UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

May 10, 2017

Stephen Twyerould
Excelsior President and CEO
Excelsior Mining Arizona, Inc.
2999 North 44th Street, Suite 300
Phoenix, AZ 85018

RE: Technical Review Comments
Class III Underground Injection Control Well Permit Application
Excelsior Mining Arizona, Inc.

Dear Mr. Twyerould:

The US Environmental Protection Agency, Region IX (EPA) is conducting technical review of Excelsior Mining Arizona, Inc.'s Underground Injection Control (UIC) Permit application for the proposed Gunnison Copper Project, Cochise County, Arizona. We have reviewed the information submitted by Excelsior on March 29, 2017. In addition, we participated in the conference call on April 27, 2017 with Excelsior and Arizona DEQ staff to discuss Excelsior's proposal. Based on the materials submitted and our technical discussions, we are providing technical review comments and requesting additional information/clarifications as detailed in the enclosure. Accepted responses should be incorporated into the revised application. Please provide a response to all items noted in the enclosure and submit two copies of a complete revised application in hard copy and in electronic format to:

Attn: Nancy Rumrill
U.S. EPA Region IX, WTR-3-2
75 Hawthorne Street
San Francisco, CA 94105

In addition, as we noted in our recent communications, EPA received a response from the Arizona State Historic Preservation Office regarding compliance with the National Historic Preservation Act. We are also awaiting a response to our April 14, 2017 letter requesting concurrence or comment from the U. S. Fish & Wildlife to ensure compliance with the Endangered Species Act.

If you have any questions regarding this letter, please contact me at 415-972-3971 or call Nancy Rumrill at 415-972-3293.

Sincerely,

for David Albright
Manager, Drinking Water Protection Section

Enclosure

cc w/enc.: Dave Dunaway, ADEQ (via e-mail)
Rebecca Sawyer, Excelsior Mining Arizona, Inc. (via e-mail)

ENCLOSURE
EPA Comments on Excelsior's March 2017 Responses to Prior Comments
Excelsior Mining Arizona Gunnison Copper Project
Class III UIC Permit Application

Note: For reference, the document presents the text of EPA's February 27, 2017 requested information to Excelsior and EPA Comments on Excelsior's March 29, 2017 response, with additional requests for information or clarification.

Attachment A[1]

1. Provide a proposal to demonstrate the effectiveness of wellfield operations and conduct model validation and, if necessary, recalibration based on early Stage 1 operations performance, prior to full implementation of commercial-scale ISR operations in Stage 1 and later stages. An EPA review of this early performance and demonstration of effectiveness will be required prior to EPA approval and initiation of full-scale commercial operations. The timeline for this initial demonstration phase should be one to two years. The proposed intermediate monitoring wells and other well locations for this initial phase should be specified and shown on a map in the updated application. Subsequent monitoring well locations, proposed as ISR operations expand, will be subject to prior EPA approval.

   EPA Comment: Excelsior responded that operations will continue during the EPA review and comment period for the first-year report of operations. EPA understands that operations are expected to continue during the review period and that suspension of operations would not be necessary if Excelsior is in compliance with all permit terms and conditions.

   Excelsior stated that all wells designated as intermediate monitoring wells (IMWs) will be fitted with a transducer that will measure both water levels and specific conductivity at least once daily. A single measurement of conductivity in a well does not typically represent the conductivity profile over the full extent of the lengthy injection intervals.

   During the conference call with Excelsior on April 27, 2017, Excelsior explained that specific conductivity will be monitored in intermediate monitoring wells with one sensor and it is expected to be representative of the lengthy injection interval in the oxide zone. Please provide justification of why the proposed sampling is representative and preferential flow paths are not considered.

   Amend and update the application accordingly.

Attachment A-1, Area of Review Method, Groundwater Modeling Report, Aquifer Testing Report

[1] References made to specific figures or attachments in these Comments refer to materials contained in the original permit application. Reference to a prior response is from Excelsior's response in December 2016.

Section 3. Hydrogeologic and Operational Considerations

3.1.1 Site Specific Characteristics, Unsaturated Basin Fill.

2. The Underground Source of Drinking Water (USDW) definition at 40 CFR § 144.3 includes "*or (B) Contains fewer than 10,000 mg/l total dissolved solids; and (2) Which is not an exempted aquifer.*" The basin fill saturation qualifies for that part of the definition, but may not qualify on the basis of "*sufficient quantity to supply a public water system*" if not considered part of the underlying bedrock aquifer. EPA believes there is sufficient evidence to include the basin fill saturated zones as hydraulically connected and part of the bedrock aquifer, and that it should be included within the aquifer exemption as presented in the Excelsior response.

   EPA Comment: Response is acceptable. Amend and update the application accordingly.

3.1.2 Low Conductivity Sulfide Zone.

3. EPA agrees that the pump testing data for the sulfide zone indicate a lack of sufficient capacity or quantity of groundwater to supply a public water system well. However, the proximity of the two wells tested to known faults and fractures in the sulfide zone is not known. Hydraulic conductivity (HC) could be much higher in the fault zones, as it is in the oxide zone, and some of the faults are known to transect the oxide-sulfide boundary. One option is that monitoring wells (MWs) could be installed and screened in the sulfide zone in close proximity to the fault zones to better assess the hydraulic connection between the oxide and sulfide zones and to monitor for vertical excursions into the sulfide zone. *Applicant should propose MW locations, subject to EPA approval.*

   Portions of the sulfide zone may qualify as a USDW and require protection from contamination or should be included in the exempted zone. Injection well depths should not penetrate within 40 feet of the sulfide zone as a precaution unless the upper sulfide zone is included in the exemption zone. Excelsior suggested that the upper 200 feet of the sulfide zone could be included in the exempted zones to address this concern and presented more information regarding the close proximity of the two sulfide test wells to faults that transect the oxide-sulfide interface. The absence of a confining layer between the oxide and sulfide zones means that an exchange or mixing of aquifer fluids between the oxide and sulfide zones during ISR operations is likely to occur where injection and recovery wells are situated near a fault zone and the oxide-sulfide interface. The possible exchange or mixing of fluids between the oxide and sulfide zones will be enhanced due to the drawdown of the hydraulic control and recovery wells in the oxide zone and pressure increases with outward flow at the injection wells.

   EPA Comment: Excelsior's response is acceptable. Amend and update the application with the additional information for the aquifer exemption of the sulfide zone and the basis for the exemption.

