Gunnison Copper Project, Excelsior Mining Arizona, Inc.
Class III In-Situ Production of Copper Permit No. R9UIC-AZ3-FY16-1
Response to Comments

Description of Changes to the Draft Permit

Pursuant to Title 40 Code of Federal Regulations (40 CFR) § 124.17(a)(1), EPA's final permit decision includes changes to certain provisions of the Gunnison Copper Project draft Permit, as specified below in items 1 to 28. In addition to the descriptions of changes, EPA provides the reasons for the changes in this final permit decision.

1. EPA revised the monitoring program at the eastern boundary of Mine Block 1 operations during the first year of in-situ recovery (ISR) and monitoring operations described at Part II.F.1. This revised language is consistent with the HC well monitoring protocol approved for the southern wellfield perimeter. As an alternative to the draft Permit's requirement for installation of three additional observation well (OW) pairs on the eastern boundary (OW-10, OW-13, and OW-19), the associated hydraulic control (HC) wells (HC-10, HC-13, and HC-19) shall be installed prior to Block 1 operations (in addition to operating [pumping] wells HC-15, HC-17, and HC-18). EPA also revised the draft Permit to require monitoring of HC-10, HC-13, and HC-19, in conjunction with the monitoring of intermediate monitoring wells (IMWs), to provide an early detection of any ISR fluids approaching the eastern boundary of the wellfield. If an excursion is detected at one of the HC monitoring wells, the revised language in the Permit requires pumping the HC wells and installation of the three OW pairs for inward gradient monitoring.

2. EPA added a provision for the option to use hydrasleeves instead of purging the wellbore before collection of water samples at Part II.F.1. This new provision includes a requirement for further justification by Excelsior to demonstrate that hydrasleeves provide an equivalent or superior sample quality or are necessary due to very low recharge rates. The change to the draft Permit language will allow hydrasleeves or similar devices when applicable for collection of water samples in wells that display stratification of water quality and at the intersection of high permeability zones and preferential pathways in a wellbore or if necessary due to very low recharge rates.

3. EPA added language at Part II.F.1 that a demonstration of an inward gradient at the inactive HC wells on the southern and eastern wellfield perimeter is not required in the first year of ISR operations, but wellfield extraction rates should exceed injection rates regardless of the inward gradient monitoring. Modeling results provided by Excelsior indicate that the ISR fluids in Mine Block 1 will be contained to the wellfield without additional pumping at the inactive HC wells to demonstrate an inward gradient. This change will allow Excelsior to conserve groundwater, as they will not be required to demonstrate an inward gradient by pumping the inactive HC wells at the eastern wellfield boundary unless it is necessary for containment of fluids to the wellfield. The amended Permit language states that if monitoring at the IMWs or the inactive HC wells detects outward ISR fluid movement, the HC wells would be activated and the three OW pairs would be installed and required to monitor and maintain an inward gradient.

4. EPA clarified language at Part II.F.1 by inserting "associated" OW pairs and "at locations subject to EPA approval" into the permit language describing requirements for a verified exceedance at the southern boundary that requires the installation of three associated OW pairs at locations subject to EPA approval.

5. EPA added language at Part II.E.3.a.ii(A) that casing and cementing records shall be provided for all existing test wells and coreholes that will be converted to IMWs *if the records are available*. According to Excelsior, casing and cementing records are not generally available for all existing test wells and coreholes that will be converted to IMWs. See EPA response to Comment 92 for further justification of this Permit change.

6. EPA revised Table A-1 in Appendix A to reflect a shift in the location of Mine Block 1. The change reflects abandonment of test well NSD-011 prior to the start of mining because it is inside the new mine block. Corehole CS-06 and test well NSM-001 are changed from outer IMWs to inner IMWs because of their closer proximity to Mine Block 1.

7. EPA revised the footnotes to Tables 1 and 2 in Part II.F.2 to reflect the actual schedule for point of compliance (POC) well, HC well, and OW installation. The footnotes at the end of Tables 1 and 2 were not consistent with the schedule of POC and OW installation. POCs 1, 2, and 3 will be installed prior to year 1, but POCs 4 and 5 will not be installed until prior to Stage 2 operations (year 10). OWs will be phased in during the project as shown in the Well Installation Schedule table provided in Excelsior's comments and in Tables 2.5-2 and 2.5-2 in Appendix A of the Permit. EPA revised the footnote below Table 1 as follows: "TBD - To be determined and approved by the director for the POC wells, inactive HC wells at the southern and eastern wellfield perimeter, and observation wells required by EPA according to the final installation schedules for these wells. The final schedule for POC well, HC Well, and OW installation will be subject to EPA review of ISR operations performance and monitoring data as operations proceed." The footnote below Table 2 was revised to read the same as below Table 1 except that the inactive HC wells were omitted because they are not subject to Level 2 monitoring. Language at the end of II.F.2.a and b was edited to indicate that Tables P-3 and P-4 refer to POC well monitoring details, not *complete* details

8. EPA revised the schedule at Part II.F.3.a for collection of baseline water quality data from all POC wells and outer OWs to be consistent with the installation schedule for those wells, as discussed in item 7 above. EPA added inactive HC wells at the southern and eastern wellfield boundaries to this schedule.

9. EPA added language at Part II.F.3.b to clarify the statistical methods that will be used to ensure the quality of baseline sample results used to establish ALs, as described in Attachment P in Appendix I of the permit.

10. EPA revised the schedule at Part II.F.4 for monitoring at all POC wells and outer OWs to be consistent with the installation schedule for those wells, as discussed in item 7 above.

11. EPA added "HC" wells to the text at Part II.H.1.a.i to clarify that HC well flow rates can be adjusted, in addition to the flow rates for the recovery and/or injection wells, to restore the percent of recovered fluid volume to at least one-hundred-one (101) percent of the injected volume.

12. EPA revised language at Part II.F.6.a.i to require specific conductance (SC) monitoring and baseline conductivity measurements in the IMWs, activated HC wells, inactive HC wells at the southern and eastern boundaries, and outer OWs. Baseline SC measurements in IMWs and HC wells were required in the draft Permit language at Part II.F.6.a.i. For clarification, EPA added the outer OWs, activated HC wells, and inactive HC wells used for monitoring SC levels at the southern and eastern boundaries in the first year of ISR operations in this revised language.

13. EPA revised language at Part II.E.6.d to reduce the optional benzene, toluene, ethylbenzene, and xylene (BTEX) demonstration duration for injectate fluid monitoring from six months to the first month of operations, subject to an extension to six months if results are inconclusive. Also, the language regarding the *averag*e *monthly* concentration of total petroleum hydrocarbons (TPH) in the lixiviant for each quarter of monthly sampling was revised from *average monthly* to monthly concentrations of TPH. This revision in the BTEX concentration demonstration will not affect the injectate solution monitoring requirements at Part II.F.7. The information provided in Excelsior's comments indicate that BTEX concentrations will be below MCL levels and are anticipated to not vary in concentration that would cause an MCL exceedance due to the process related contaminates over time regardless of the length of time of operations. This change was made in response to the request from Excelsior to remove the TPH-Diesel Range Organics (DRO) analysis from the injectate monitoring requirements.

14. EPA added an additional figure in Appendix E of the Permit, labeled as the Gunnison Existing and Proposed Facilities, to clarify that the proposed facilities utilized in Stage 1 of ISR operations include the Solvent Extraction and Electrowinning (SX-EW) plant at the Johnson Camp mine site and associated proposed facilities. A commenter noted that the Facility Site Plan (Figure H-1 in Appendix E of the Draft UIC Permit) shows the SX-EW plant at the mine site but omits the SX-EW plant at the Johnson Camp mine site.

15. EPA added IMWs to the text in Part II E.1.a to clarify that, in addition to HC well and OW locations, the choice and number of IMW locations to be monitored during the three stages of ISR and rinsing operations shall be subject to EPA review and approval, as described in Attachment P in Appendix I of the Permit. EPA also clarified that the updated model and operational experience will be used to review and modify the proposed locations of HC wells, OWs, and IMWs in Stage 1 and 2 and beyond year 13 in Stage 3 of ISR operations.

16. EPA added text at Part II.J of the Permit to clarify that simulation of the injection/recovery well performance may be included in the assessment of operating mine block performance if warranted by ISR operational performance and monitoring data. This language was added to address a comment that the permit should require consideration of the effect of the injection/recovery system on local or regional flow paths.

17. EPA amended the Permit language at Part II.L to clarify the requirement that Excelsior provide estimated closure costs and updated financial assurance for Stage 2 and 3 operations before initiating drilling and ISR operations in those stages. The amended Permit language also requires that those cost estimates and the updated financial assurance mechanism be reviewed for acceptance by EPA in accordance with Part II.L of the Permit, 40 CFR §144.52(a)(7), and 40 CFR Subpart F before Excelsior will be authorized to begin those operations. Attachment R-3 of the Permit application, the Closure Plan and Cost Estimates for the Gunnison ISR Stage 1 Wellfield, was added to Appendix C and referenced in Part II.L of the Permit. This review and update of the financial responsibility amount and mechanism was already at Part II.L of the Permit, and the amendment clarifies this requirement for Stages 2 and 3 ISR operations.

18. EPA removed the requirement that was mistakenly included for a temperature log during open-hole geophysical logging in Part II.C.2. Temperature logs are not useful for open-hole logging, but are required in the Permit when cased-hole geophysical logs are run (See Part II.E.3).

19. EPA amended Part II.C.5, Cementing, to add HC wells, OWs, POC wells, and new IMWs to the requirements for cementing consistent with injection and recovery well casing from a depth of 40 feet below the first contact with competent bedrock to 100 feet above the basin fill/bedrock contact. These omissions were an oversight in the draft Permit.

20. EPA revised SC monitoring requirements at Part II.C.6.c to add HC wells located at the southern and eastern boundaries of the wellfield in accordance with Part II.F.1. SC sensors will be placed in the three HC monitoring wells at the southern wellfield boundary and in three HC wells at the eastern boundary as replacements for SC monitoring in the three OW pairs associated with those HC wells in the first year of Stage 1 ISR operations.

21. EPA corrected typos deleting “and Observation” and “Semi” in references to Tables P-3 and P-4 in Appendix I in the Table of Contents.

22. EPA added language in Part I consistent with other changes described above to state that three proposed HC wells at the southern wellfield perimeter and three proposed HC wells at the eastern wellfield perimeter shall be utilized for monitoring specific conductance of injection zone fluids and groundwater quality during the first year of ISR operations.

