



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

## *Via U.S. Mail and E-Mail*

November 18, 2014  
VRP 15-129

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

**RE: Review of draft Baseline Human Health Risk Assessment Work Plan**  
Freeport-McMoRan Inc. Sierrita Operations  
Green Valley, Arizona  
VRP Site Code: 100073-03

Dear Mr. Broderick:

The Arizona Department of Environmental Quality (ADEQ) Waste Program's Division Voluntary Remediation Program Unit (VRP) in conjunction with Kleinfelder Inc., the third party risk assessor, has completed review of the draft document titled *Baseline Human Health Risk Assessment Work Plan* (Work Plan) dated February 1, 2013 and received by ADEQ on February 28, 2013. The Work Plan was submitted by ARCADIS on behalf of Freeport McMoRan Copper & Gold (now Freeport-McMoRan Inc.) Sierrita Operations (Sierrita) for approval by VRP pursuant to Arizona Revised Statutes (A.R.S.) § 49-177.

### **Required Information:**

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).

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

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### **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.

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.

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.

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.gov/raf/prawhitepaper/pdf/raf-pra-white-paper-final.pdf>

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>

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?

7. Section 2.3.3, page 8:

What is the current state of the re-vegetated 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?

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?

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.

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.

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.

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.

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?

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.

16. Section 4.2.1, page 13:

The term constituent of interest (COI) is introduced here. How are COIs related to COPCs?

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.”

18. Section 4.2.2, page 14:

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

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.

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.

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.

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.

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)."

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.

25. Section 5.1:

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

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.

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.).

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.

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.

30. Section 5.1.1.4, page 21:

Refer 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?

32. Section 5.1.2:

Please provide a definition of the reasonable maximum exposure (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.

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.

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

36. Section 5.2, page 27:

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

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.

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.

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  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$  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.

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.

**Recommendations**

VRP recommends that Sierrita submit a revised Work Plan along with a response to this letter within 45 calendar days from the date of this letter. VRP would like to share that ADEQ recently developed a Site Investigation Guidance Manual that Sierrita may want to refer to in finalizing the Work Plan. The manual is available on-line at: <http://www.azdeq.gov/environ/waste/index.html>.

Attached to this letter is a VRP Work Plan Checklist that has been provided for Sierrita’s use to assist in complying with A.R.S. § 49-175(B). Please note that the use of the check list is optional.

**How to Submit**

Please submit documents sent in response to this letter using one of the following methods:

1. Hard copy to:

ADEQ  
Attention: Danielle Taber, Voluntary Remediation Program  
1110 W. Washington Street  
Phoenix, AZ 85007

2. E-mail to [dt3@azdeq.gov](mailto:dt3@azdeq.gov)

In general, VRP requests two hard copies and one electronic copy (.pdf) of submitted documents.

**Additional Information**

The VRP site name and site code should be consistently used on all correspondence and reports relating to this site to ensure accuracy of file identification.

Information pertaining to the Voluntary Remediation Program can be obtained by accessing ADEQ’s web page at [www.azdeq.gov](http://www.azdeq.gov), or by visiting ADEQ’s office at 1110 W. Washington Street, Phoenix, Arizona. Information pertaining to A.R.S. Title 49 can be obtained by accessing the Arizona State Legislature web page at [www.azleg.gov](http://www.azleg.gov). Information pertaining to Arizona Administrative Code rule citations may be found at [www.azsos.gov](http://www.azsos.gov).

You may contact the ADEQ Records Management Center staff about reviewing or copying file information at 602-771-4380.