3.2.1 Hydraulic Gradients

4. Excelsior modeled 1, 2 and 3 percent ratios of excess fluid withdrawals to injection rates and volumes within the wellfield to evaluate the feasibility of these scenarios for operation of the wellfield. However, Excelsior's prior response does not address the minimum extent of over-pumping at the hydraulic control wells necessary to maintain hydraulic control of injected fluids within the proposed wellfield operation. The proposed wellfield design and operation is acceptable with some modification and flexibility for over-pumping recovery wells and/or reducing injection rates in the event of outward movement of ISR fluids and exceedances of conductivity and water level alert levels detected at intermediate monitoring wells (IMWs). The IMWs will be located within the AOR between the downgradient hydraulic control wells and the active mine blocks and upgradient to the active mine blocks. A required minimum over-pumping rate at HC wells should be established during ISR operations which demonstrates maintenance of the minimum required drawdown gradient between observation wells and hydraulic control of ISR and rinsing fluids. The appropriate over-extraction rates will be determined and monitored on an individual HC well basis, depending on maintenance of the required minimum inward gradient at the observation well pairs.

   EPA Comment: Response is acceptable with appropriate permit conditions. *Amend and update the application accordingly.* Proposed permit conditions will require a minimum net extraction rate, based on the rate necessary to maintain an inward gradient at all observation well-pairs of at least 0.01 ft/ft. The minimum inward gradient will be subject to review and adjustment based on monitoring data at IMWs and observation wells.

5. Modeling predictions are subject to errors due to preferential flow paths coincident with the fault plane orientations and other factors that are difficult to model accurately. Injection wells that are near a fault zone oriented in a west-to-east direction could overcome the natural gradient to the east and cause flow to the west if recovery wells are not capturing the entire flow from those wells before exiting the western limits of the wellfield and area of review. We recommend placement of observation well pairs or monitoring wells on the west side of the wellfield to monitor electrical conductance and water levels as suggested by Excelsior in their response and later discussions during conference calls. If the gradient is not sufficiently inward toward the wellfield at any well pair, action would be required to reverse the gradient by means of increasing extraction or decreasing injection rates or increasing HC well pumping to increase drawdown at the wellfield.

   Excelsior should propose monitoring well locations at the western perimeter of the wellfield at a spacing consistent with the PowerPoint (PPT) presentation viewed during the meeting with Excelsior on February 9, 2017. In addition, observation wells should be placed to the south of the westernmost HC well in Figure A-7A in Attachment A-1 of the response document. Final proposed locations for HC and observation wells will be subject to EPA approval. The outer observation wells of all well pairs and intermediate monitoring wells should also be equipped with conductivity sensors to monitor for movement of ISR fluids beyond the wellfield. The PPT presentation viewed during the February 9th meeting should

be included in the updated application and the application should be updated to be consistent with that presentation, subject to final EPA approval and permit conditions.

EPA Comment: EPA may require additional HC and IMWs at specific locations not depicted by Excelsior in the Figures A-13, A-14, A-15, and A-16.

Please explain the information in Tables A-1 and A-2 more completely and describe the placement of conductivity sensors in the screened or open hole intervals.

6. The reported natural groundwater flow velocities in the model domain varies widely in the wellfield as illustrated in Figure A-4C. The specific flow velocity attributable to the wellfield area is not provided.

   Excelsior should provide an estimate of average and maximum groundwater flow velocities within the AOR beyond the wellfield perimeter and the estimated travel time from the wellfield to the point of compliance (POC) wells at the eastern AOR boundary.

   EPA Comment: The time for particles to reach the POC wells at the eastern AOR boundary is on the order of 20 years or longer, based on average particle velocities, according to the modeling results presented in Figures XI and X3. Additional monitoring wells should be placed within the AOR at a distance from the wellfield to detect any escaping contaminants within the five-year post-closure monitoring period to insure adequate protection of underground sources of drinking water, pursuant to 40 CFR §146.10(a)(4). Existing observation wells might serve that purpose if periodic groundwater sampling and analysis were included in the monitoring protocol for calibration of the specific conductivity data collected in those wells.

   Figure XI lacks the color code for time of travel of particles in the legend of that figure. Please add the color code.

3.2.2 Injection Flow.

7. The minimum net fluid withdrawal to injection volume ratios and minimum inward hydraulic gradients at all observation well pairs will be determined empirically and based on testing and observation of aquifer response during initial ISR operations and may be adjusted as the wellfield development expands over time, in accordance with permit conditions and subject to EPA review and approval. Initial minimums can be set at one (1) percent for net withdrawals in the wellfield and 0.01 ft/ft for hydraulic gradients pending the evaluation of testing and observation at each well pair in correlation with the withdrawal versus injected volume.

   EPA Comment: Response is acceptable. *Amend and update the application accordingly.*

8. The proposed 30-day rolling average basis for operation of the wellfield and maintaining the balance of fluid injection with recovery well and hydraulic control volumes is acceptable with a demonstration that it is sufficiently protective of USDWs. Initially, the permit will

require re-balancing on a 48-hour basis as discussed in greater detail in Comment 59 below until the applicant demonstrates that the 30-day rolling average re-balancing of volumes is as protective as re-balancing on a 48-hour basis during initial Stage 1 ISR operations. The intermediate monitoring and observation well data collected over a sufficient period of time may provide an adequate demonstration during start-up operations.

Excelsior should propose and submit an operational and monitoring plan for the demonstration and amend the application accordingly in this section and in Attachment H of the application.

EPA Comment: Response is conditionally acceptable. The reference to Comment 38 in the reply is correct. The last sentence in the first paragraph should be edited to add consideration of water level and specific conductivity data from observation wells. The 30-day rolling average re-balancing demonstration may result in less than 30 days and as little as 48 hours for re-balancing, depending on the results of the demonstration.

9. Excelsior believes that a minimum gradient of 0.01 feet/foot (ft/ft) should be sufficient and measurable. As proposed, Excelsior should revise Section 3.2.2 of Attachment A-1 in response to EPA's Comments 7, 8, and 9 as presented in your prior response. The 30-day rolling average basis for operation of the wellfield will have to be demonstrated, as discussed above.

   EPA Comment: Response is adequate with appropriate permit conditions. For clarification, if monitoring data indicate that a 0.01 ft/ft gradient is not sufficient to maintain hydraulic control, the minimum gradient will be increased. *How will the barometric and earth tide effects be measured and removed from the water level data?*

   The first bullet in the response should be amended to clarify that the 30-day rolling average basis for re-balancing is subject to the demonstration of protection equivalent to a 48-hour basis for re-balancing, as discussed in Comment 8 above. Clarify the bullet considering the discussion in Comment 8 and bullet 3 related to re-balancing on a 48-hour basis in this response.

   Amend and update the application accordingly.

