



Copper Queen Branch/Freeport-McMoRan Corporation  
36 West Highway 92  
Bisbee, Arizona 85603

February 27, 2014

Ms. Mindi Cross  
Water Quality Compliance Section  
Arizona Department of Environmental Quality  
1110 West Washington Street  
Phoenix, Arizona 85007

**Re: Response to ADEQ Comments on the Draft Feasibility Study for Drinking Water Supplies that May be Affected by Sulfate In the Future Mitigation Order on Consent No. P-121-07**

Dear Ms. Cross:

Freeport-McMoRan Corporation, Copper Queen Branch (CQB) has reviewed the Arizona Department of Environmental Quality (ADEQ) letter of January 24, 2014 providing comments on the Draft Feasibility Study for Drinking Water Supplies that May be Affected in the Future (FS) dated July 30, 2013. The draft FS was submitted to ADEQ pursuant to Mitigation Order on Consent No. P-121-07 between ADEQ and CQB. This letter provides CQB's responses to ADEQ's comments.

This response uses the same headings and numbering of comments as in ADEQ's comment letter. Each of ADEQ's comments is provided in its entirety in normal font followed by CQB's response in bold italics.

## **GENERAL COMMENTS**

### ADEQ Comment:

1. The FS shall be revised to state for all alternatives that Freeport-McMoRan Copper & Gold, Inc. (FMC) would review, at least once a year, Arizona Department of Water Resources (ADWR) records for domestic wells that may be drilled. If new wells are discovered, FMC would offer to sample the wells for sulfate and if impacted by sulfate over 250 mg/l offer them one of the domestic well mitigation options. This is especially important for areas east of the Black Gap Fault in the Undifferentiated Bisbee Group bedrock aquifer as the FS only focuses on the alluvial aquifer.

***CQB Response: Please note that the party to the Mitigation Order is CQB, not its parent company, Freeport-McMoRan Copper & Gold Inc. Further, the FS addresses both existing private and public drinking water supplies that may be affected in the future, regardless of***

*whether they are located in the alluvial aquifer or bedrock. The FS does place emphasis on wells in the alluvial aquifer because this is where future plume migration has the potential to affect existing drinking water supply wells. As is stated below in response to Comment 6, the sulfate plume within the bedrock east of the Black Gap fault is stable or decreasing in extent.*

*Section III.E of the Mitigation Order on Consent applies to existing drinking water supplies that are determined to be affected based on water sampling and analysis, not to supplies that may be proposed in the future, such as proposed new wells that have not been installed or sampled. Regardless, the FS will be revised to include an annual review of ADWR records to identify new drinking water supply wells within a mile of the sulfate plume. CQB will offer water quality sampling to any new drinking water supply wells identified and will report to ADEQ any new drinking water supply wells found to have sulfate concentrations exceeding 250 milligrams per liter (mg/L). The details of the annual review and reporting will be addressed in the Mitigation Plan.*

ADEQ Comment:

2. The FS states that MNA is the proposed option for all three sub-options for Alternative 1. However, what is proposed does not meet the usual definition of MNA. The FS states based upon contaminant transport modeling, that the sulfate plume will migrate approximately 6,500 feet down-gradient over the next 100 years. In EPA Guidance "Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites" Directive Number 9200.4-17P, dated April 21, 1999, MNA may be selected if the following four issues are shown:

- "Demonstration of active contaminant removal from ground water & dissolved plume stability;
- Determination of the mechanism and rate of attenuation;
- Determination of the long-term capacity for attenuation and stability of immobilized contaminants; and
- Design of performance monitoring program, including defining triggers for assessing MNA failure, and establishing a contingency plan."

The proposed alternative does not meet any of the above mentioned criteria and definition of MNA. Therefore, the FS shall be revised and use alternative language to describe Alternative 1, such as long term migration and plume tracking or another similar term.

