan,

> *Exposures will be calculated with the algorithms recommended by USEPA (1992c, 2004) for the potentially complete pathways identified in the CSM (Figure 5-1) and considering the exposure parameters defined in Table 5-1.*

34. Section 5.1.3.2.1 through 5.1.3.2.3, pages 23 through 26:

The site use factor (SUF) appears to be unnecessary, please consider omitting or discuss the reason for including it in these algorithms.

Sierrita Response: Site use factors are a part of the USEPA algorithms and these algorithms are presented here in their entirety. Inputs used to calculate exposure will be presented and discussed as necessary in the BHHRA report.

35. Pages 24 through 25:

Identify the source and inputs for the following factors:

a. gastrointestinal absorption factor,
b. dermal absorption factor, and
c. inhalation absorption factor

Sierrita Response: Absorption factors will be added to Table 5-1 in the Work Plan.

36. Section 5.2, page 27:

This section would be more valuable if a discussion of potential inputs for bioavailability values was provided.

Sierrita Response: In the event that bioavailability values are incorporated into the BHHRA, values and inputs will be discussed with ADEQ and these values detailed in the report.

37. Section 5.3.2, page 28, last paragraph:

Subchronic reference doses and subchronic reference concentrations are introduced for the first time in the section. There was no preceding discussion about assessing less than lifetime exposures under occupational or residential exposure scenarios. If exposures of subchronic duration are to be assessed, then this approach should be introduced in Section 1.1 and discussed in Sections 5.1.2, 5.1.3, and 5.1.3.2. Also assumptions for subchronic duration exposures should be provided in Table 5-1.

Sierrita Response: The subchronic exposure evaluation approach will be introduced in Section 1.1 and discussed in Sections 5.1, and assumptions added to Table 5.1 as appropriate.

38. Section 5.4, page 30, first paragraph following Equation 5-7:

The Work Plan indicates that when a hazard index (HI) is greater than one, the hazard quotient (HQ) can be recalculated to account for the mechanism of action or toxic endpoints. It would be more appropriate for this assumption to be based upon Arizona statute, regulation, policy, or guidance. In order for VRP to determine if this is appropriate for use at Sierrita, please provide a more appropriate citation and an explanation on how this assumption will impact the outcome of risk assessment. Examples of constituents for which the hazard quotient would be recalculated and how would be valuable.

Sierrita Response: This comment incorrectly cites the Work Plan. The Work Plan text correctly states, "If the resulting HI is greater than one, it may be recalculated summing only HQs for constituents with a similar mechanism of action or toxic endpoints (USEPA 1989). This statement is consistent with ADHS risk assessment guidance, which describes this procedure in Section 6.1.2 of the guidance document (ADHS 2003): "*If the initial screening level HI exceeds 1, it may be appropriate to segregate the compounds by effect and mechanism of action to derive separate HIs for each group.*" For consistency, the ADHS citation will be added to the sentence stated above in the Work Plan. Examples will not be provided in the revised Work Plan as it will only be determined, upon completion of initial calculations in the BHHRA, whether such additional action is needed and appropriate. Should such actions be needed, details will be provided in the report as to the calculations performed.

39. Section 5.4, page 30, last paragraph

The Arizona Administrative Code R18-7-206 does not state that excess lifetime cancer risks (ELCRs) greater than the range of 1 x 10-6 to 1 x 10-4 or noncancer HIs greater than one "may pose a potential threat to human health". A more clear discussion of these points of departure for risk management would be helpful in explaining how the risk assessment could be used to protect human health.

Sierrita Response: A clearer discussion of the points of departure for risk management will be provided in the revised Work Plan, and statements from the Arizona Administrative Code R18-7-206 will be revised to more closely reflect the language of the code.

40. Section 5.7, page 31, paragraph 2:

The Work Plan indicates that "site-specific parameters" will be used wherever possible; however, no such parameters were provided or discussed, except for the PEF in Section 4.4.2.

Sierrita Response: In the event that site-specific values are available and incorporated into the BHHRA, values and inputs will be detailed in the report.

Sincerely,

Diana Kelts
Chief Environmental Engineer

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