3.2.4 Borehole Abandonment.

10. Excelsior proposes plugging and abandonment of any wells or boreholes within an active mining block that are not suitably constructed to allow for monitoring or possible migration of injected solutions outside of the injection interval. Generally, the plugging and abandonment of wells and boreholes located within active mining blocks and the use of existing wells as intermediate monitoring wells around areas of injection should be adequately protective of USDWs. However, EPA considers the saturated portion of the basin fill and the underlying bedrock aquifer to be one aquifer and a USDW where not exempted, as discussed in Comment 2 above. EPA has concerns about the protection of the substantial USDW downgradient of the project area from migration of undetected contaminants through

the basin fill or bedrock zones during ISR operations or rinsing and post-closure periods. EPA is not fully convinced that the bedrock ridge located just to the east of the wellfield would provide a permanent barrier to ISR fluids not captured by hydraulic control wells as implied in the response to this Comment. However, intermediate monitoring wells and POC wells placed downgradient at the AOR perimeter should detect contaminants migrating to the east of ISR operations and trigger corrective actions to address an exceedance of water quality standards.

EPA Comment: Response is generally acceptable. See Comment 6 regarding placement of additional monitoring wells east of the wellfield within the five-year travel time distance from the wellfield. *Amend and update the application accordingly.*

3.2.6 Mechanical Integrity Testing.

11. According to the prior response, Excelsior agreed to conduct Part 2 mechanical integrity testing and will revise the text as presented. However, the response is unclear if all wells would be tested for Part 2 mechanical integrity. If the saturated portion of the basal fill zone is included in the aquifer exemption, as discussed above, Part 1 mechanical integrity tests (MITs) in monitoring, observation, HC, and POC wells would not be required, unless converted to injection wells. All injection and recovery wells require Part 1 MITs. In addition, all other wells should be pressure tested for casing leaks during construction or conversion to assure the permittee and EPA that observation and monitoring wells will provide data representative of the injection zone. HC well casings should be pressure tested to ensure that fluids are withdrawn from only the injection zone. The results of the MITs and pressure tests should be included in a well conversion or completion report. See additional discussion and EPA Comments on MITs for Attachment P.

    Excelsior should clarify that well casings in all wells will be pressure tested for leaks and Part 2 mechanical integrity testing will be conducted in all but the intermediate monitoring wells as described in Section 3.2.6. All injection and recovery wells require Part 1 MITs. Permit conditions will require that well construction records, including casing and cementing details, be provided for the proposed intermediate monitoring wells before EPA approval for conversion to monitoring wells. The application should be amended and updated accordingly.

    EPA Comment: Excelsior's response needs clarification. A minimum test pressure should be proposed for situations when the maximum allowable injection pressure is less than the minimum test pressure (typically 300 psig). Part I MITs will be performed in Class III injection wells every five years as described in the related response under Attachment P.

    Part II MITs should be conducted in all but the converted IMWs. Clarify this section of the response. It should be clear that temperature logs will be run in all wells and cement bond logs (CBLs) will be run in all wells with steel casing, not just injection/recovery wells.

    Provide a description of the pressure test for casing leaks that will be conducted in non-injection wells and describe what would constitute a failure of the test.

The statement that existing core holes or other existing borings/wells used for IMWs will not be pressure tested is acceptable. However, an assessment of the cement seal to adequately isolate the injection zone when converted to IMWs will need to be conducted, and the construction details that supports this assessment will be reviewed.

3.2.7 Rinsing.

12. a) *Please revise the last sentence on page 8 to read: "and all regulated constituents are at or below aquifer water quality standards (AWQSs)* ***and UIC permit water quality standards.*** *"*

UIC permit water quality standards will refer to primary maximum contaminant levels (MCLs), or pre-mining background concentration levels of regulated constituents, whichever are higher.

EPA Comment: Response is acceptable. *Revise the application accordingly.*

b) The permit may require that samples be collected from all recovery wells within each mining block after the third step and before approval of closure. As an alternative, the sampling requirement after the third step may be relaxed in subsequent mine blocks if it can be demonstrated that sampling 10 percent of the wells is statistically equivalent to sampling 100 percent of the wells in the rinsing of the initial mine block.

EPA Comment: See Comments 5 and 62 on Excelsior responses as cited by Excelsior.

c) *Please revise the last sentence in paragraph 2 on page 9 to read: "Analysis will be conducted for APP* ***and UIC permit*** *regulated metals (dissolved), sulfate, TDS, pH, and specific conductivity."*

The applicable UIC permit condition will be written to be consistent with the requested revision to paragraph 2 on page 9 and applicable water quality standards as stated above.

EPA Comment: Response is acceptable. *Amend and update the application accordingly.*

Section 4. Area of Review

4.3 AOR Delineation.

13. The second paragraph states that the proposed western boundary of the AOR is coincident with the property boundary and is *only* 100 feet from the nearest injection wells. The eastward hydraulic gradient is expected to exceed the injection flows to the west, but the gradient and groundwater velocity values are not provided. Moreover, no hydraulic control or observation wells are proposed at the perimeter of the western AOR boundary and wellfield perimeter. If hydraulic containment were lost to the west, that loss would go undetected without HC and observation wells located at the western AOR boundary. The groundwater flow model results show containment at the western boundary, however, due to the

heterogeneity and highly faulted structure of the orebody, this modeled outcome cannot be assured during actual ISR operations.

The use of intermediate monitoring wells, as described in the Excelsior PPT presentation of February 9th, addresses these concerns. Refer to Comment 5. Excelsior should identify the hydraulic parameters to be measured when the HC wells are installed and tested. Observation or monitoring wells should be installed at the western perimeter of the wellfield as discussed in the prior response and Comment 5.

EPA Comment: Response is generally acceptable. In addition, water levels in the two IMWs at the western margin of the wellfield and AOR boundary should be compared to water levels in the inner IMWs to ensure that the inward gradient is maintained at 0.01 ft/ft or greater if necessary to maintain hydraulic containment of ISR fluids. *Amend and update the application accordingly.*

14. *Excelsior should clarify the hydraulic parameters noted in the prior response to Comment 16 to be measured when the HC wells are installed and tested.*

    EPA Comment: Response is acceptable. *Revise the application accordingly.*

15. POC wells are to be placed at an appropriate distance to detect movement of regulated constituents during the proposed five-year post-closure monitoring period. Permit conditions may require additional POC wells to be placed at the AOR boundary or closer to the wellfield perimeter if recalibration of the groundwater flow model during ISR operations indicates a need for closer spacing of POC wells. Excelsior proposed the retention of 10 percent of the injection and recovery wells for post-rinse monitoring through the life of the mine, as presented in the February 9th PPT presentation. This would include monitoring a subset of retained wells annually for five years to verify no rebound has occurred.