***CQB Response: The FS will be revised to replace the term Monitored Natural Attenuation (MNA) with "long-term plume monitoring" or a similar term in the discussion of Mitigation Alternatives 1A, 1B, and 1C.***

ADEQ Comment:

3. In evaluating potential options for Alternatives 2 through 4, injection of treated water into the aquifer was rejected as a potential option for these alternatives because "hydraulic barrier using injection wells has uncertain long-term effectiveness and no currently identified need". This is based on the evaluation rationale presented on the third page of Table 1 Mitigation Actions, Control Technologies, and Process Options Evaluated for Development of Mitigation Alternatives. The Groundwater Section has concerns that the FS stated that injection of water into the aquifer was presented as being not a long-term effective way to dispose of treated water. There are numerous examples of injection of water into the aquifer as being highly effective over the long term. However, it is not necessary to revise the FS to include an analysis of groundwater injection.

**COB Response: Comment noted. No action needed.**

## SPECIFIC COMMENTS

ADEQ Comment:

4. Page 2 - Section 1.2 - Previous Mitigation Order Work - The last sentence on this page states that the Aquifer Characterization Report (ACR) was approved in October 2011. The paragraph shall include the statement the ACR was approved with the condition that the reclamation of the North and South Tailings Impoundment would be discussed in the FS.

***COB Response: The North and South Tailing Impoundments are inactive facilities that last received tailing in 1974. The North and South Tailing Impoundments were not reclaimed as a requirement of the Mitigation Order, but were voluntarily reclaimed by CQB between 2011 and 2013. ADEQ's October 4, 2011 letter<sup>1</sup> approving the ACR<sup>2</sup> did request that the FS include a discussion of reclamation activities for the tailing impoundment. Section 2.1 of the FS provides a general discussion of the reclamation activities. To accommodate ADEQ's request, Section 1.2 of the FS will be revised as follows "The 2010 ACR was approved by ADEQ in October 2011 under the condition that the FS include a discussion of the tailing impoundment reclamation voluntarily undertaken by CQB (ADEQ, 2011). This discussion is presented in Section 2.1." In addition, the discussion will be updated to provide a more detailed discussion of these voluntary reclamation activities.***

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<sup>1</sup> ADEQ, 2011. Correspondence from Mindi Cross, ADEQ, to Rebecca Sawyer, CQB, Re: Review of Revision 1 – Aquifer Characterization Report, Task 4 of Aquifer Characterization Plan for Mitigation Order on Consent No. P-121-07, Cochise County, Arizona, prepared by Clear Creek Associates, P.L.C., dated December 15, 2010. October 4, 2011.

<sup>2</sup> Clear Creek Associates, 2010. Revision 1 Aquifer Characterization Report, Task 4 of the Aquifer Characterization Plan, Mitigation Order on Consent Docket No. P-121-07, Cochise County, Arizona. December 15, 2010.

ADEQ Comment:

5. Page 10 - Section 2.1 - Site History - The second paragraph of this section describes the reclamation that took place at the North and South Tailings Impoundment. The FS shall provide a figure or figures that document the reclamation.

***COB Response: The FS will be revised to include a figure showing the major features of the tailing reclamation project.***

ADEQ Comment:

6. Page 16 - Section 2.3 - Distribution of Sulfate in Groundwater - The first sentence on this page states:

*"Water quality monitoring data support the interpretation that expansion of the plume is halted in the upgradient eastern portion of the plume near the Bisbee Junction/Airport area and in the northern and southern margins of the plume."*

ADEQ does not agree with this assessment. As was stated in the ACR and discussed by ADEQ and FMC, due to the extreme heterogeneity of the Undifferentiated Bisbee Group bedrock aquifer, the sulfate plume has not and will not be defined in the bedrock aquifer.

The FS shall be modified to reflect that due to the complex heterogeneity and fracture system in the Undifferentiated Bisbee Group bedrock aquifer, additional characterization did not take place.