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, Waste Programs Division

enc: Voluntary Remediation Program Work Plan Checklist

cc: Stuart Brown, FMI, Senior Director – Remediation Projects (w/o enc)  
Deborah Chismar, FMI – Sierrita Operations, Senior Environmental Specialist  
Diana Kelts, FMI – Sierrita Operations, Chief Environmental Engineer  
Katy Brantingham, ARCADIS, Project Manager (w/o enc)  
Scott Dwyer, PhD, DABT, Kleinfelder, Practice Leader, Risk Analysis & Toxicology (w/o enc)

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20141118-001

## Voluntary Remediation Program Work Plan Checklist

Complete Shaded Areas and Submit with Work Plan

Site Name: \_\_\_\_\_ VRP Site Code: \_\_\_\_\_

Volunteer/Applicant Name: \_\_\_\_\_

Volunteer/Applicant Email Address and Phone: \_\_\_\_\_

Authorized Agent (AA)/Consulting Company: \_\_\_\_\_

AA/Consultant Email Address and Phone: \_\_\_\_\_

Reference	Summary of Statutory Requirement	Page(s) Where Addressed in Work Plan	VRP Use Only
	<small>(please review all statutes in their entirety to ensure compliance)</small>	<small>(write N/A if not applicable)</small>	
<a href="#">§49-175A.1</a>	Summary of existing site characterization and assessment information; information regarding any remediation previously conducted; copies of referenced reports not previously submitted;	_____	<input type="checkbox"/>
<a href="#">§49-175A.2</a>	If the site has not been characterized, a plan to conduct site characterization and a schedule for completion.	_____	<input type="checkbox"/>
<a href="#">§49-175A.3.a</a>	If site characterization is completed, a description of how the remediation will comply with <a href="#">§49-175B</a> ("Work Plans") and how the completion of remediation will be verified. A schedule for completion must be included.	_____	<input type="checkbox"/>
<a href="#">§49-175A.3.b</a>	If site characterization is completed, the work plan may provide for the remediation to be conducted in phases or tasks. A schedule for completion must be included.	_____	<input type="checkbox"/>
<a href="#">§49-175A.4</a>	Schedule for submission of progress reports.	_____	<input type="checkbox"/>
<a href="#">§49-175A.5</a>	A proposal for community involvement as prescribed by <a href="#">§49-176</a> ("Community Involvement Requirements")	_____	<input type="checkbox"/>
<a href="#">§49-175A.6</a>	If known, a list of institutional or engineering controls necessary during remediation and after completion of the proposed remediation to control exposure to contaminants.	_____	<input type="checkbox"/>
<a href="#">§49-175A.7</a>	A proposal for monitoring during remediation and after the remediation if necessary to verify whether the approved remediation levels or controls have been attained and will be maintained.	_____	<input type="checkbox"/>
<a href="#">§49-175A.8</a>	A list of any permits or legal requirements known to apply to the work or already performed by the applicant.	_____	<input type="checkbox"/>
<a href="#">§49-175A.9</a>	If requested by the department, information regarding the financial capability of the applicant to conduct the work identified in the application. <i>(IF APPLICABLE)</i>	_____	<input type="checkbox"/>