    Excelsior should clarify the rationale for the proposed POC well spacing at the eastern AOR boundary in response to our concerns about distance of the POC wells from the wellfield. The closure/post-closure strategy described in the February 9 PPT presentation should be added to the updated permit application. Monitoring frequency will be subject to EPA permit conditions and adjustment for monitoring results during rinsing and post-closure monitoring.

    EPA Comment: Response is incomplete. The proposed downgradient POC wells are located at approximately 1,300 feet to the east of the wellfield. Based on the modeling presented in response to Comment 6 above, the average particle travel time to the easternmost POC wells exceeds 20 years. Consequently, these wells are too distant to serve as confirmation of the modeling prediction in the five-year post-closure period to insure protection of downgradient underground sources of drinking water. If HC and/or observation wells serve as water quality monitoring wells during the post-closure monitoring period, additional downgradient monitoring wells may not be needed, as discussed in Comment 6. These wells would serve as compliance monitoring wells within the five-year post-rinsing monitoring period. *Excelsior should respond to this concern.*

No sampling is proposed after step 1 and 2 of the rinsing operations, contrary to the previous proposals. Excelsior should clarify and justify that change.

The first bullet in Step 3 of the rinsing plan does not include a provision to demonstrate that sampling 10 percent of recovery wells is statistically equivalent to sampling 100 percent of the recovery wells, as described in the response to Comment 59. *Excelsior should clarify and correct this inconsistency.*

The final bullet that monitoring will stop and all wells will be plugged and abandoned when the closure verification wells (CVWs) have met AWQSs and MCLs for five consecutive years requires clarification. HC and/or observation wells may be needed for use as monitoring wells until at least five years after rinsing ceases in all three stages of the ISR operations. POC wells and other monitoring wells located beyond the wellfield perimeter should be retained until at least five years after closure of rinsing operations in the entire project area. CVWs should be retained in the closed mine blocks after the initial five-year monitoring period ends to monitor for excursions from active mine blocks. *Excelsior should clarify the wells remaining open for post-closure monitoring related to the final closure discussion in the response.*

The discussion of post-closure groundwater monitoring omits the monitoring at HC wells for initial detection proposed in the first paragraph of the response. Please explain this omission.

The final paragraph repeats the statement in the final closure bullet discussed above. Please clarify when all remaining wells will be abandoned during the post-closure period.

Attachment A-2, Groundwater Modeling Report

Groundwater Model

2.5.1 Aquifer Systems.

16. Refer to Comment 2. EPA believes there is sufficient evidence to include the basin fill saturated zones as hydraulically connected to and part of the bedrock aquifer, and that it should be included within the aquifer exemption as presented in the Excelsior response.

    EPA Comment: Response is acceptable. *Amend and update the application accordingly.*

2.5.2 Groundwater Movement and Boundary Conditions.

17. The application indicated that the recharge calculations are based on approximately 3% of available precipitation recharges the aquifer, with the assumption based on information from other similar modeling studies. No references to those other modeling studies were provided in the application.

    EPA Comment: Response is acceptable. *Update the application with the citations as presented in the response.*

4.4 Hydraulic parameters.

4.4.1 Hydraulic Conductivity

18. The vertical hydraulic conductivity values used in the model should be re-calibrated to ISR operations performance as operational data are collected and evaluated in the initial stage. Refer to Comment 1.

    EPA Comment: Response is acceptable.

4.4.2 Storage values.

19. The range of porosity values for the sensitivity analyses in the model predictions should also reflect the distribution of the porosity values in the formation. The 50% reduction in porosity might not be sufficient to incorporate the expected porosity values in the site. Furthermore, Figures 42A and 42C in the prior response document show there is a slight excursion of the particles out of the boundary in the south and west sections of the wellfield which coincides with the AOR boundary. If a combination of conditions is selected that would result in the potential loss of hydraulic control (hydraulic conductivity values in the fault zone and other zones of the model and porosity values), it is possible that this excursion could extend further outside the AOR. Therefore, additional monitoring wells should be placed to the west of the wellfield for detection of loss of containment in or excursions from the AOR. Later during ISR operations, if monitoring and observation well data indicate a loss of hydraulic containment or excursion of ISR fluids beyond the proposed AOR, the AOR could be expanded at the southern and western boundary. The proposed intermediate monitoring wells discussed in the conference calls with Excelsior should provide protection from excursions to the south and west of the wellfield.

    EPA Comment: Response is generally acceptable. Identify appropriate intermediate monitoring wells for Stage 3. See the basis for additional intermediate monitoring wells in the response to Comment 23. *Amend and update the application as presented in the response.*

Model Predictions

5.1 Hydraulic Control Simulation.

20. The simulated time for particles to reach the POC wells 2, 3, 4, and 5 at the AOR boundary is estimated to exceed 20 years. If an excursion occurs beyond the wellfield to the east and north in the post-rinsing period of five years, it would not be detected at the POC wells. Excelsior indicated that the HC and observation wells would be retained during the five-year post-rinsing period during our conference call discussion on February 9th. If the HC and observation wells at the boundary of the wellfield are retained for post-rinsing monitoring, excursions could be detected within the five-year post rinsing window and reversed.

Figure 64 should be revised to show the AOR boundary. Excelsior should clarify and add the commitment to retain the HC and observation wells during the post-rinsing period and propose a monitoring plan and schedule for the observation wells. The related conference call discussions should be documented in the updated permit application.

EPA Comment: Response is partially acceptable. HC and observation wells are described as available for monitoring at any stage of the Project, but a monitoring plan and schedule was not proposed. Monitoring should be conducted at the HC and/or observation wells or at supplemental monitoring wells beyond the wellfield until the end of entire project, coincident with CVW monitoring within the wellfield, as discussed in response to Comment 15. *Please clarify the response.*

5.1.2 Hydraulic Control Wells.

21. The proposed intermediate monitoring wells should detect excursions from active mining areas that the modeling fails to predict and the limited number of HC or observation wells fail to detect in the early years of ISR operations, which reduces the need for full activation of 19 HC and observation wells in the early years. *Activation of site-specific HC wells should be dependent on intermediate monitoring well data.*

    EPA Comment: Response is generally acceptable. In addition, water levels can be mapped to show contours of the data, inward gradients, and hydraulic control. Contour maps can be used to report the data in addition to other EPA required reports.

5.1.3 Particle Tracking.

22. The application indicated that because of the slow movement of particles across the mining area, particles are first released six years after mining starts. Due to faulting and fracturing in site geology, it is possible that ISR fluid could move faster through fractures (secondary permeability features) in some parts of the site.