As stated in General Comment #1, ADWR records shall be reviewed at least once a year and if a new domestic well has been drilled FMC should offer to sample the new well. If impacted by sulfate greater than 250 mg/l FMC would offer one of the mitigation options for domestic wells.

***COB Response: The bedrock aquifer is heterogeneous. This is particularly evident east of the Black Gap Fault, as discussed in the ACR. Nonetheless, the lateral extent of sulfate-affected groundwater is adequately defined by sulfate measurements from monitoring and private wells. COB fully agrees with ADEQ that further characterization work to better define the extent of the plume would not improve the conceptual model described in the ACR or change the results of the FS. However, groundwater monitoring in the bedrock since 2007 in the vicinity of the plume does demonstrate that wells outside and proximal to the north, east and south sides of the plume have not shown evidence of increasing concentrations over time. These data give confidence that the lateral extent of the plume is adequately defined and is not expanding on the east, north, and south. Additional text will be added to the FS to discuss the heterogeneity displayed by bedrock material properties and the ability to discern the plume boundary. Please refer to the response to Comment 1 concerning review of ADWR records.***

ADEQ Comment:

7. Page 19 - Section 3 - Identification and screening of Potentially Applicable Mitigation Actions, Control Technologies, and Process Options - The second, third and fourth sentences of the third paragraph state:

*"Plume management actions could include groundwater monitoring to track the migration of the plume quality of drinking water supplies so that mitigation actions can be taken if needed, or the operation of an engineered wellfield to control the plume and reduce its extent by extracting groundwater. Pumping groundwater to control or reduce the extent of the plume is not one of the specific mitigation measures that ADEQ can impose under ARS § 49-286.A.1 to 3, but would fall under the type of mitigation measure that could be imposed by "mutual agreement" of ADEQ and CQB under ARS § 49-286.A.4. The inclusion of these measures in the FS for evaluation and comparison with other options is not intended to indicate that CQB would agree that they should be part of a Mitigation Plan for purposes of ARS § 49-286.A.4."*

ADEQ does not agree with the statement that a mitigation option would only be imposed by "mutual agreement" based upon Arizona Revised Statute (A.R.S.) § 49-286(B). The fourth sentence of the third paragraph should be removed.

***COB Response: CQB believes that the language of ARS § 49-286.A is clear on this point. ARS § 49-286.A.1 to 3 lists specific potential mitigation measures that ADEQ may unilaterally impose by order, none of which involve groundwater pumping to control or reduce plume extent. ARS § 49-286.A.4 distinguishes other mitigation measures as "such other mutually agreeable mitigation measures as are needed to achieve the purpose of this section." That said, because ADEQ is approving the mitigation alternative proposed by CQB in the FS and the mitigation alternative does not include a groundwater pumping option, CQB will remove the language to which ADEQ has objected.***

ADEQ Comment:

8. Page 22 - Section 3.2 - Mitigation Actions - See Comment #2 above.

***COB Response: The FS will be revised to replace the MNA terminology as noted in the response to Comment 2.***

ADEQ Comment:

9. Page 28 - Section 3.3.1.2 Well Replacement - Public Drinking Water Supply - The FS shall state in the first paragraph on this page that Naco Water Company (NWC) implemented a well replacement approach by drilling a deeper replacement well for production well NWC-4 after NWC-4 was impacted by sulfate above 250 mg/l.

***COB Response:*** *The current supply well NWC-04 (55-551849) was installed to a depth of 462 feet in 1995 and deepened to a depth of 795 feet by NWC in 2008. Based on water quality sampling conducted for the Mitigation Order<sup>3</sup> and historical sampling results<sup>4</sup>, groundwater monitoring at NWC-04 has not detected sulfate in excess of 250 mg/L, although concentrations in 2013 were between 200 and 230 mg/L. There is a capped well within 100 feet of NWC-04, NWC-04 CAP (55-627685), that is not currently used for water supply. NWC-04 CAP was installed in 1925 to a depth of 379 feet. Historical water quality data for samples collected from 1996 through 2002 indicate that the sulfate concentration at NWC-04 CAP ranged from 248 to 314 mg/L. Although NWC-04 CAP was affected by sulfate, CQB has no information documenting the reason that NWC-04 was drilled. The FS will be modified to discuss the chronology of well installation and deepening at NWC-04 CAP and of NWC-04, and the effect the deepening had on sulfate concentrations. Information on the wells is limited to what is available in the Arizona Department of Water Resources imaged records.*