23. EPA added language at Part II.C.6.c.i to clarify that the results of a demonstration of the equivalence of a single conductivity measurement to measurement using an array of CS in the open hole intervals of inner IMWs near the first mine block of Stage 1 ISR operations apply to inactive HC wells at the southern and eastern wellfield boundary used in Stage 1 operations in addition to SC monitoring in the outer observation wells.

24. EPA added language at Part II.F.2.c to clarify the procedures for establishing ALs for POC wells and the outer OWs and inactive HC wells at the southern and eastern wellfield perimeter as described in Section 2.4 in Attachment P, Monitoring Program (Alert Levels), in Appendix I of

the permit, and Section 2.5.3 in the Aquifer Protection Permit (APP). EPA also inserted in Appendix I the statistical methods as described in Section 2.5.3.1.2.1 of the APP.

25. EPA added IMWs to the list of well types in Part II.F.5, Hydraulic Control Monitoring Wells, for which EPA will review and approve any revisions to the installation and activation schedule, choice, number, and locations to be monitored during the three stages of ISR and rinsing operations.

26. EPA added language at Part II.F.6.a, Specific Conductance Monitoring, to require the collection of baseline conductivity measurements to establish the range of background specific conductance levels and baseline specific conductance measurements in the IMWs, outer OWs, and activated HC wells associated with the new mine blocks and in inactive HC wells at the southern and eastern wellfield perimeter prior to commencement of injection in the first activated mine block.

27. EPA updated the number of pages in Part I of the permit.

28. EPA added the word “well” after HC in Parts II.E.1.a and II.F.5 for clarification.

Summary of Significant Public Comments and EPA Response to Comments

Pursuant to 40 CFR § 124.17(a)(2), below in items 1-99, EPA briefly describes and responds to all significant comments raised during the public comment period and during the public hearing held on February 27, 2018. For clarity, EPA organizes the comments and responses below under several topical headings.

Regional Hydrogeology

1. A commenter asserts that the hydrogeology discussion in the UIC Permit application should present a water balance for the regional aquifer system, with an estimate of recharge and an estimate of groundwater flow leaving the basin through the two gaps on the east.

   EPA Response: Based on the Excelsior Mining Corp. (Excelsior) and Arizona Department of Environmental Quality (ADEQ) responses to this comment presented in the Excelsior comments dated February 22, 2018 ("Excelsior comments"), EPA is satisfied that a detailed water balance analysis in the initial groundwater flow model is not necessary, but it will be addressed in the re-calibration of the model during the long-term in-situ recovery (ISR) operations in accordance with the Permit condition at Part II.J. The basis for our response is the evidence presented in Attachment A-2, Section 2.5.4 of the UIC Permit application that indicates that the aquifer system is in a steady state condition. The estimated discharge should be equivalent to the estimated recharge to the aquifer system in a steady state system. The commenter apparently agreed that Excelsior estimated and described recharge values properly but not the discharge values. The amount of groundwater flow that is predicted by the model to leave through the two gaps should be the same as the recharge values in a steady state system. The above-refenced permit condition requires Excelsior to re-evaluate the calibration of the model during early ISR operations.

Aquifer Properties and Pump Tests

Several comments are critical of Excelsior's pump testing analysis and the application of aquifer properties in the modeling and project design, including fault and fracture orientation, horizontal anisotropy, aquifer storativity, porosity, and the presence of an aquifer divide. A commenter provided the following comments and specific recommendations:

2. Excelsior should consider horizontal anisotropy in its modeling and project design. The effects of not considering this are described in the discussion of modeling.

   EPA Response: The model design accounts for horizontal anisotropy through the distribution of high permeability zones to represent highly fractured fault zones and preferential flow paths.

3. Excelsior should complete at least one longer-term pump test using the higher producing wells and monitor their wells within the wellfield, outside the wellfield, and beneath the wellfield to provide improved evidence regarding connectivity throughout the aquifers near the project site.

   EPA Response: Excelsior will conduct additional pump testing within the wellfield and monitoring at key observation wells during the early stages of ISR wellfield development in

accordance with the Permit condition at Part II.C.8, which should provide additional evidence of connectivity. However, the UIC Permit application already provides sufficient evidence of connectivity near the project site. There is connectivity between the bedrock and overlying alluvium where saturated and where they are considered as portions of a single interconnected aquifer within the vertical limits of the aquifer exemption area as described in Attachment S of the UIC Permit application. The groundwater model described in Attachment A-2 of the UIC Permit application is constructed as a single aquifer with seven layers, including the saturated portion of the basin fill unit. Near vertical faults extend through the bedrock units and the lack of a confining unit at the base of the basin fill unit provides the vertical interconnection. Figures A-9 to A-12 in Attachment A-1 of the UIC Permit application show that the aquifer is interconnected between the tested wells and the observation wells.

4. The values of storativity vary over six orders of magnitude, which indicates great variability and no average value should be applied over the entire model domain.

   EPA Response: Excelsior's groundwater model simulates unconfined conditions in the aquifer system with confined conditions in the deeper areas, according to the discussion at Section 4.1.2 in Attachment A-2 of the UIC Permit application. According to the text on page 23, Model layer 1 is unconfined, Layers 2 and 3 are unconfined/confined (convertible depending upon whether the overlying layer is saturated), and Layers 4 through 6 are confined. The specific yield and porosity values assigned to the model were based on fracture intensity correlations with well log porosities and vary by formation and within each formation, as shown in Table 11 in Attachment A-2 of the application. EPA considers that to be a reasonable assumption since storage values varied widely in the well tests and within the tested formations. Consequently, the assignment of discrete values of specific storage to the model is impractical and unnecessary because storage is typically not a sensitive parameter. EPA notes that Excelsior's derived storage value, which was calibrated as part of the transient calibration to the aquifer test at NSH-15, appears consistent with the hydrogeology expected for this geologic setting.

5. Porosity values vary from 0.0133 to 0.0577, which demonstrates significant variability across the site. Graphs of how porosity varies vertically should be presented to illustrate the potential for vertical flow.

   EPA Response: Porosity graphs are not needed because Excelsior's gamma-gamma density logs show how porosity varies vertically in each formation. Porosity values assigned to the model were based on fracture intensity correlations with well log porosities and vary by formation and within each formation, as discussed in response to Comment 4 above. The average porosity of 2.7 percent from gamma-gamma density logs was only used to estimate rinsing volumes for wellfield closure. Porosity values and fracture intensity estimates are presented in Table 11 (Attachment A-2 of the UIC Permit application) by zone in each formation. In addition, Excelsior conducted sensitivity analyses to lower values of porosity and higher K values than originally simulated to assess the assumption of higher flow velocities resulting from lower porosities or higher permeabilities. The results indicated that containment and capture will be maintained even under those assumptions. In consideration of these results, if vertical flow occurs locally around injection wells, EPA does not expect this flow to cause the escape of groundwater from the wellfield as the commenter asserts. Moreover, the surrounding recovery wells and hydraulic control (HC) wells will capture injected fluids because an excess of at least 1 percent of injected fluids is required to be extracted from the wellfield. In addition, monitoring at

intermediate monitoring wells (IMWs) and the requirement for maintaining an inward gradient of at least 1 percent (i.e., 0.01 ft./ft.) at the observation wells (OWs) will ensure that fluids will not escape the wellfield perimeter.

6. The model relies on a groundwater divide that would separate the project area from the aquifer further south. But even if it exists, it would not prevent contaminants from transporting south through preferential flow paths which could connect areas south and north of the regional divide.

   EPA Response: The groundwater divide is not considered a barrier to groundwater flow to the south and is not relied upon to prevent movement in that direction. It was also not integrated into the model as any sort of boundary. The natural gradient at the wellfield is generally to the east, and the purpose of the IMWs, HC wells and OWs is to detect a potential excursion of ISR fluids and correct it before it can move beyond the wellfield perimeter to the south or in any direction.

7. The groundwater divide is very flat and, just south of the divide, the regional gradient is more south and southeasterly than north of the divide. This would direct contaminants that cross the divide towards Dragoon.

   EPA Response: EPA agrees that the regional gradient is very flat to the east of the wellfield based on the data in the UIC Permit application but the commenter has not provided any new information that indicates a southerly or southeasterly direction within a mile south of the wellfield and the groundwater divide. The general direction is to the east until it flattens midway through the wellfield with no distinct direction. Also, as noted above, the Permit requires contingency actions to be taken to reverse outward ISR fluids movement detected in IMWs, HC, or OWs to contain ISR fluids to the wellfield.

Water Chemistry and Petroleum Products in Groundwater

8. A commenter asserts that the Johnson Camp mine cannot be ruled out as a source of the petroleum products in the groundwater at the site; therefore, the commenter asserts, Excelsior must complete a larger survey of the Light Non-Aqueous Phase Liquids (LNAPLs) contamination and assess whether and how it could affect ISL operations.

   EPA Response: EPA does not rule out Johnson Camp mine as a possible source of some of the LNAPL contamination, but EPA considers it highly unlikely based on the additional information provided by Excelsior in its comments on the draft Permit. Any remaining LNAPL is expected to be extracted and removed from the recovered pregnant leach solution (PLS) during the solvent extraction and raffinate treatment process before lixiviant is re-acidified and injected into the orebody.

9. Citing the importance of understanding the source of petroleum products in the groundwaters on the project site, a commenter asserts that Excelsior should reconsider the potentiometric surface map and whether the water levels all represent the same aquifer level. The commenter asserts that it is possible that groundwater flows southeast from the mine at certain levels, and therefore the Johnson Camp mine cannot be ruled out as a source of the petroleum products.

   EPA Response: Refer to the response to Comment 8 above. Based on our review of the information provided by Excelsior in its comments, the source of the petroleum products is most

likely from the old drilling method used to drill the borings and residual contamination from the former Leaking Underground Storage Tank (LUST) near the southwest corner of the project site.

Copper Mining Project – Specific Technical Comments

Below are technical comments and recommendations regarding the overall project and EPA's responses to those comments:

10. The site plan (Figure 6 of the draft Permit) shows the SX-EW plant at the mine site but omits the SX-EW plant at the Johnson Camp mine site.

    EPA Response: The proposed facility site plan, which includes the SX-EW plant at the Johnson Camp mine site, is Figure H-1 Appendix E of the Draft UIC Permit. EPA included an additional Figure in Appendix E of the Permit that has Gunnison's Existing and Proposed Facilities depicting the Johnson Camp mine site.

11. The development blocks (refer to Appendix I, Figure 45) indicate that sections of the wellfield would be developed such that 5-spot patterns would overlap with adjacent 5-spot patterns, which would cause the 4:1 collection to injection well ratio to not hold throughout the project life.