    Excelsior should amend and update the application in Section 5.1.3 as presented in your justification for particle release time given possible fracture flow in places in the prior response to this Comment.

    EPA Comment: Response is acceptable. *Amend and update the application accordingly.*

5.2.2 Capture Analysis.

23. Figures 57, 58, and 59 in Attachment A-2 of the application show some particles leaving the wellfield area and possibly leaving the AOR on the west side of the site. Due to uncertainties, additional monitoring wells should be placed to the west of the wellfield for detection of possible excursions or loss of containment in the AOR. Excelsior proposed the addition of intermediate and other monitoring wells west of the active mining blocks during the February 9th conference call with EPA with PPT illustrations of the well locations in the wellfield.

Excelsior should document those proposals and illustrations in the updated permit application.

EPA Comment: Response is partially acceptable. As indicated by Excelsior in Comment 5, the proposed IMWs for the western boundary of the well field are designed to detect any excursions occurring during Stage 1. Monitoring for excursions during Stage 3 is not described. EPA may require additional IMWs besides what Excelsior may propose for the western boundary to monitor mining activities during Stage 3.

Table 5, Well Information for Project Area.

24. *Please discuss the purpose of the many Env-Monitor wells or piezometers listed on this table. Also, please identify the zone(s) in which each well is open: basin fill, oxide bedrock, sulfide bedrock, or another zone/aquifer.*

    The purpose of the Env-Monitor wells or piezometers listed in Table 5 is not discussed in the prior response as requested.

    Excelsior should provide the requested information.

    EPA Comment: Response is generally acceptable but incomplete regarding the specific monitoring purpose of the Env-Monitor wells and completion zones. Excelsior states that the completion zone information is not available.

Figure 16, Comparison of Fracture Intensity to Hydraulic Conductivity Data.

25. R^2 (R squared) presenting the goodness of the fit was added to the revised Figure 16 as requested. *The figure should replace the original figure in the application.*

    EPA Comment: Response is acceptable. *Update application accordingly.*

Figures 48 to 56.

26. *Based on the prior response, the revised Figures 48 to 56 should replace the original figures in the application.*

    EPA Comment: Response is acceptable. *Update the application accordingly.*

Attachment B, Maps of Well/Area and Area of Review

27. The revised Table B-1 referenced in the response document is not provided in the paper copy or CD of the response document.

    Excelsior should provide the revised Table B-1.

    EPA Comment: Response is acceptable. *Update the application accordingly.*

28. The POC well locations have been moved to inside of the proposed AOR and aquifer exemption boundary as requested. Intermediate monitoring wells are proposed around and between the mine block and HC well locations as discussed in the response to Comment 10.

    The revised Figures H-2 and P-1 should replace the original figures in the application and the Excelsior response should be documented in the updated application.

    EPA Comment: Response is acceptable. *Update the application accordingly.*

29. Permit conditions may require that the AOR be expanded at the southern and western boundary later during ISR operations if monitoring and observation well data indicate a loss of hydraulic containment and excursion of ISR fluids beyond the proposed AOR. The EPA aquifer exemption guidance document includes a recommendation for a buffer zone. Intermediate monitoring and observation wells should provide early detection of an excursion before it reaches the AOR boundary. Refer to Comment 5 for more discussion of this issue.

    EPA Comment: Response is acceptable.

Attachment C, Corrective Action Plan and Well Data

1. Introduction

30. The basin fill saturated zones should be included in the exempted portion of the bedrock aquifer as described in Comment 2.

    EPA Comment: Response is acceptable. A*mend and update the application accordingly.*

2. Wells within the Area of Review

31. Table C-1. The record of construction, completion, and status all wells are not provided in the revised Table C of the prior response or referenced elsewhere in the application.

    Excelsior should amend and update the application accordingly.

    EPA Comment: Response is incomplete. The well construction and completion details are not provided in Table C-1 as revised in the December 2016 response to EPA Comments. Please explain why the information is not provided. Casing and cementing information should be provided in this table or in individual well schematics.

Attachment D Maps and Cross Sections of USDWs

1. Underground Source of Drinking Water

32. Monitoring wells may be required in the sulfide zone as described above. The absence of a confining layer between the oxide and sulfide zones means that an exchange or mixing of

aquifer fluids between the oxide and sulfide zones during ISR operations is likely to occur where injection and recovery wells are situated near a fault zone and the oxide-sulfide interface. The exchange or mixing of the sulfide zone fluids with oxide zone fluids will be enhanced due to the drawdown of the hydraulic control wells in the oxide zone. Refer to Comment 3 for more discussion of this issue.

Excelsior should amend and update the application to include the additional relevant information provided in connection with conference calls with EPA and add a proposal to include the upper 200 feet of the sulfide zone in the aquifer exemption zone. Additional monitoring wells in the sulfide zone near the fault zones may not be required if the upper 200 feet of the sulfide zone is exempted.

EPA Comment: Response is acceptable. *Amend and update the application with the relevant information.*

Figures D-3, D-4, and D-5, Geologic Cross Sections

33. *Figure D-5 in the prior response should be revised to illustrate the presence of the USDW/area of exemption in the Quartz Monzonite zone.*

EPA Comment: Response is acceptable. *Update the application accordingly.*

Attachment H, Operating Data

2. Description of Operations.

2.1 Process Description

34. Figures H-1 and H-2 in the prior response were revised as requested except for addition of the additional HC, observation, and POC wells in Figure H-2 as discussed above. Refer to Comment 5 and other related Comments for more information.

The use of intermediate monitoring wells, as described in the Excelsior presentation of February 9th, addresses these concerns. The relevant discussion and figures included in the PPT presentation should be added to the application.

EPA Comment: Response is conditionally acceptable, subject to EPA review of the text to be added to the application in Attachments A-1 and P. Figure H-2 illustrates the locations of future injection/recovery wells, but only three IMWs are shown in the northwestern area of Stage 3 mine development. Additional IMWs will be required in that area. *Is this the full extent of proposed IMWs to be utilized in that area or will Excelsior submit a plan that includes additional IMWs before authorization is granted for ISR operations in the area northwest of I-10? Please explain the reason for delayed planning of IMWs.*

2.2 Injection Rates

35. As discussed in Comments 8 and 9 above, the permit will require re-balancing on a 48-hour basis unless the applicant demonstrates that the 30-day rolling average re-balancing of volumes is as protective as re-balancing on a 48-hour basis during initial Stage 1 ISR operations. The intermediate monitoring and observation well data, collected over a sufficient period of time, may provide an adequate demonstration during start-up operations.