ADEQ Comment:

10. Page 41 - Section 3.4.2 Monitored Natural Attenuation - See Comment #2.

***COB Response:*** *The FS will be revised to replace the MNA terminology as noted in the response to Comment 2.*

ADEQ Comment:

11. Page 53 - Section 3.4.4.2 Groundwater Barriers - Hydraulic Barrier Using Injection Wells - See Comment #3

***COB Response:*** *Comment noted. No action needed.*

ADEQ Comment:

12. Page 66 - Section 4.1.1 Alternative 1 - Monitored Natural Attenuation and Enhanced Groundwater Monitoring with Contingent Drinking Water Supply Mitigation – See Comment #1.

***COB Response:*** *As noted in the Response to Comment 1, the FS will be revised to include an annual review of ADWR records to identify new drinking water supply wells within a mile of the sulfate plume.*

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<sup>3</sup> Clear Creek Associates, 2014. Fourth Quarter 2013 Groundwater Monitoring Report, Tasks 1.0 and 2.2 of Aquifer Characterization Plan, Mitigation Order on Consent Docket No. P-121-07, Cochise County, Arizona. January 14, 2014.

<sup>4</sup> Clear Creek Associates, 2010. Revision 1 Aquifer Characterization Report, Task 4 of the Aquifer Characterization Plan, Mitigation Order on Consent Docket No. P-121-07, Cochise County, Arizona. December 15, 2010.

ADEQ Comment:

13. Page 68 - Section 4.1.1 Alternative 1 - Monitored Natural Attenuation and Enhanced Groundwater Monitoring with Contingent Drinking Water Supply Mitigation - The last sentence of this section states:

*"For example, while not specifically called out as one of the alternatives, CQB could decide that, based on monitoring results or other changes in circumstance, CQB might wish to implement Alternative 3 as a contingent action rather than RO treatment or providing a replacement water supply as a contingent action."*

This is not acceptable and this language shall be revised to state if the AWC or NWC well fields are impacted or about to be impacted by sulfate, FMC would implement the agreed upon mitigation action of providing an alternative water supply or wellhead treatment using RO.

***COB Response: Alternative 1 includes expanded groundwater monitoring to determine whether there is a potential for the AWC or NWC wellfields to become affected in time to implement a contingent action. Contingent actions could include an alternative water supply that could be used to replace or supplement an affected public supply or water treatment.***

***The purpose of the sentence that ADEQ refers to in its comment is to illustrate the potential role of adaptive management included in the Mitigation Order. As explained in the FS, mitigation of the AWC and NWC drinking water supplies is not expected to be required under Alternatives 1B and 1C. For that reason, the mitigation actions are called contingent and the costs of the hypothetical water treatment and alternate water supply development are not estimated. If development of an alternate water supply is determined to be infeasible and the future cost of implementing wellhead RO treatment at a public supply is determined to be greater than the cost of Alternative 3, the new information would indicate that Alternative 3 is the most cost effective action. In this hypothetical case, it may be reasonable to use the adaptive management provision of the Mitigation Order to modify the mitigation action if Alternative 3 is still a viable alternative at the time new information is developed.***

ADEQ Comment:

14. Page 85 - Section 5.1.4 Groundwater Flow and Transport Model Predictive Simulations - The first paragraph in this section states that pumping stresses were assumed to remain constant for the next 100 years because of no significant growth in the residential, industrial or agricultural water demand in the Bisbee-Naco area. The FS shall provide a discussion of the documentation of this assumption. For example, the FS may include details of discussions that FMC had with the Town of Bisbee, Town of Naco, AWC and NWC on projected growth in the Bisbee-Naco area.