    EPA Response: The 5-spot patterns overlap with adjacent 5-spot patterns and the recovery well to injection well ratio will vary over the life of the project, as explained in the UIC Permit application. However, according to Excelsior's comments and language in the UIC Permit application, the ratio of fluids recovered to fluids injected in each mining block will remain at approximately 1:1. The Permit requires pumping at the HC wells to maintain the net volume of 1 percent over-extraction for the wellfield and an inward gradient of 1 percent at the OWs.

12. The proposed 0.9 safety factor applied to the maximum injection pressure at each well may be insufficient in some areas. Fracturing could connect previously unconnected fractures and preferential flow zones allowing lixiviant to escape the project area through unmonitored fracture zones.

    EPA Response: The 0.9 safety factor is applied to the fracture pressure of each formation based on injectivity testing in six wells and 28 intervals. The maximum wellhead pressure will be based on the lowest measured fracture gradient of the weakest formation open to injection in each well, which EPA believes provides a very conservative basis for establishing the maximum allowable wellhead injection pressure in each well (see Permit condition Part II.E.4.a). Monitoring specific conductance (SC) and water quality at multiple IMWs and outer OWs should allow for the detection of any potential movement and excursions of ISR fluids from the active mine blocks and wellfield perimeter. Excelsior's over-extraction of groundwater and maintenance of an inward gradient provides additional assurance of containment.

13. There is no guarantee that the HC wells would intercept flow in each preferential flow path. The model does not consider the potential for fractures to transmit flow and contaminants from the wellfield.

    EPA Response: Aquifer testing presented in the UIC Permit application demonstrated good connectivity within the bedrock due to faulting, fracturing, and bedding plane pathways. Well

testing and core data indicate that the fracturing is so extensive that the bedrock acts essentially as an equivalent porous media with faults providing preferential pathways through the bedrock. The major faults are included in the model to account for preferential flow paths. HC wells will be placed to intercept flow in the major pathways. The hydraulic interconnectivity of the faults and fractures provides a high level of confidence that ISR solutions will be contained or captured at the HC wells. Over-extraction at HC wells or recovery wells and monitoring SC and fluid levels at the OWs will provide further assurance of containment.

14. Excelsior should provide a realistic assessment of attenuation capacity, considering the amount of limestone that escaping acid solution would contact.

    EPA Response: Excelsior's comments explain that the geochemical model does consider how much of the acid solution contacts the limestone using a factor called the water:rock ratio. Excelsior's comments further explain that the geochemical model considered the estimated secondary porosity of 3% for the downgradient limestone. In the UIC Permit application, the geochemical modeling in Attachment H-2 demonstrates the attenuation capacity of downgradient limestone, which will act as a safety factor in the highly unlikely event that all other safeguards against escaping ISR solutions and aquifer restoration fail. The preferential pathways argument is otherwise addressed above at the response to Comment 13.

    In its UIC application, Excelsior also indicated that it does not intend to use the neutralizing capacity of limestone to prevent excursion during operations because containment during operations is accomplished through either mine block recovery or hydraulic control wells. The neutralization is an element of the wellfield closure strategy in Appendix F of the Permit.

15. Rather than specifying a number of pore volumes to be rinsed, the Permit should require rinsing until a given contaminant concentration is reached.

    EPA Response: EPA agrees with this comment. The number of pore volumes ultimately required for rinsing will be determined based on Excelsior reaching the water quality standards specified in the Permit conditions. The number of pore volumes cited in the application are for preliminary estimation of closure costs and will be increased during rinsing if Excelsior is required to use more pore volumes to restore the aquifer in the initial mine blocks.

16. The draft Permit should outline a strategy for remediation during the post-rinsing period.

    EPA Response: The UIC Permit requires that water quality monitoring continues at the outer OWs, closure verification wells (CVWs), and point-of-compliance (POC) wells during the post-rinsing period, and contingency plans require remedial action if standards are exceeded, as described in detail in the UIC Permit and Wellfield Closure Strategy.

Monitoring Wells

Commenters expressed concerns about the adequacy of monitoring well spacing, preferential pathways intersected by the wellbores, horizontal dispersion of ISR solutions, alert limits (ALs) and aquifer quality limits (AQLs), contingency plans for long-term exceedances, and the duration of monitoring beyond the end of rinsing operations. Specific comments and recommendations (and EPA's responses) follow:

17. Even if observation wells show a 1% inward gradient, it is possible for fluids to escape hydraulic control through preferential flow pathways.

    EPA Response: Monitoring requirements at the outer OWs and the outer IMWs are designed to detect any exceedances of set groundwater quality levels if they occur, and to subsequently confirm the correction of any exceedance that occurred. As indicated in Attachment P, Appendix I of the Permit, outer IMWs will be located along the more conductive fluid pathways (bedding parallel and structures), several hundred feet from the active mining area, in a radial pattern spatially distributed and surrounding the mining area. Extraction rates and/or HC pumping may be increased to increase the inward gradient and regain HC as a corrective action. POC wells, HC wells, and OWs will be placed strategically to intercept flow in known preferential pathways. The interconnection of the fracture system and dispersion of groundwater flow in that system would allow detection and prevent the escape of ISR fluids beyond the outer HC wells and associated OWs.

18. While the draft Permit (Appendix A, Figures A-7A, A-8, and A-13 through A-16) shows the monitoring wells as operated for given time periods, it does not show the monitoring well layout after year 13 (i.e., Figure A-16), which is the end of mining stage 2.

    EPA Response: Excelsior will use updated model and operational experience to identify the location of IMWs beyond year 13. Appendix I of the Permit specifies that Excelsior will provide a report to EPA and ADEQ proposing IMWs for Stage 3 operations. EPA clarified the Permit language to make clear that Excelsior's identification of outer IMWs prior to Stage 3, made in accordance with Appendix I in the Permit, is subject to EPA's review and approval.

19. The monitoring well scenario described in the draft Permit is insufficient to protect offsite resources, including wells near Dragoon; this violates requirements for monitoring well spacing based on an assessment of geology.

    EPA Response: EPA disagrees with the commenter's assertion. Monitoring well spacing is designed to protect offsite resources and is based on an assessment of geology and hydrology as documented in information provided by the applicant, and as clarified in the responses that follow.

20. The current monitoring program is inadequate to detect contaminant migration from the current area of review (AOR) and, if contaminant migration does occur, it will not be detected beyond the AOR because there are no monitoring wells beyond the AOR.

    EPA Response: EPA disagrees with the commenter's assertion. The IMWs, OWs, and POC wells provide three perimeters of defense and detection of any potential contaminant migration beyond the wellfield within the AOR. It is not necessary or appropriate to place monitoring wells beyond the AOR because placement of the three types of proposed monitoring wells is based on modeling and containment of fluids to the AOR by maintenance of over-extraction rates and an inward gradient. The AOR defines the spatial limit of possible impacts associated with the ISR mining operations. Moreover, the AOR can be enlarged through a Permit modification process with a requirement for additional monitoring wells at the perimeter of the AOR if ISR operational experience and monitoring data show that an expansion of the AOR is necessary.

21. The gradient measured by the OWs as designed could meet the monitoring standard, but there could be zones within the monitored rock with gradients away from the project. Each productive zone could have its own gradient which could be masked within the OW well, resulting in flow leaving the mine site undetected.

    EPA Response: The productive zones are determined by interconnected fault and fracture zones across formations, which would preclude different gradients in interconnected formations. The HC wells and associated OWs will be screened in the overall productive intervals. Natural gradients are very low in the downgradient portion of the project area, and pumping the HC wells would reverse any outward gradient in the productive intervals. OW monitoring will detect any potential excursions and trigger more pumping if an excursion occurs beyond the wellfield.

22. Each OW should be assessed to determine whether there are different productive zones and each zone should be monitored separately, including groundwater level and water quality.

    EPA Response: The Permit includes a Permit condition with an alternative for an early demonstration in IMWs close to the initial mine block to evaluate whether a single conductivity sensor would be as effective as multiple probes placed in known fault and fracture zones (different productive zones) for detection of an exceedance in a well. The results of that evaluation will determine whether single SC sensors will be sufficient in outer OWs. If the results are negative or the demonstration is not performed, the Permit requires multiple sensors in the outer OWs to ensure the detection of any excursions in preferential pathways.

23. The HC wells should be evaluated as to whether they control some flow zones better than others. The HC wells should have the ability to produce from all productive zones they intersect.

    EPA Response: EPA believes the proposed network of HC wells, IMWs, OWs and POC wells and screened intervals is sufficient for detection and reversal of any possible excursion from the wellfield. The HC wells will be screened across all productive zones. Some zones are expected to be more productive than others, but all zones would yield some fluids to the HC wellbore. Hydraulic control will be demonstrated by an inward gradient and will prevent the escape of fluids even in the least productive zones. Moreover, well test results indicate good interconnection of the orebody structures from test wells to observation wells.

24. The draft Permit establishes special consideration for three HC wells established on the southern project boundary prior to year 1, but the response is inadequate because the wells are spaced too widely and would be insufficient to monitor the threat of contaminant escape southward through the NW-SE trending faults that transect the southern boundary.

    EPA Response: Several IMWs will be activated within the wellfield between the active mine blocks and the HC wells for SC and water level monitoring to trigger early warning to increase extraction rates in the mine block or the existing HC wells at the eastern boundary before fluids would reach the HC wells on the southern boundary. The IMWs are located to intersect one or more of the six major faults trending NW-SE in the wellfield. The HC wells will serve as a secondary line of defense at the southern boundary in year one and will be activated for HC if a SC or water quality exceedance is detected. The associated OWs would then be drilled and activated.

25. The five POC wells located outside the AOR (Figure 7) are grossly insufficient to address preferential flow pathways because large contaminant plumes could flow between the wells undetected.

    EPA Response: The POC wells located outside of the AOR are positioned for monitoring at the surface facilities and impoundments and are not associated with POC monitoring of the mining operations. The five POC wells at the AOR will be located within the AOR boundary. Monitoring at the outer OWs is required to detect any potential excursions from the wellfield much sooner than would be detected at the POC wells, three of which are located far beyond the five-year travel time distance for groundwater flow to the east. Eleven outer OWs will be positioned at the wellfield perimeter downgradient of the ISR mine blocks with much closer spacing, in addition to the outer IMWs within the wellfield. Any contaminant plumes would be detected and reversed long before they could reach the POC wells. The POC wells will serve as the third line of defense within the AOR for protection of underground sources of drinking water (USDWs) beyond the exempted aquifer.