    Excelsior should propose and submit an operational and monitoring plan for the demonstration and amend the application accordingly. The full response to the Comment should be added to Section 2.2 in the permit application, including the table titled "Estimated Average Injection Rates by Year."

    EPA Comment: Response is conditionally acceptable, depending on EPA review of the revised text in Attachment H-1 of the application.

36. *The revised application should include a proposed minimum net extraction to injection ratio or percentage within wellfields as a means to maintain hydraulic control of ISR fluids in addition to pumping from the HC wells. Please design the ISR operations and groundwater model to provide and simulate containment of ISR fluids to the wellfield as it expands during the life of the project, not merely to the ultimate wellfield planned for year 21.*

    During our recent conference calls, Excelsior discussed that the proposed intermediate monitoring wells and additional observation wells should suffice for monitoring and maintaining containment of individual mine block fluids and detection of excursions.

    The full response to this Comment, including the relevant PPT presentations and Excelsior responses provided during the recent conference calls, should be added to the updated application.

    EPA Comment: Response is conditionally acceptable. Refer to Comments 4 and 7 above for more information.

3. Injection Pressure

37. As discussed in our conference call on February 23rd, the methods used to estimate the fracture pressure are useful, but are different from the standard step-rate testing EPA requires. A gradient of 0.75 pounds per square inch per foot (psi/ft) is acceptable as an initial limitation for injection pressure, and EPA will require confirmation by step-rate testing in a representative number of injection wells in the wellfield as a permit condition. The discussion of fracture pressure in Attachments H and I of the application states that injection pressures will be measured daily.

    Permit conditions will require continuous monitoring and daily recording of injection pressures. The revised application should modify your description, accordingly, under

Section 3 Injection Pressure in Attachment H and Section 3 Fracture Pressure in Attachment I.

EPA Comment: Response is conditionally acceptable. The Excelsior methodology for fracture gradient estimation may be applicable for "oil field fracking," but not necessarily for Class III injection wells. However, based on a closer review of data from the 31 fracture gradient tests, a standard step-rate test may not yield conclusive results in the long open-hole and fractured rock environment of the Gunnison ISR project. In addition, the ultra-low injection rates with relatively high injection pressures, typical of most of the fracture gradient tests, would not be conducive to performing standard step-rate tests. Therefore, EPA will accept the results of the Excelsior fracture gradient tests for estimation of the fracture gradient.

Please clarify how injection pressures will be measured and monitored. If at the surface, how will the downhole pressure gradient be converted to surface pressure? If downhole, at what depth will the pressure gauge or transducer be placed? Downhole pressures should be measured at the top of the injection zone, and the maximum allowable injection pressure will be based on the pressure at that depth.

4. Nature of Annulus Fluid

38. Annulus fluid refers to the fluid in the annulus of injection wells with packers installed, as in Figure M-3 in Attachment M. The prior response is somewhat inconsistent with the discussion of annulus fluids.

    Excelsior should clarify why corrosion resistant fluids would not be placed in the annulus of wells constructed with steel casing and packers.

    EPA Comment: Response is conditionally acceptable. Native groundwater in the annulus of steel casing and tubing may be acceptable as an annulus fluid, but corrosion-resistant annulus fluid would be more protective of the steel casing, tubing, and packer integrity, especially with the injection and extraction of highly corrosive fluids that could leak into an annulus.

    Does Excelsior mean that the annulus may not be filled with a liquid? A leak into the annulus would be more likely if not filled with a liquid or pressurized with a non-reactive gas such as nitrogen. Please clarify.

<u>4.1 The Evolution of the Process Solution Chemistry during Mine Operations</u>

39. "EPA water quality standards" is the correct terminology. It means primary MCLs or pre-mining background concentrations, whichever are higher. Groundwater must be restored to background levels if greater than primary MCLs.

    EPA Comment: Response is acceptable. *Amend and update the application accordingly.*

Attachment I, Formation Testing Program

4. Chemical Characteristics of Formation Fluids

40. Reference is made to the Arizona DEQ aquifer water quality standards (AWQS) throughout this section, but not to federal MCLs for drinking water quality.

    The revised application should reference federal MCLs wherever reference to AWQS is provided and state the MCL when it differs from the AWQS stated in the discussion of a particular constituent.

    EPA Comment: Response is acceptable. *Amend and update the application accordingly.*

4.5 Groundwater Quality in the Vicinity of the Project

41. The water quality data for the Johnson Camp Mine (JCM) POC wells will be considered for its historical data and the relatively close proximity to the Gunnison site.

    Please provide the requested data, which can be provided electronically, and the location of the JCM POC wells on Figure I-7, Potentiometric Surface Map.

    EPA Comment: Response is acceptable.

Attachment L, Construction Procedures

3. Logging Procedures

3.2 Geophysical Logging

42. *Excelsior should clarify why electrical logs are omitted in the prior response.*

    E-logs should be run in open hole from total depth to surface casing if open hole conditions are conducive to running logs to the surface casing. Include the reason sonic logs are preferable to density logs to evaluate porosity. Please clarify the statement: "Geophysical logging will not be conducted prior to installing casing." All logs should be run from total depth to surface casing depth if open hole conditions permit it.

    EPA Comment: Response is incomplete. Provide an explanation for omitting electric logs in the open hole below the cased portion of basin fill and uppermost bedrock. Density-neutron logs provide more accurate measures of porosity than sonic logs. Density logs were reportedly run in seven test wells without incident and were the basis for porosity estimates in the bedrock. A limited number of density logs could be run to calibrate to the sonic log porosities, perhaps one in each mine block.

Attachment M, Construction Details

43. *Excelsior should be more explicit in describing under what circumstances PVC casing would be installed.*

    EPA Comment: Response is acceptable.

Attachment N, Changes in Injected Fluid

44. *As discussed during conference calls with EPA, Excelsior should amend and update the application to add a proposal to include the upper 200 feet of the sulfide zone in the aquifer exemption zone.*

    EPA Comment: Response is acceptable. *Revise the application accordingly.*

45. *The saturated basin fill intervals should be included in the aquifer exemption for the bedrock aquifer, and the application should be revised accordingly, as stated in previous Comments.*

    Revised Figure I-2 should be added to the application.

    EPA Comment: Response is conditionally acceptable, subject to EPA review of the revised Figure I-2 and Attachment S in the application.

3.3 Hydraulic Parameters

3.3.4 Porosity

46. In the prior response, Excelsior provides an extensive discussion of the data collection and evaluation for development of the structural and hydrogeological models of the orebody. However, the core analysis reports were not provided as requested.