**Voluntary Remediation Program Work Plan Checklist**  
 Complete Shaded Areas and Submit with Work Plan

Site Name: \_\_\_\_\_ VRP Site Code: \_\_\_\_\_

Reference	Summary of Statutory Requirement	Page(s) Where Addressed in Work Plan	VRP Use Only
	(please review all statutes in their entirety to ensure compliance)	(write N/A if not applicable)	
<a href="#">§49-175B</a>	Remediation levels or controls for remediation conducted pursuant to this article shall be established in accordance with rules adopted pursuant to <a href="#">§49-282.06</a> unless one or more of the following applies: see §49-175B.1 through §49-175B.4, below.		<input type="checkbox"/>
<a href="#">§49-175B.1</a>	The applicant demonstrates that remediation levels, institutional controls, or engineering controls for remediation of contaminated soil comply with <a href="#">§49-152</a> and the rules adopted.		<input type="checkbox"/>
<a href="#">§49-175B.2</a>	The applicant demonstrates that remediation levels, institutional controls, or engineering controls for remediation of landfills or other facilities that contain materials that are not subject to <a href="#">§49-152</a> (i.e.: asbestos) do not exceed a cumulative excess lifetime cancer risk between $1 \times 10^{-4}$ to $1 \times 10^{-6}$ , and a hazard index of no greater than 1.		<input type="checkbox"/>
<a href="#">§49-175B.3</a>	The applicant demonstrates that on achieving remediation levels or controls for a source or potential source of contamination to a navigable water, the source of contamination will not cause or contribute to an exceedance of surface water quality standards, or if a permit is required pursuant to <a href="#">33 United States Code §1342</a> for any discharge from the source, that any discharges from the source will comply with the permit.		<input type="checkbox"/>
<a href="#">§49-175B.4</a>	The applicant demonstrates that, on achieving remediation levels or controls for a source of contamination to an aquifer, the source will not cause or contribute to an exceedance of aquifer water quality standards (AWQS) beyond the boundary of the facility where the source is located.		<input type="checkbox"/>
<a href="#">§49-175C</a>	The VRP may waive any work plan requirement under this section that it determines to be unnecessary to make any of the determinations required under <a href="#">§49-177</a> . <i>If any waivers are requested in the Work Plan or have been previously requested and approved by the VRP, cite them in the Work Plan, including a citation of the statute for which the waiver applies.</i>		<input type="checkbox"/>

## Voluntary Remediation Program Work Plan Checklist

Complete Shaded Areas and Submit with Work Plan

Site Name: \_\_\_\_\_ VRP Site Code: \_\_\_\_\_

*To support the prerequisites established by A.R.S. §49-177 and §49-180, the VRP expects certain documentation to accompany a Work Plan. The following provides a list of attachments/exhibits which are recommended for submittal with a Work Plan to provide the information required by the statutes.*

Work Plan Information	Title of Figure/Table/Attachment/Exhibit Where Requested Information is Cited <small>(write N/A if not applicable)</small>	Figure/Table/ Attachment or Report Page Number <small>(write N/A if not applicable)</small>	VRP Use Only
Site Location Map <i>(topographic or aerial)</i>	_____	_____	<input type="checkbox"/>
Site Map <i>(to scale)</i>	_____	_____	<input type="checkbox"/>
Historical Sampling Data Table	_____	_____	<input type="checkbox"/>
Historical Sample Location Map <i>(to scale)</i>	_____	_____	<input type="checkbox"/>
Proposed Sample Location Map <i>(to scale)</i>	_____	_____	<input type="checkbox"/>
Sampling and Analysis Plan <i>(includes Field Sampling Plan &amp; Quality Assurance Plan)</i>	_____	_____	<input type="checkbox"/>
Proposed Remediation System Location Map	_____	_____	<input type="checkbox"/>
Proposed Remediation System Layout <i>(Design Drawings)</i>	_____	_____	<input type="checkbox"/>
Schedule for Implementation of Project Activities* <i>(Gantt Style Chart)</i>	_____	_____	<input type="checkbox"/>
<small>*Project Activities are defined in A.R.S. §§49-175A.2 through 49-175A.4, and 49-176A.2 (Community Involvement).</small>			
Proposed Language for Public Notification of Remediation <i>(i.e.: example signage)</i>	_____	_____	<input type="checkbox"/>
Plan for Investigative Derived Waste (IDW)	_____	_____	<input type="checkbox"/>
Evaluation of Remedial Alternatives <i>(i.e.: for Feasibility Study Work Plan)</i>	_____	_____	<input type="checkbox"/>
<b>DOES THE WORK PLAN PROPOSE IMPLEMENTING SITE-SPECIFIC REMEDIATION LEVELS?</b>			
Yes		No	
<input type="checkbox"/>		<input type="checkbox"/>	
<b>DOES THE WORK PLAN PROPOSE EVALUATION OF BACKGROUND LEVELS?</b>			
Yes		No	
<input type="checkbox"/>		<input type="checkbox"/>	

NOTE: When reports are submitted which document any type of sampling activity, the submittal of Electronic Data per ADEQ's [Groundwater Data Submittal Guidance \(V3.4\)](#) is strongly recommended.