***COB Response: The assumption that groundwater pumping would be static for the next 100 years is based on the general decline over time in area population and industrial activity. Between 1980 and 2012, the population of Bisbee steadily declined from 7,154 to 5,498, a 24***

***percent decline in 43 years. The decline in population likely reflects the reduction and elimination of mining operations in the 1980s. Inasmuch as mining is not expected to resume, domestic and commercial water use is expected to remain steady into the future. Agricultural water use is also not expected to expand greatly. Aerial photographs discussed in the FS indicate that amount of land used for agricultural irrigation in Naco, Sonora did not change significantly between 1992 and 2011, suggesting that agricultural water use is not growing. A discussion of these and other factors supporting the assumed future pumping rates will be added to the FS to address this comment.***

ADEQ Comment:

15. Page 86 - Section 5.2 Cost Analysis Methodology - The second paragraph in this section describes a discount rate of 7.8 percent and an escalation rate of 2.4 percent to calculate the present value estimates. The FS should documentation [sic] to support these rates.

***COB Response: The FS used discount and escalation rates of 7.8 and 2.4 percent, respectively. These rates are economic metrics used by Freeport-McMoRan Corporation. The rates used in the FS are the same as the discount and escalation rates used to evaluate sulfate mitigation actions near Green Valley under Mitigation Order on Consent No. P-50-06<sup>5</sup>.***

ADEQ Comment:

16. Page 89 - Section 5.3.1 Alternative 1 - Monitored Natural Attenuation and Expanded Groundwater Monitoring with Contingent Drinking Water Supply Mitigation – See Comments #1 and #2.

***COB Response: The FS will be revised to include an annual review of ADWR records to identify new drinking water supply wells within a mile of the sulfate plume. The FS will be revised to replace the MNA terminology.***

ADEQ Comment:

17. Page 122 Section 5.4.2.2 Conservation of Groundwater Resources - Potential Water Level Declines Due to the Mitigation Alternatives - The FS discusses the potential water level declines that could happen if Alternatives 2 through 4 are implemented. Depending upon the alternatives with a potential maximum water level decline of 22 feet, the water level declines could be mitigated by injecting treated water back into the aquifer at the periphery of the sulfate plume. That would mitigate the water level decline that would be observed at the AWC, NWC and in the Mexico well fields. While the ADEQ disagrees with the FS, the FS does not need to be revised to evaluate groundwater injection.

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<sup>5</sup> Hydro Geo Chem, Inc., 2008. Feasibility Study for Sulfate with Respect to Drinking Water Supplies in the Vicinity of the Freeport-McMoRan Sierrita Inc. Tailing Impoundment, Mitigation Order on Consent Docket No. P-50-06. October 22, 2008.



**COB Response: Comment noted. No action needed.**

**ADEQ Comment:**

18. Page 129 Recommended Mitigation Alternative - Recommended Alternative - The FS proposes Alternative 1 with the third sub-option which is to find an alternative water supply for any AWC and/or NWC production wells that are impacted by sulfate above 250 mg/l. If an alternate water supply is infeasible, the second sub-option would be employed, adding RO treatment to the impacted public supply wells. FMC shall include language and timeframes in the FS indicating the alternate water supply will be further investigated under the Mitigation Plan.

**COB Response: The description of FS Alternative 1C will be revised to indicate that the alternate water supply study will be conducted as described in the Mitigation Plan.**

If you have any questions regarding our comment responses, please contact me at (602) 366-8303.

Sincerely,



Stuart Brown  
Sr. Director, Remediation Projects  
Freeport-McMoRan Corporation

cc: Robert Quintanar/Freeport-McMoRan Corporation, Copper Queen Branch  
Jim Norris/Clear Creek Associates  
Sheila Deely/Freeport-McMoRan Copper and Gold