    Excelsior should justify the omission of those reports or provide the reports in the response. The figures and added text in Section 3, Data Collection and Evaluation, should be added to update the application.

    EPA Comment: Response is conditionally acceptable, subject to EPA review of the revised text in Attachment N of the application.

6. Direction of Movement of Injected Fluid

47. The prior response did not address the issue of ISR fluids recovered in the hydraulic control wells and the reduction of PLS fluids produced in the recovery wells resulting from the proposed ISR operation. However, the addition of intermediate monitoring wells should allow for early detection of ISR fluids escaping from the mine blocks and trigger actions to reverse those excursions by adjustments of injection/withdrawal rates in the mine blocks.

Excelsior should discuss the disposition of ISR fluids recovered in the HC wells and the ramifications to the feasibility of the project.

EPA Comment: Response is acceptable.

Attachment O, Plans for Well Failures

2. Contingency Plan Elements

2.1 Loss of Hydraulic Control

48. Permit conditions will require maintenance of over-extraction volumes on a daily basis and actions to rebalance within 24 hours of detection, or 48 hours total for detection and confirmation of non-compliance, or a demonstration that the 30-day rolling average is as effective as daily re-balancing as discussed in other related Comments.

Please revise the application accordingly with a specific proposal for the demonstration.

EPA Comment: Response is conditionally acceptable. EPA will review the revised permit application, when submitted by Excelsior, for consistency with this response.

2.2 Well Failures

2.2.1 Mechanical Integrity

49. The requirements for mechanical integrity testing described at §146.33(b) are *minimum* requirements. EPA requires a five-year frequency for all Class III injection wells and the permit will include that provision as a requirement.

Excelsior should amend and update the application accordingly.

EPA Comment: Response is partially acceptable. Class III wells that are inactive for more than two years are considered temporarily abandoned (TA) and must be plugged and abandoned or comply with alternative actions described at 40 CFR 144.52(a)(6). MIT requirements applicable to active wells also apply to TA wells. Please amend to replace the phrase "as long as the well is in use" with "as long as the well is not plugged and abandoned."

Attachment P, Monitoring Program

2. Monitoring

2.1 Injected Fluids

50. *Radium and uranium would be monitored on an annual basis rather than monthly as proposed for the other constituents.*

Please clarify the basis for the less frequent monitoring requirement for radionuclides.

EPA Comment: Response is conditionally acceptable. Please clarify the rationale for annual monitoring instead of the monthly monitoring proposed for non-radionuclides.

2.3 Mechanical Integrity

51. All wells should be tested for casing leaks and mechanical integrity Part 2 to ensure isolation of the injection zone and containment of other formation fluids.

    Excelsior should clarify that well casings in all wells will be pressure tested for leaks and Part 2 mechanical integrity testing will be conducted in all wells as described in Comment 11. Excelsior should amend and update the application accordingly.

    EPA Comment: For clarification, pressure testing of the casing and Part 2 MITs are not required in existing wells or core holes that are converted to IMWs. The casing and cementing record can be reviewed to ensure isolation of the monitored injection interval in those wells.

    Excelsior's response refers to the response to Comment 11. The response to Comment 11 needs clarification on Part II MITs for all wells.

2.3.1 Part 1 Mechanical Integrity Requirement

52. *As noted above, EPA will require Part 1 mechanical Integrity testing in Class III injection wells at least once every five years until a well is plugged and abandoned in accordance with UIC permit conditions. Excelsior should revise this section accordingly.*

    Excelsior should amend and update the application accordingly.

    EPA Comment: Response is conditionally acceptable, subject to EPA review of the revised Section 2.3.1 of the UIC application. Refer to EPA Comment 49.

2.5 Groundwater Monitoring

2.5.1 Monitoring Locations

53. *Please include the schedule for POC installation in Attachment P of the UIC permit application. The POC wells should be located within the AOR boundary, rather than just outside the AOR and aquifer exemption boundary, to confirm that there is no migration of contaminants into the USDW located beyond the aquifer exemption boundary. Please revise Section 2.5 in the permit application in accordance with these requirements.*

    EPA Comment: Response is partially acceptable. The eastern POC wells (2, 3, and 4) will not be useful within the life of the project, including the five-year post-closure monitoring

period, based on the predicted average groundwater travel time to those wells, which may exceed 20 years.

Please provide the ambient monitoring schedule for the intermediate and other monitoring wells, including HC and/or observation wells used for monitoring of groundwater quality. Water quality should be measured and monitored at locations much closer than the easternmost POC wells are located relative to the well field, as discussed in prior Comments. Consider the observation wells for monitoring wells during the post-closure period or designate supplemental monitoring wells at the five-year travel time distance from the wellfield.

2.5.2 Monitoring Parameters

54. *The revised application should clarify that AQLs will be established based on federal MCLs.*

EPA Comment: Response is acceptable. *Amend and update the application as presented in the prior response.*

2.6. Hydraulic Control Monitoring

2.6.1 Fluid Levels:

55. The proposed minimum gradient of 0.01 ft/ft is acceptable as an initial gradient but may be increased depending on the statistical variation of water level data at each observation well pair.

Excelsior should amend and update the application as presented in the prior response.

EPA Comment: Response is conditionally acceptable. See Comment 4. Permit conditions will require a minimum net extraction rate, based on the rate necessary to maintain an inward gradient at all observation well-pairs of at least 0.01 ft/ft. The minimum inward gradient will be subject to review and adjustment based on monitoring data at IMWs and observation wells. The minimum gradient may increase based on the review of monitoring data.

2.6.2 Specific Conductance Monitoring:

56. Excelsior should amend and update the application as presented in the prior response and affirm that conductivity sensors will be installed in the outer observation wells, not the inner observation wells.

EPA Comment: Response is generally acceptable but needs clarification. Conductivity sensors should be installed at appropriate intervals in the injection zone to provide a profile of formation conductivity. *Describe where the sensors will be placed and how baseline data will be collected and evaluated.*

It is unclear whether the last paragraph refers to conductivity sensors in observation or intermediate monitor wells or both. Excursions should be detected at the outer IMWs and reversed before reaching the inner or outer observation wells. *Please clarify that discussion.*

2..6.3 Injection vs. Extraction Volumes:

Table P-1 and Figure P-1, POC, Observation, and Hydraulic Control Well Locations

57. Excelsior proposed the addition of intermediate monitoring wells surrounding and west of the wellfield as discussed in their prior response to the Comment and presented during the February 9th conference call with EPA and ADEQ. Placement of additional POC wells may be included as a permit condition and may be required if model updates and monitor well data indicate a need for them.