26. The number and spacing of the POC wells should be determined based on modeling of contaminants being released either within the wellfield or the ponds accounting for horizontal dispersion. EPA should increase the number of required POC wells from five to at least 20 (not including the liquids impoundment POC wells).

    EPA Response: Refer to the response to Comment 25 above. No additional POC wells are needed at the AOR boundary since the IMWs and OWs are much more numerous and much closer to the mining operations, which will allow for early detection and a much quicker response to any potential exceedance of monitored parameters.

27. The POC wells downgradient from the wellfield should monitor different vertical preferential flow paths separately.

    EPA Response: Vertical profiling at the POC wells is not warranted due to the distance and long groundwater travel time to the POC wells located to the east of the wellfield and the predicted wide dispersal of potential contaminants in the interconnected fractures over that time and distance. The Permit also contains a condition for a vertical profile monitoring demonstration for SC at the outer OWs, as discussed in EPA's response to Comment 22 above.

28. The Permit should require monitoring for contaminant excursions across the southern boundary by considering the following:

    a. The HC wells should be fully installed and active at the beginning of mining operations. This would create a trough in the water table that would prevent excursions if the pathways are connected to the regional water table.

       EPA Response: The HC wells at the southern boundary will be installed before the inception of ISR operations but pumping will not be activated in year one unless an exceedance of monitored parameters is detected at a HC well. That would also trigger the installation and activation of the OWs associated with each HC well. Three of the HC wells at the northeastern wellfield perimeter will be activated to induce drawdown and flow toward the

northeast and away from the southern boundary. The initial mine blocks will be positioned at a considerable distance from the southern wellfield and the AOR boundary and, if ISR fluids were to escape the mine block, they would not reach the HC wells before being detected by IMWs located between the mine block and the HC wells. Early activation of pumping at the southern HC wells would tend to draw fluids to the south from the active mine blocks and be counterproductive to the interest of groundwater conservation.

b. HC wells should be installed in fracture zones associated with the faults.

EPA Response: IMWs intersect all major faults, and HC wells intersect faults if they are present at the wellfield boundary, but are sited based on particle tracking simulations to prevent ISR fluids from leaving the wellfield. Moreover, the prevalence and interconnectivity of fractures would cause the HC wells to be in hydraulic connection with the major faults and prevent fluid movement beyond the wellfield.

c. The faults should be more fully monitored, with IMWs situated along each of them.

EPA Response: As documented in Table A-2 of the UIC Permit application, the location of IMWs are along the more conductive fluid pathways interconnected by the primary faults and bedding plane structures. Attachment P in Appendix I of the Permit further describes the basis of locating the IMWs.

d. POC wells on the south boundary should be about 300 feet south of the HC wells, and be associated with fractures and pathways associated with the faults.

EPA Response: The number, placement, and activation schedule of HC wells and OWs is subject to EPA review and approval as ISR operations proceed in each mining stage. EPA may require additional monitoring wells and OWs along the project's southern boundary based on the results of ISR operations monitoring and model re-calibration.

29. EPA should require modeling of leaks from the project, without the HC wells operating, to estimate the likely plume that would develop, including dispersion, to determine the needed POC well spacing on the east side of the project. EPA should require that POC wells are spaced based on the updated plume modeling results.

EPA Response: Excelsior performed particle tracking modeling in the absence of HC well pumping to support the proposed placement of HC, OW, and POC wells along preferential pathways. Additional OWs may be required at the eastern wellfield perimeter if warranted based on operational experience, monitoring, and model re-evaluation. Based on the information provided in the application, there is no justification for additional POC wells at the eastern AOR boundary.

30. Contaminant dispersal through all the interconnected pathways is highly unlikely because contaminant migration will follow gradients and disperse unequally through a pathway. The Permit should require monitoring of pH in addition to SC at the IMWs; this could provide early warning of a loss of hydraulic control through pathways.

EPA Response: The IMWs are located to intersect the six major faults trending NW-SE in the

wellfield. Excelsior will monitor for pH at least once per quarter in the outer OWs and POC wells. Monitoring pH at the IMWs, in addition to daily SC and water level monitoring is a less reliable and unnecessary method to detect excursions because Excelsior's geochemical modeling in its application shows the acid consuming host rock would neutralize the PLS quickly.

31. The alert limits and aquifer quality limits should be set and enforced for each POC, by screened interval, to set limits and commence mitigation based on preferential pathways.

    EPA Response: Limits at each POC well based on preferential pathways is not warranted due to the distance and long groundwater travel time to the POC wells located to the east of the wellfield and the predicted wide dispersal of potential contaminants in the interconnected fractures over that time and distance. Moreover, the Permit requires monitoring at the outer OWs to ensure the detection of any potential excursions in preferential pathways. Refer to the response to Comment 22 above for further explanation of this issue.

32. The concentration limits specified for monitoring at the POC wells should account for dilution. This would account for the fact that standards could be exceeded over a portion of the water column but not all of it.

    EPA Response: The possible effects of dilution will be evaluated in the early demonstration of deploying conductivity sensor arrays as compared to a single sensor in IMWs close to the initial mine block. However, an exceedance in a preferential pathway would be detected as an exceedance in the whole sample since the preferential pathway would contribute a share, and probably a larger proportional share of sample, to the whole sample and cause the AQL or AL to be exceeded although somewhat diluted.

33. What happens if contaminants migrate and they are not detected in monitoring wells which don't exist and aren't proposed to exist? There must be very specific criteria for what happens when baseline conditions are exceeded in groundwater quality much farther away from the mine site. The Permit should indicate that, if exceedances last for more than six months, the facility, or at least the specific section of the wellfield responsible for the exceedance, must cease operations and commence rinsing. The draft Permit does not come close to addressing that and to having strict criteria for what happens when mining has to stop and rinsing has to begin. None of those things are addressed properly in the draft Permit.

    EPA Response: As described in other responses to comments above, the proposed network of HC wells, IMWs, OWs and POC wells and screened intervals should sufficiently detect and reverse any possible excursion from the wellfield. Permit conditions at Part II.E.1.d require actions to be taken on a timely basis to restore hydraulic control or to reverse outward ISR fluid movement detected in one of the monitoring wells. The Permit provides adequate contingency actions for correcting a loss of hydraulic control and any potential AL or AQL exceedances. The Permit requires that corrective actions be taken much sooner than six months after an exceedance is verified. The Permit describes specific requirements for contingency actions at Part II.H. Among contingency actions, EPA may require additional monitoring or action beyond what is specified in the Permit. Partial cessation of operations and commencement of aquifer rinsing may be required if other actions prove unsuccessful within a reasonable timeframe.

34. The length of the monitoring period that Excelsior proposed for the POC wells (monitoring for

four quarters after rinsing is complete) is insufficient because it is not long enough for contaminants residing within the wellfield, but that are not neutralized, to flow from the wellfield through the POC wells.

EPA Response: The UIC Permit requires monitoring of level 1 parameters on a quarterly basis for two years and annually thereafter and after rinsing is completed. As established in the Wellfield Closure Strategy in Appendix F of the Permit, post-closure monitoring will also be conducted at CVWs within the wellfield and at outer OWs. Monitoring of level 2 parameters will continue on an annual basis at the CVWs, outer OWs, and POC wells during the post-rinsing period, which is a minimum of five years in duration.

35. Monitoring beyond the end of rinsing should continue as long as the estimated travel time for particles from the most distant part of the wellfield to reach the POC line, plus at least 50% for a safety factor.

    EPA Response: Travel time to the outer OWs is less than five years according to particle tracking analysis. Particle travel time to the most distant POC wells east of the wellfield exceeds 20 years. If no exceedances are detected at the outer OWs within five years, there is high confidence that no contaminants are present that could reach the POC wells in 20 or more years. If an exceedance is detected at an outer OW, corrective action would be required. Further protection is provided by monitoring at the CVWs within the wellfield during the post-rinsing period. Monitoring at the most distant POC wells serves as an added safety factor in case contaminant travel time to the POC wells is much faster than predicted and in the extremely unlikely event that some contaminants somehow bypass all the CVWs and OWs without detection.

36. Five years of post-rinsing monitoring is insufficient.

    EPA Response: Based on all the information and analyses provided, EPA believes that five years of post-rinsing monitoring is sufficient. However, the UIC Permit provides an option for EPA to require extension of the post-rinsing monitoring period beyond five years if contaminants are detected at the CVWs, OWs, or POC wells within five years of rinsing operations.

37. EPA must increase the number of required outer monitoring wells from five to at least 25, and require that these wells be drilled over a broad area extending further from the project site.

    EPA Response: EPA does not agree with this recommendation. The UIC Permit requires at least 11 outer OWs to be used as monitoring wells near the wellfield perimeter and monitoring at IMWs during ISR operations and at rinse verification wells during rinsing operations located within the wellfield. Placing additional POC or other monitoring wells further from the project site would serve no purpose, because the particle travel time would be so long that the wells would be of no use within the lifetime of the project and the post-rinsing monitoring period. If contaminants were to somehow escape from the wellfield, the outer OWs would detect the excursion and trigger corrective actions long before any contaminants could reach the POC wells.

38. The monitoring schedule is inadequate. All monitoring wells should be drilled at least one year prior to commercial operation, and extensive baseline water quality data should be collected by a third-party laboratory and posted online.

    EPA Response: The Permit requires Excelsior to install the monitoring wells and collect baseline water quality data before ISR operations commence. Samples will be analyzed by a third-party laboratory and the results will be reviewed by EPA. The reports will be available to the public upon request. Excelsior is required to submit quarterly reports per Part II.G.2 of the Permit.

39. Insufficient monitoring protocols are in place for this project. There is much too high of a chance that the contaminants will escape between the existing POC wells. Because there are too few POC wells, it creates a gap between them where sulfuric acid solution can escape between the proposed point of compliance wells and migrate downgradient, especially if there is an unknown preferential pathway underground. Additional monitoring wells outside of the AOR are requested.

    EPA Response: The presence of the IMWs, HC wells, and OWs surrounding the mine blocks and wellfield perimeter will intercept any contaminants before they can escape the AOR and protect the area beyond the AOR. The POC wells add a redundant line of defense against the escape of contaminants from the AOR. They are placed within the AOR boundary to detect and prevent the escape of contaminants beyond the AOR. In the unlikely event that a POC well detects an exceedance, Excelsior would be required under the Permit's contingency plan to correct it before any contaminant could escape the AOR, and the placement of additional monitoring wells would be an option for EPA to consider at that time. The location and orientation of the major faults and fracture zones are well known and are modeled based on the data from numerous coreholes and exploratory wells drilled in the Project area and beyond it. Based on all the information and analyses provided to EPA, installation of additional POC wells and monitoring wells outside the proposed AOR is not warranted.

40. The AOR is too small. It is not a holistic look at the broader hydrogeological complex and is really just the mine itself. It is preferred to have a larger AOR, with monitoring wells much farther away from where active mining will occur. Monitoring is not adequate.

    EPA Response: The AOR represents the area where injected fluids may migrate or where injection activities could result in subsurface pressure influences, based on Excelsior's modeling of fluid movement. This modeling approach, evaluated by the EPA as part of the Class III Permit application evaluation, incorporates the geologic, hydrogeologic, and operational characteristics of the proposed project. Delineation of the AOR is based on this modeling approach with simulated operational controls in accordance with the UIC requirement at Title 40 CFR §146.6. In the event ISR operations and monitoring data indicate that the AOR should be expanded, EPA has the option to modify the Permit subject to a public participation process in accordance with 40 CFR §144.39 and Part 124.

Review of Groundwater Modeling Report-Attachment A-2

Model Structure

41. The model includes neither horizontal anisotropy nor an orientation of grids to align with the fracture orientation, which would facilitate simulation of horizontal anisotropy (Attachment A-2, p 18). The commenter asserts that this is a failure to consider the preferential flow potential parallel to the fracture orientation.

    EPA Response: EPA concurs with Excelsior's representation that: "[h]orizontal anisotropy is accounted for in the model through the distribution of high permeability zones representing intensely fracture faults [zones]." EPA also concurs with information provided by Excelsior regarding the ADEQ's response to a similar question raised in its Aquifer Protection Program (APP) permitting process that the groundwater flow model does consider horizontal anisotropy in its design. This model design is documented in Attachment A-2 of the UIC Permit application. Based on EPA's review, the model grid was aligned appropriately with the east-west and north-south oriented fractures and the predominant regional groundwater flow direction from west to east.

Boundary Conditions

42. The water balance and flow equations require boundary conditions where either the water level, a groundwater flow, or both are specified. There are no flow boundaries on the north, west, or south bounds of the model domain which generally coincide with a topographic and expected groundwater divide, as is appropriate. The modeling does not impose any vertical gradient at the model boundary. Because the report does not provide water balance data, it is not possible to assess the reasonableness of the constant head boundaries through which groundwater flow leaves the model domain.

    EPA Response: Consistent with its UIC Permit application, Excelsior provided the following information: Water balance for the model domain includes only recharge from precipitation and outflow of groundwater through the two gaps in the Gunnison Hills. The model was calibrated in a steady state condition because of steady water levels in numerous wells and minimal pumping in the basin. Under steady state conditions, there should not be large vertical gradients, particularly at the boundary. The boundary cells are not important other than to establish head values in the model. The constant head boundaries were developed during model calibration and reflect the most current understanding of the groundwater system in that area. In addition, the water balance and the appropriateness of the boundary conditions will be re-evaluated in the calibration of the model during early ISR operations.

Modeled Material Properties

43. The fracture intensity was assumed to be lower away from the ore body, which resulted in a lower simulated conductivity away from the ore body. This has the effect of containing the simulated effects of mining to the project site. The fracture intensity is much higher in the areas with significant faults (refer to Figure 11).

    EPA Response: EPA agrees that fractures are prevalent with the presence of major faults trending mostly northwest-southeast and mostly absent where faulting is absent, as depicted in the Geologic Model and Fracture Intensity Figure in Attachment A-2 of the UIC Permit

application and the Commenter's Figure 11. The model incorporated available hydrologic and geologic data near the project area with more detailed geology and water level data from the project area. Excelsior provided facture intensity estimates from core samples from numerous boreholes. The UIC application presented the mapped faults and their orientations with the associated fracture intensity information. Fracture intensity was strongest in the area of the ore body based on the mapping. The degree of fracturing and interconnectedness of the ore body system was demonstrated by aquifer testing.

44. A commenter raised several concerns about how the model handles conductivity based on the presentation in Attachment A-2, Table 9:

    a. Permeability, and therefore conductivity, should increase with fracture density, but Attachment A-2, Table 10 has many exceptions that are not logical. Most formations have an example of higher fracture density coinciding with lower conductivity.

       EPA Response: EPA generally concurs with information provided by Excelsior, which describes ADEQ's response to a similar comment on the APP permit. Specifically, ADEQ states that the hydraulic conductivity zones for the Naco, undifferentiated Paleozoics, and Texas Canyon formations were adjusted during calibration of the model. As indicated in Table 10 of Attachment A-2 in the UIC Permit application, the other formations show an increasing K with an increasing Fracture Intensity (FI) except for FI of 0, which is explained in the ADEQ response and in the Precambrian formation, which is unexplained. Further adjustment may be necessary when the model is re-evaluated after the first year and later years of ISR operations.

    b. With the exception of basin fill, there is no simulated difference among Kx, Ky, and Kz. This means the model would treat conductivity in all directions for all bedrock formations equally.

       EPA Response: The model accounts for directional differences in permeability by assigning K values horizontally and vertically based on the extensive core data and the resultant mine geologic model. Although Table 10 (as referenced above) does not include differences in Kx, Ky, and Kz, the directional differences in permeability were taken into account by defining hydraulic conductivity zones and assigning different hydraulic conductivity values to them.

    c. The conductivity values are commonly the same depending on fracture intensity rather than formation type. This suggests there have been too few aquifer tests to justify discretizing among so many formation types. It also suggests that there are no differences among geologic formation types.

       EPA Response: The K value associated with fracture intensity is independent of formation type, according to Section 4.2 in Attachment A-2 of the application and Excelsior's comments regarding this issue. EPA considers that association to be more representative of orebody permeabilities than the individual formations in which the orebody is situated. As Excelsior indicated in its comments, the permeability associated with fracturing is independent of formation type in the area of the ore body (Table 10 shows that the conductivity associated with fracturing values are the same for the Escabrosa, Martin, Upper Abrigo, Middle Abrigo, Lower Abrigo, and Bolsa Quartzite formations).

d. The Groundwater Modeling Report (Attachment A-2 of the UIC application) claims that the formation outside of the orebody is not mapped with respect to fracture intensity, represented by zone 0 for each formation on the table. The claim is that "fracture intensity appears to be strongest in the area of the ore body," therefore the conductivity outside the ore body is usually lower than within the ore body. However, Excelsior did not sample outside the ore body, so there are no data or evidence to support this claim.

EPA Response: EPA believes it is appropriate to assume that fracture intensity and permeabilities are generally lower outside of the orebody due to the absence of faulting and fracturing associated with the Tqm intrusion just west of the orebody and the copper mineralization within the orebody. Excelsior will review these assumptions when the model is re-calibrated after the first year and in later years of ISR operations.

e. Attachment A-2, Table 11 purportedly includes calibrated K values as high as 65 ft/ day, but Figures 21-27 do not show any values greater than 10 ft/d. This is an error in the presentation of the model parameters.

EPA Response: Table 11 is a representation of Storage Zones FI, storativity, and porosity associated with each formation and zone in the model. EPA believes that the commenter is referring to Table 10 of the June 2017 revised UIC application showing the FI and K values for each formation and zone. Because no model cell had a FI of 5, no model cell was assigned a K value of 65 ft/day and the K value of 65 is not relevant to the model results, according to Excelsior's comments providing additional information on this issue.

45. There is no discussion of vertical circulation as part of the conceptual model, meaning the modelers had not expected natural vertical circulation of groundwater flow. It is likely that the numerical modeling allows an unrealistic amount of water to flow at depth through the domain because of vertical K equaling horizontal K, especially at depths below layer 1.

EPA Response: In general, modeled permeability decreases with depth, including vertical K values, which would have the effect of limiting deep groundwater flow horizontally as well as vertically.

46. Attachment A-2 does not provide water balance data, either for the entire model or for individual layers, as is customary for the presentation of groundwater model results. This limits the ability of the reviewer to assess how realistic is the simulated groundwater flow.

EPA Response: Based on information presented in Excelsior's comments and the UIC Permit application, EPA is satisfied that a detailed water balance analysis in the initial groundwater flow model is not necessary but will be addressed in the re-calibration of the model during the long-term ISR operations in accordance with Permit conditions. See also EPA's response to comments above under Regional Hydrogeology.

47. Specific storage was set equal to 0.00001/ft, which ignores the large variability in values found during the pump tests.

EPA Response: Specific storage values under confined conditions were based on an average value of 0.00005. EPA considers that a reasonable assumption since storage values varied widely

in the well tests and within the tested formations. Consequently, the assignment of discrete values of specific storage to the model is impractical and considered unnecessary. See also EPA's response to Comment 4 above.

Model Calibration

48. The rapid change in residual across the site suggests that the conceptual model for the area is inaccurate. Drawdown at NSH-019 had been predicted to be 4.89 feet but the model simulated just 0.01 feet (Figure 17). This is due to the fracture-dominated flow system and the fact that drawdown depends on the observation well being developed in the same fracture system as the pumping well.

    EPA Response: Excelsior provided an explanation of this issue in their comments which EPA considers reasonable and acceptable. The distribution of simulated heads that are too high versus simulated heads that are too low as compared to measured water levels in the Gunnison model shows no particular spatial bias, indicating that the match is reasonable. The conceptual model is considered reasonably valid.

49. Results from pump tests at NSH-015 compared to model simulation demonstrate future problems that will occur with the system. Injection of leachate into a fracture zone that does not have a collection well or a control well will allow flow to exit the system. The model cells are much larger than any fracture zone and the fracture intensity would depend on the observed fractures within the cell.

    EPA Response: The model is a necessary simplification of a complex system and simulation of individual fractures is considered unnecessary, if not impossible, for the purpose and objective of this model. Furthermore, results at 5 of the 6 observation wells matched closely to the pump test results, according to information provided by Excelsior.

50. Based on the information regarding calibration of recharge and material properties at the same time in Attachment A-2, the Gunnison model is nonunique since there are no measurements of recharge, which could affect the predicted results of the project. It is accurate only if the recharge estimates are accurate but there are no measurements of recharge. In addition, the problems with the model being nonunique are that the parameter values may be grossly wrong. This could affect the predicted results of the project simulations and lead to inappropriate assumptions about the operations of the model, especially on a regional basis.

    EPA Response: Recharge is based on measurements of precipitation, which is considered the only significant source of recharge. The groundwater system is modeled in steady state conditions and will be re-calibrated during the long-term ISR operations, in accordance with Permit conditions as discussed above. The model is therefore not nonunique, as claimed by the commenter, in a steady state system.