    Excelsior should add the relevant discussion and figures included in the PPT presentation during the conference call on February 9th.

    EPA Comment: Response is generally acceptable, but requires clarification regarding the compliance schedule for Stage 3 IMW installation and placement. The compliance schedule statement references the APP but not the UIC permit. For clarification, the UIC permit will also require a compliance schedule for Stage 3 operations and identification of monitoring well placement. The proposed new well locations depicted in Figure P-1 and the IMW locations depicted in Figures P-2 to P-5 will be subject to EPA review and approval as a proposed permit condition.

Attachment Q-1, Plugging and Abandonment Plan

2. Licensure and Permitting

2.2 Abandonment Notification and Authorization

58. The Plugging and Abandonment Plan forms 7520-14 for each type of well in the prior response show the well number as "Hydraulic Control Wells" and the casing sizes are inconsistent with that shown on schematic diagrams for each well type except the small diameter HC and injection/recovery wells (6.1 inch). Also, the schematics include a note stating that casing and cement will be removed to 2 feet below grade and covered with fill material. However, the schematics show the casing intact and the 7520-14 forms state that casing will be left in the wells.

    Please clarify those inconsistencies. The 7520-14 forms should be signed and dated by a company officer.

    EPA Comment: Response is acceptable. Include in the updated application.

Attachment Q-2, ADWR Well Abandonment Handbook and Example ADWR Notice of Intent to Abandon Form.

59. "Restoration" is the terminology used by EPA for cleanup and monitoring of the aquifer after ISR operations are completed and before closure is approved. Restoration standards are primary MCLs or pre-mining background (ambient) concentrations, whichever are higher. Samples will be collected from all of the recovery wells after the third step of rinsing operations, rather than just 10 percent. As an alternative, sampling requirements after the third step may be relaxed in subsequent mine blocks if it can be demonstrated that sampling 10 percent of the wells is statistically equivalent to sampling 100 percent of the wells in the rinsing of the initial mine block as discussed in Comment 12b. The wellfield closure and rinsing plan may require more than five pore volumes to achieve regulatory limits of water quality standards. The results of the proposed rinsing plan will be reviewed and amended if necessary to achieve and maintain those standards.

Excelsior should amend and update the application in accordance with EPA Comments. In addition, Excelsior should provide a post-closure monitoring plan.

EPA Comment: Response is generally acceptable but is not fully consistent with responses to Comment 15's basis for the proposed 10 percent sampling protocol. Clarification is needed as discussed in EPA Comments 12b and 15.

Attachment R-2, Demonstration of financial Capability

60. *The proposed financial assurance instrument should also state that it will cover post-rinsing monitoring and contingency costs. If a surety bond is provided, Excelsior should also establish a standby trust agreement.*

EPA Comment: Response is generally acceptable.

Attachment R-3. Wellfield Closure Costs, Appendix M

Appendix M, Closure of ISR Wellfield

Fixed Closure Costs

61. *The revised Attachment R-3 should replace Attachment R-3 in the original application.*

EPA Comment: Please clarify the response. The format and content of the revised Attachment R-3 is inconsistent with the December 2016 revision of Attachment R-3 and less detailed. Also, the Executive Summary is omitted from this version of Attachment R-3.

Please explain and define the new terminology used in this version: "rinsing outside of the active mine blocks" and "pullback pumping." There is no discussion or reference to these operations in the application or the responses to Comments on rinsing and closure operations. The new closure strategy in the response to Comment 15 is silent on that aspect of rinsing and closure.

The cost estimates have not been accepted as final at this point. Excelsior should clarify the response to this Comment on Attachment R-3.

Variable Closure Costs

62. The revised cost estimate provides for sampling of only 10 percent of the recovery wells after the three steps in the rinsing and restoration operations, which is not responsive to the request to revise the verification sampling cost estimates based on 100 percent of recovery well sampling prior to abandonment and additional rounds of sampling at wells that may require more rinsing in step 3 prior to abandonment of those wells. Refer to Comments 12b and 59 for more information and a discussion of a possible alternative to the proposed sampling plan.

    Excelsior should revise the verification sampling plan and cost estimates accordingly.

    EPA Comment: Response is generally acceptable. Refer to EPA Comments on responses to Comments 12b, 59, and 61.

Table M-9, Stage 1 Cumulative Wellfield Closure Liability by Production Year

63. Post-closure monitoring cost estimates are based on five years of monitoring at three POC wells. Monitoring should be performed at all of the POC wells and possibly for more than five years. The duration of post-closure monitoring may be increased beyond the proposed five years, depending on the monitoring results after five years. The sampling and abandonment costs for the retained wells used for rinsing and post-rinsing monitoring, as proposed in the PPT presentation viewed during the February 9th conference call, should be added to the Attachment R-3, Stage 1 Closure Costs.

    The cost estimates and schedules for wellfield rinsing, sampling, closure, post closure monitoring, and abandonment of retained wells should be adjusted in Attachment R-3 accordingly.

    EPA Comment: Response needs clarification. Which three POC wells will be sampled for closure of the Stage 1 operations? As discussed above in Comment 15, the easternmost POC wells are too distant from the wellfield to be diagnostic of aquifer restoration stability. Sampling should occur at the HC or outer observation wells, or at supplemental monitoring wells located within the five-year travel time from the wellfield, and cost estimates should address the sampling and abandonment of those wells.

Attachment S-1, Aquifer Exemptions

4. Proposed Area of Exemption.

64. The saturated basin fill intervals should be included with the bedrock zone in the proposed aquifer exemption, as suggested by Excelsior in their response. The bedrock sulfide zone would need the installation of monitoring wells in proximity to the near-vertical faults that transect the oxide-sulfide transition zone to ensure that ISR fluids are contained in the oxide zone unless the upper sulfide zone is included in the aquifer exemption zone.

    Excelsior should amend the application accordingly and as discussed during recent conference calls with EPA.

    EPA Comment: Response is generally acceptable. Permit conditions may include the option to require monitoring wells in the sulfide zone to ensure ISR fluids are contained within the exempt zone.

Figure S- 9, Area of Exemption

65. Permit conditions may require that the proposed aquifer exemption boundary be expanded at the southern and western boundary later during ISR operations if monitoring and observation well data indicate a loss of hydraulic containment or excursion of ISR fluids beyond the proposed AE boundary. Intermediate monitoring wells located west of the active portions of the wellfield should provide early detection of an excursion before it travels beyond the AE and AOR boundaries.

    Excelsior should amend the application to be consistent with the proposed plan for intermediate monitoring well placement presented during the February 9th conference call.

    EPA Comment: Response is conditionally acceptable, subject to EPA review of the revised permit application when received.