Model Recommendations

51. The model should be improved with a better conceptual flow model that better accounts for the fracture system near the wellfield due to the faults. It should better simulate horizontal anisotropy as caused by the fracturing. It should have more layers to better simulate the steps in

the observed water table.

EPA Response: EPA considers the model to be a reasonable representation of the geologic conditions and fracture system as stated in numerous responses above. In addition, the Permit requires updating of the conceptual model and groundwater flow model on a periodic basis throughout the life of the project. See Permit condition at Part II.J.

52. The conceptual model should include estimates of discharge from the model domain. These estimates should be targets in the calibration, which would make the model more unique.

EPA Response: As discussed in EPA's responses to comments above (see responses to Comments 1, 42, and 50), discharge is equal to recharge in a steady state system and recharge is a known quantity since measured precipitation is the only significant source of recharge.

Simulation of the ISL System

A commenter asserts that the simulation of particle capture and release is not an accurate representation for the following reasons:

53. Drawdown throughout the mining area caused by pumping only the hydraulic control wells is unrealistic. Without simulating the injection/collection wells, the model does not provide reliable information regarding the effect of the injection/recovery system on local or regional flow paths. The actual injection/recovery wells should be simulated with injection rates depending on the localized conductivity and pressures that would be acceptable for operations.

EPA Response: Because recovery and injection rates in the mine blocks will be in relative balance, the effect of the injection/recovery system on local or regional flow paths would be minimal, and simulation would provide little useful information. If ISR fluids were to escape from an active mine block, the outer IMWs would detect the movement and trigger remedial operations. If warranted by ISR operational performance and monitoring, simulation of the injection/recovery system could be required under Permit terms and conditions for periodic reevaluation of the groundwater model. Part II.J of the Permit states that the groundwater flow model evaluation and updated report shall include updates to the groundwater flow model to assess comparisons of ISR operational performance with model predictions, including particle tracking (fate and transport), and the model shall assess the performance of the operating mine blocks, rinsing of mine blocks, and capture associated with hydraulic control wells. EPA amended the Permit to clarify that simulation of the injection/recovery well performance is included for the assessment of operating mine block performance if warranted by ISR operational performance and monitoring data.

54. Contaminants in the model would be released at the edge of the interior wellfields (Figures 19 and 20), but they would not be under pressure as they will be during operations. During operations, the particles would be released at the beginning of a pressurized stream, which would cause the particle to move faster than simply being placed at given levels in the aquifer.

EPA Response: EPA generally concurs with information provided by Excelsior, which describes ADEQ's response to a similar comment on the APP permit. Specifically, particles may move faster at the initiation of injection but would be captured by adjacent recovery wells or

detected at a nearby IMW if particles were to escape capture at a recovery well. As noted in EPA's responses to prior comments, any detection of a possible excursion at an outer IMW would trigger a remedial operation.

55. The model simulates pathways that are at a minimum 50-feet wide (model cell sizes) which means the properties are effectively an average over an area that wide. This approach would completely miss the potential narrow pathways that could preferentially allow particles to exit the system.

    EPA Response: EPA does not agree with the commenter's assertion. The 50-foot wide cell size is approximately equivalent to the 5-spot injection/recovery well pattern and the fracture pathway system cannot be modeled more accurately with a smaller cell size.

A commenter recommends improving the simulation by doing the following:

56. The model should be discretized into much smaller cells at the mine so that injection/recovery can be simulated more accurately. This could include telescoping the regional model into a much more detailed model at the wellfield. The geology/fracture intensity model should also be used at a smaller scale to provide more detail of flow paths through the wellfield.

    EPA Response: EPA does not agree with the commenter on these points. Decreasing the cell size will not increase the accuracy of model predictions unless the spatial density of data support it. Well spacing in the Gunnison Project is too wide to support a smaller cell size. Additional uncertainties on the parameter values would be created when the groundwater flow model grid size is decreased. More details of flow paths would not be achieved by reducing the scale of the geology/fracture intensity model. See also EPA's response to Comment 55 above.

57. The flow model should be used with MT3DMS to simulate transport from the wellfield to the POC wells. Assuming sources emanating from various positions through the wellfield, the model could simulate a plume that POC wells should be positioned to detect.

    EPA Response: The distance of the POC wells at the eastern boundary of the AOR is much too far to detect a plume during ISR operations and the five-year post-rinsing period, based on predicted particle velocities. That is the purpose of using the outer OWs as monitoring wells, which will be located much closer to the wellfield perimeter and within the 5-year travel time and distance from the wellfield. EPA considers using MT3DMS for contaminant transport modeling unnecessary at this time, but it could be an option for periodic re-evaluation of the model results if warranted based on ISR operations and post-rinse monitoring data.

58. Clear Creek Associates should provide figures similar to Figure 21 for other time periods and for other model layers, and simply maintaining a drawdown is insufficient; it is necessary to maintain a hydraulic low point wherein no flow from the wellfield can escape into the regional flow field.

    EPA Response: Other figures (see Figures 55-63 in Attachment A-2 of the UIC Permit application) are provided depicting the predicted drawdown contours for other time periods and layers. The drawdown contour figures show that no flow escapes the wellfield, and the maintenance of an inward gradient at the OWs ensures that flow will be inward during ISR and

rinsing operations.

Water Quality Monitoring Parameters

Commenters offered the following assertions and suggestions related to the water quality monitoring conditions in the draft Permit:

59. Baseline data should include every known constituent of concern that could degrade groundwater quality in any way.

    EPA Response: All constituents of concern are included in the baseline water quality data. EPA confirmed constituents of concern based on similar Copper Recovery Processes at other mining operations and the sources of information in Excelsior's UIC application, such as the Operating Data, Forecast Compositions, and Geochemical Characterization of In Situ Recovery Process Solutions in Attachment H, the Chemical Characteristics of Formation Fluids in Attachment I, and the proposed monitoring of analytes in Attachment P. In addition, prior to commencement of operations, the Permit conditions at Part II.E.6 require injection solution reporting to identify any additional constituents to ensure representative data on its characteristics and expand the groundwater monitoring program, if necessary.

60. Excelsior and EPA must demonstrate that they are committed to the preservation of baseline water quality.

    EPA Response: The UIC Permit terms and conditions ensure the protection of USDWs, the environment, and the health of persons. The water quality standards described in the Permit require protection and aquifer restoration to baseline water quality or SDWA maximum concentration levels (MCLs) provided at 40 CFR Part 141 if baseline water quality is less than the MCL for constituents with MCLs.

61. Water quality parameters for Level 1 and 2 alert levels must be determined and included in the draft Permit, and subject to public comment. Before a final Permit is issued, EPA must establish both concentration and mass-based limits to all parameters. Sampling requirements for Level 1 should be no more than monthly and level 2 shall be no more than quarterly.

    EPA Response: The draft UIC Permit requires the determination of Level 1 and 2 alert levels (ALs) when the OWs, POC wells, and the HC wells used as monitoring wells are drilled and prior to commencement of ISR operations. The Permit requires ALs to be established by the Permittee for Level 1 and 2 analytes subject to review and approval by EPA as described in Attachment P in Appendix I of the Permit or based on other methods approved by EPA. In Attachment P, the ALs will be established based on the statistical methods from ADEQ's standard methodology. For clarification, EPA inserted in Appendix I of the UIC Permit the statistical methods to be used as described in the APP condition at section 2.5.3.1.2.1. ALs will be determined based on baseline sample results after OWs, POC, and other monitoring wells are constructed. The ALs will be incorporated into the Permit without public comment because the ALs are set from average baseline conditions in each well and using a standard statistical method for quality control of sampling results as described by the ADEQ methodology referenced in the Permit. The rationale for mass-based limits and more frequent monitoring is not well supported by the commenter and does not warrant inclusion as a Permit condition.

62. If vertical mixing of contaminants is determined to pose any risk of spreading pollutants in potential pathways to wells within a five-mile radius, EPA should require the complete plugging of any well that maybe affected.

EPA Response: There is no evidence in the record indicating that any wells or USDWs would be impacted beyond the AOR, based on the Zone of Endangering Influence evaluation of the Gunnison ISR project (see the UIC requirements at 40 CFR §146.6). Thus, EPA did not consider contingencies for the plugging of abandoned wells beyond the AOR.

63. At all monitoring wells, including the additional ones requested in these comments, a third-party laboratory should collect and analyze data on the frequency requested above. Any detectable change beyond the alert limit at monitoring wells shall be published online.

EPA Response: Samples will be analyzed by a third-party laboratory on the schedule required by the Permit and the results will be reviewed by EPA. The reports will be available to the public upon request.

64. Some of the in-situ chemicals are proprietary but they all must be monitored regularly: in pregnant leach solution, water treatment plant effluent, evaporation and drain ponds, raffinate pond, the recycled water pond, and any runoff from the SX-EW plant. These are sources of pollution related to and sometimes beyond what is actually injected into the ground.

EPA Response: The lixiviant and in-situ solutions will be monitored on a regular basis as required by the UIC Permit. The solutions at the surface will be regulated under the APP permit issued by ADEQ.

65. Determining the source of pollution for a monitored exceedance at Gunnison in any circumstance beyond an obvious surface spill a (common problem with uranium in-situ) will be difficult. For example: which of the 1,434 wells that are up to 1,400 feet deep and injecting up to 25,600 gallons per minute of acid solution into the ground, at a pressure and rate that is unknown, could be responsible for an exceedance of water quality standards?

EPA Response: Subsurface water quality standards will be monitored at the IMWs, OWs, and POC wells, not at the injection wells. If an exceedance occurs at one of these monitoring wells, the location of ISR fluid movement would be known and corrected by adjustment of ISR operations in the wellfield area and/or pumping rates at HC wells. As long as containment of ISR fluids to the wellfield is achieved as required in the Permit, identifying the source of a potential exceedance is not essential for compliance.

66. Excelsior should be required to make the results of monitoring available to the public.

EPA Response: As noted in several responses above, monitoring results will be made available to the public upon request.

67. Some commenters provided recommendations related to the monitoring schedule. These comments and EPA's responses are presented below:

    a. Monitoring at all wells is requested: monthly during the first year of commercial production; bi-monthly in the second year; quarterly in years 3-5; and biannually thereafter.

EPA Response: The commenter does not clearly state which wells should be monitored for which parameters and provides no rationale for an increased frequency of monitoring. EPA considers the monitoring frequency included in the Permit to be sufficiently protective. Specifically, the injection wells will be monitored for rates and pressures continuously. SC will be monitored in IMWs, outer OWs, and HC wells daily. Water quality in outer OWs and POC wells will be monitored on a regular basis as specified in the UIC Permit.

b. The Permit should include mandatory biannual monitoring requirements of existing wells on private property for those who request it within at least a five-mile radius.

EPA Response: EPA does not have authority to require monitoring of existing wells beyond the AOR under the UIC permitting regulations, and there are no water wells located within the AOR. The Permit terms and conditions for ISR operations, aquifer restoration, and monitoring are written to protect USDWs and existing water wells, within the area of influence of the project, from endangerment due to ISR operations.

Area of Review Delineation

Commenters raised concerns about the delineated AOR and the guidance on which EPA based the AOR evaluation. These concerns and EPA's responses are provided below:

68. It is unclear/not well justified why the AOR only includes the Project Area or the approach to determining the size and scope of the AOR for the project. In particular, commenters asserted the guidance EPA used to determine the AOR was applied for the first time in Region 9 in permitting the Gunnison project, and expressed concern that it has not been subject to public comment. Commenters further contend this potentially constitutes a de-facto rulemaking whereby EPA established precedential guidance without consulting the public, thereby violating the Administrative Procedures Act. If guidance for the Gunnison Project was developed uniquely and is not primarily or entirely the same as the Dewey-Burdock guidance, and if such guidance sets a precedent that impacts the future permitting activities of Region 9 or any other EPA region regarding implementation of the UIC program, then such guidance is also rightfully considered a de-facto rulemaking. EPA must make publicly available all documents and correspondence involved in creating the guidance and re-notice the draft UIC for a new 90-day comment period.

EPA Response: The EPA based the AOR delineation on the "zone of endangering influence," which is defined in relevant part at 40 CFR §146.6(a)(ii) as "the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause migration of the injection and/or formation fluid into an underground source of drinking water." EPA Region 9 previously applied this AOR delineation approach to the Florence Copper Class III ISR Permit issued in 2017 for a ISR copper mining project located approximately 104 miles northwest of the Gunnison Project. EPA Region 9 had also applied the same approach to AOR delineation in the initial Class III ISR Permit for the commercial scale BHP Florence Copper Project in 1997. EPA described this approach to AOR delineation in the draft Permit for the Excelsior project and in the statement of basis for the Permit and the Record of Decision for the Aquifer Exemption. Moreover, these documents were the subject of a 120+ day public comment period

and a public hearing held in Dragoon, Arizona on February 27, 2018 at the request of public commenters.

EPA does not agree that following the recommendations of Agency guidance constitutes de-facto rulemaking. EPA guidances are interpretations of the UIC regulations and are only intended to provide recommendations to permit applicants and permit writers on applying the regulations to real-world situations. As noted, the draft Permit (including the proposed AOR) was subject to a substantial public participation process.

69. In the case of the Dewey-Burdock project, the AOR included a 1.2-mile buffer zone from the Project Area (the area of hydraulic control). This differs significantly from the Gunnison AOR, which essentially only includes the Project Area. EPA should explain and justify defining the AOR as being essentially the same as the area of hydraulic control, as opposed to a much more comprehensive AOR that includes surrounding groundwater and cites monitoring wells some distance from the area of hydraulic control.

    EPA Response: The AOR for the Gunnison Copper Project is based on the "zone of endangering influence," which is defined at 40 CFR §146.6(a)(ii), as described above. The more extensive AOR for the Dewey-Burdock project was based on the NRC guidance for groundwater resources rather than a fixed distance of ¼ mile from the project boundary or an AOR based on calculation of the zone of endangering influence. AOR delineations and approaches are specific to the site characteristics and local hydrogeology. The Gunnison Project AOR is delineated at a distance of approximately 1,200 feet downgradient of the eastern limits of the wellfield, the project area boundary in the upgradient direction to the west, the project area southern boundary, and 250 feet from the northern perimeter of the wellfield. This AOR represents the area where injected fluids may migrate or result in pressure influences, based on modeling of fluid movement performed by the applicant. This modeling approach, evaluated by the EPA as part of the Class III Permit application evaluation, incorporates the geologic characteristics and operational controls of the proposed project and is consistent with 40 CFR §146.6(a)(ii). Groundwater modeling demonstrates containment of ISR fluids, and maintenance of an inward gradient at the wellfield perimeter will promote containment of fluids within the AOR boundary. OWs at the wellfield perimeter will be monitored for water levels to ensure an inward gradient is maintained and water quality to detect any exceedance of SC, ALs, and AQLs before reaching the AOR boundary. IMWs within the wellfield will provide an interior perimeter for daily monitoring of any SC exceedances, and POC wells at the AOR boundary will provide a third line of defense against any potential excursion of contaminants beyond the AOR.

Cumulative Impacts Analysis and NEPA Review

70. While it is understood that EPA regulations do not require formal National Environmental Policy Act (NEPA) compliance for UIC permitting actions, this exemption is premised upon the EPA process providing the "functional equivalent" to a NEPA study. The supplemental comments submitted for the hearing by numerous groups on February 26, 2018, have stressed the legal and technical need for a cumulative review, which would be equivalent to analysis carried out under the National Environmental Policy Act. EPA must complete a Cumulative Impacts Analysis in a revised/supplemental UIC Permit. This analysis must include cultural impacts, social impacts, socioeconomic impacts and long term cumulative environmental impacts. Once completed and

incorporated into a revised/supplemental UIC Permit, it should be re-noticed for a new 90-day public comment period.

EPA Response: EPA complied with the regulatory provisions at 40 CFR §144.4 ("Considerations under Federal Law") applicable to the issuance of this Permit as described in the Statement of Basis for the Draft Permit. Moreover, EPA's General Program Requirements at 40 CFR 124.9(b)(6) provides that "all [UIC] permits are not subject to the environmental impact statement provisions of … [NEPA]."

In addition, the cumulative effects of drilling and operation of all proposed injection wells were considered during the evaluation of the Class III area Permit application, in accordance with 40 CFR §144.33(c)(3). The draft Permit incorporates terms and conditions that account for the cumulative impacts of the Gunnison ISR Project development, operations, and aquifer restoration over its 23-year life. Stage 3 ISR operations may be modified, based on a review of the experience and results of Stage 1 and 2 ISR operations. Final plans for Stage 3 development, operations, and aquifer restoration will be reviewed by EPA for compliance with Permit terms and conditions before Excelsior is authorized to proceed with Stage 3 development. If major modifications of Permit requirements are proposed or warranted, EPA would review the cumulative effects of the modifications, initiate a public participation process, and consider public comments before making a final decision on the proposed modifications to the Permit.

Radionuclides

71. Some commenters expressed concern about groundwater contamination associated with the geology at southern Arizona copper mines. Southern Arizona copper mines have a history of releasing radioactive substances (although less than uranium mine pollution "plumes") and certain heavy metals into groundwater**.** These may be naturally part of the ore body but are released usually by acidity from mining activity. The same constituents may be of concern to monitor at Gunnison coupled with other chemicals that will be specifically used in the injection process as well as at the Johnson Mine SX-EW plant. Commenters request expanding the list of radioactive chemicals and elements sampled in monitoring wells and that mass-based limits be set and sampled monthly for all radioactive compounds. Sampling of the pregnant leach solution, the water treatment plant effluent, the pipeline drain pond, the evaporation pond, the raffinate pond, the recycled water pond, and the plant runoff pond for radioactive chemicals and elements should also beconducted on a regular basis.

EPA Response: The BHP Pilot Test operations at the Florence Copper ISR facility (a southern Arizona copper site) were successful in restoring the aquifer to water quality standards for all monitored constituents, including radionuclides. This Permit, at Part II.F.2, requires monitoring for forty-two (42) chemical constituents, including radioactive substances and heavy metals. The commenters did not identify additional radioactive constituents or chemicals of concern to be monitored. All parameters and probable constituents of concern to EPA will be monitored in samples collected from the outer OWs, POC wells, and HC wells serving as monitoring wells and from the injectate. EPA considers the sampling and monitoring program outlined in the Permit for the Gunnison project to be adequate and fully protective of USDWs located beyond the exempted area. Sampling of fluids in surface impoundments for radioactive substances or other elements is not applicable to the UIC Permit. If applicable to ADEQ requirements, the APP would address those concerns.

72. Earthworks and other groups have studied these operations as well and have been unable to find a single case in which uranium ISL operations have *not* resulted in groundwater contamination. A study published by the U.S. Geological Survey in 2009 found that *"To date, no remediation of an ISR operation in the United States has successfully returned the aquifer to baseline conditions."*

    EPA Response: The commenter refers to restoration results at ISR uranium mines, which have had documented challenges in returning *all* constituents to baseline conditions. Restoration results at ISR copper operations at the Gunnison site are not directly comparable to results at uranium ISR mines due to numerous factors, including differences in geological settings, geochemical reactions, and mobilizing solutions applied to recover copper versus uranium. Uranium ISR mines in the United States are typically in unfractured sedimentary deposits while the copper deposits at the Gunnison site occur in highly faulted and fractured sedimentary rocks. Moreover, groundwater restoration at the BHP Pilot Test site was successfully demonstrated by Merrill Mining in 2004 and approved by EPA in July 2005, seven years after restoration operations began. No exceedances related to the BHP operations have been detected at the POC wells since that time. Here, EPA has included a Permit condition for continued groundwater monitoring beyond five years, if necessary, to assess groundwater restoration stability during the post-rinse monitoring period.

Corrective Actions as Conditions of Approval

The commenters suggested the addition of several Permit conditions on corrective actions. These suggestions, and EPA's responses, include:

73. The Permit should require that ADEQ, Excelsior, and all interested civic groups meet immediately, if and when any detectable change beyond the alert limit occurs to discuss the specific nature of the baseline deviation, and what may be the cause of it.

    EPA Response: Excelsior shall notify EPA of verified water quality exceedances and comply with contingency plans to evaluate, report, and mitigate the exceedance in accordance with Permit conditions at Part II.H.2. Upon review of the report documenting the AL or AQL exceedance and mitigation of the exceedance, EPA may require additional monitoring and/or action beyond those specifically listed in the Permit. EPA is not required to notify or involve the public in contingency actions for addressing exceedances that are corrected without formal enforcement actions. However, if EPA takes any formal enforcement action to address Permit non-compliance, then there would be public notice of EPA's actions. In addition, if ISR operations and monitoring data indicate that the existing Permit conditions need to be modified to ensure protection of USDWs, EPA could re-open the public participation process and modify the Permit.

74. If the exceedance continues for six months, Excelsior must cease all injection operations, or, if the problem appears to be local and specific to monitoring wells next to liquids storage facilities, those facilities shall be drained and repaired immediately. If any analytes exceed state and/or federal maximum contaminant levels for groundwater that were not already exceeded in the baselines, Excelsior must cease all injection operations, immediately drain liquids from impoundments, and repair the leak(s). During this cessation period, EPA, Excelsior, and civic groups shall convene to attempt to reach consensus about the cause of the

exceedances and produce a plan for immediate corrective actions. Once the corrective action plan is created and implemented, injection of lixiviant shall cease until the affected monitoring wells return to baseline. If conditions fail to return to baseline or continue to worsen, rinsing operations shall begin per the UIC Permit procedures, and Excelsior shall not be permitted to stop rinsing or continue reinjection until conditions have returned to baseline.

EPA Response: The actions required at Part II.H of the Permit ("Contingency Plans") are adequate and fully protective of USDWs. Contrary to the commenter's assertion, an exceedance shall not be allowed to continue for six months without contingency actions to evaluate, report, and mitigate it, in accordance with Permit conditions at Part II.H.2.

Financial Assurance

Several commenters raised concerns about whether the financial assurance conditions in the Permit are adequate to address potential contamination of the site. These comments and EPA responses include:

75. The state has required a $9.524 million closure and post-closure bond to "return the site to original groundwater and surface conditions." EPA has issued a bond requirement of $8.792 million, and neither agency has offered a justification for the amounts. While the draft Permit requires a bond, the draft Permit and supporting documents do not supply any information about how this bond was calculated and whether it is sufficient to protect the public from any liability for cleanup if the bond is insufficient. The Permit must contain the bond calculations and rationale and be reissued for public comment.

    EPA Response: The EPA bond amount is based on third-party cost estimates to close, remediate, restore, and monitor the Stage 1 wellfield water quality for five years or longer if necessary. The estimated cost to remediate an excursion of ISR fluids is also included in the bond amount. EPA considers this bond amount adequate to provide financial assurance for closure of Stage 1 operations covering the maximum closure costs occurring in Year 10 as described in Attachment R-3 of the UIC Permit application. The Permit requires that upon EPA request, Excelsior shall review and update the level and mechanism of financial responsibility. In accordance with the Permit, EPA will require Excelsior to provide estimated closure costs and updated financial assurance for Stage 2 and 3 operations before initiating drilling and ISR operations in those stages. These estimates will be part of the Permit record and will be reviewed for acceptance by EPA in accordance with Part II.L of the Permit, 40 CFR 144.52(a)(7), and 40 CFR Subpart F before Excelsior will be authorized to begin those operations. Periodic review of the financial responsibility demonstration will ensure that the cost estimate is sufficient for each stage in the operations and key information, such as documentation and financial strength criteria, is up to date. EPA added Attachment R-3 of the Permit application, Closure Plan and Cost Estimates for the Gunnison ISR Stage 1 Wellfield, to Appendix C referenced to the Attachment in Part II.L of the Permit.

76. Depending on how far the plume escaped and other factors, one might be able to gain hydrologic control over the plume, but it could be a perpetual pump-and-treat situation. Otherwise, groundwater flows very slowly, and returning to baseline conditions would likely take thousands of years or longer. If "perpetual" pump and treat is needed, who will perform this for centuries, and what will the real expenses be?

EPA Response: Groundwater flows very slowly to the east of the project area but rinsing operations will greatly accelerate flow to the recovery wells and HC wells, resulting in greatly accelerated restoration and reasonable closure costs. Rinsing to restore the aquifer to pre-mining water quality or MCLs is expected to reach that goal within three years, based on geochemical modeling, but will continue longer if necessary. Closure verification wells will monitor for rebound of contaminants within the wellfield and OWs and POC wells will monitor any potential movement of contaminants beyond the wellfield for five years or longer after rinsing stops. The commenter's assertion of perpetual remediation is unfounded, based on the restoration experience at the BHP Pilot Test site. Also, the Permit's financial assurance requirements are subject to periodic review and adjustment to account for actual closure, remediation, restoration, and monitoring costs experienced during each stage of operations.

77. Commenters request a guarantee of future water quality of the same high quality as exists today. Specific requests include: 1) a legal guarantee that no contamination will occur, 2) a multisector committee overseeing monitoring data with the ability to require restoration to baseline analyte levels from the mine, and 3) when or if contamination does occur during operation, closure, or post closure, it will be restored to current quality, backed by adequate financial resources.

    EPA Response: The Permit was written in accordance with the SDWA and UIC regulations, which require protection of underground sources of drinking water for potential future use. The Permit specifically requires Excelsior to restore the exempted aquifer to federal MCLs or initial background levels, if higher, to ensure this protection of USDWs outside the exempt area. The Permit also includes financial assurance requirements that EPA considers adequate, based on our review of the third-party cost estimates for closure, restoration, and monitoring operations and experience with the BHP Pilot Test site as discussed in the response to Comment 75 and similar comments above.

General Comments on the Gunnison ISR Project

The commenters expressed the following general concerns about the Gunnison ISR Project:

78. This project would utilize a largely untested technology for copper production and carries the potential to contaminate groundwater on which multiple communities and businesses rely. While copper ISL has been utilized on an experimental basis at existing hard rock mines, site conditions and engineering designs at those projects are so different that forming useful environmental comparisons to a greenfield project is not realistic.

    EPA Response: Based on the operational standards, monitoring requirements, contingency, closure and restoration requirements, and existing geologic setting at the project site, EPA believes the activities authorized by the Permit are protective of USDWs defined at 40 CFR §144.3, as required by the SDWA. EPA Region 9 issued another Class III ISR Permit, and copper ISR technology was tested successfully, at the BHP Pilot Test site in 1997 and 1998. Commercial scale operations were deferred due to depressed copper prices. Aquifer restoration of the pilot project was completed successfully in 2004. ISR technology has been utilized for recovery of uranium in Wyoming and Texas for decades. Operational and monitoring adjustments may be required if warranted based on operational experience, monitoring, and model re-evaluation after the first year and later years of ISR operations. In addition, if ISR operations and monitoring data indicate that the existing Permit conditions need to be modified to ensure protection of USDWs, EPA could re-open the public participation process and modify

the Permit.

79. Conceptual flow models of the project area and downgradient of it indicate that existing water wells could be permanently compromised in a contamination scenario, including the town of Dragoon's municipal supply well and the Amerind Foundation's wells.

    EPA Response: The existing Dragoon and Amerind Foundation water wells are not downgradient of the Gunnison Project injection wells, based on water level maps of the regional aquifer included in the UIC Permit application. Groundwater modeling and particle tracking analysis indicate that the groundwater flow is predominantly toward the east and groundwater from the Gunnison Project area would not reach the existing wells for hundreds of years. The Permit's requirements for hydraulic containment and aquifer restoration are designed to prevent the escape of ISR fluids from the wellfield, and monitoring wells within and beyond the wellfield perimeter will be located to detect any potential contaminants that might escape recovery well and HC well extraction.

80. Several comments raised concerns about the potential for contamination and other impacts to local communities near the mine. These comments and EPA's responses include:

    a. In-situ uranium mines throughout the world, using alkaline as well as acidic (as in the Gunnison project) solutions to leach uranium have a history of leaving groundwater polluted and unable to remediate back to baseline levels of potability. Commercial in-situ recovery for copper mining is a new, untested technology; uranium mining is the only analogue, and contamination is common at these sites.

       EPA Response: Uranium ISR mines apply similar technology but are not directly comparable to copper ISR mining technology for reasons discussed above in EPA's response to Comment 72 and 78 Refer also to responses to similar comments under the heading of "Radionuclides" above. The BHP Pilot Test was permitted as a commercial copper ISR project at the Florence Copper site, as discussed above, and serves as an analog to the Gunnison Project.

    b. Local residents say their greatest concern is the safety and health of their community, people, their institutions and businesses, now and in the future, for centuries to come.

       EPA Response: EPA understands and appreciates the commenters concerns; however, the Gunnison ISR Project Permit conditions were written to ensure that the Project will have no negative impact on and protect USDWs and existing water supply wells in the area.

    c. At full field production, up to 1,424 wells and boreholes that are up to 1,400 feet deep will have been drilled through 600 feet of gravels and below the water table of the non-recharging Willcox aquifer into this fissure prone area and each will have to be monitored and lighted 24 hours a day, 7 days a week for 20 years.

       EPA Response: The commenter does not identify a specific concern. Only a relatively small portion of the 1,424 wells will be open and active at any given time as ISR and rinsing operations proceed in three stages and inactive mine blocks are deactivated and ISR wells are closed.

    d. Toxic chemicals will be transported along I-10 and no information has been provided

regarding who will be responsible for any accidents during transport; specific monitoring plans for the water treatment plant effluent, evaporation and drain ponds (which Excelsior's 2014 publicity documents say will be covered with a tarp); or plans for continuous monitoring of the raffinate pond, the recycled water pond, the sludge storage tanks, and the runoff from the SX-EW plant.

EPA Response: Chemical product transportation and surface facilities are outside the scope of the UIC permit under the authority of the SDWA. However, the Arizona Department of Public Safety and the state Department of Transportation are responsible for ensuring safe transport of hazardous materials in Arizona based on the U.S. Department of Transportation federal guidelines and regulations. The ADEQ's APP regulates the pond facilities at the project site with design, discharge, operational, inspection, and monitoring requirements. The UIC Permit terms and conditions address compliance with the ISR well requirements and subsurface operations.

e. The in-situ mining method, by definition, intentionally pollutes groundwater.

EPA Response: In-situ copper recovery (ISCR) mining is a technology that allows recovery of copper from an underground ore body by injecting a solution into the ground to extract the copper and remove it. Solution mining through injection wells is an option that can minimize the environmental footprint and potential impact to surface water compared to more traditional open pit mining processes. To prevent contamination of ground water, more fluid is extracted than is injected in the mining processes, thus preventing fluids from moving out of the mining area. The impacted groundwater is contained within the wellfield perimeter, which is an exempted aquifer under the UIC program. When ISR operations are completed, the aquifer is restored to baseline conditions or MCLs to ensure protection of USDWs outside the project area.

f. How will the excess water that is produced and not re-injected and the solid wastes in the ponds be treated or managed?

EPA Response: Excess water will be evaporated at the evaporation pond designed to meet ADEQ requirements for environmental protection. Solid precipitates will be stored in the Solids Impoundment during the project operations and properly disposed of during closure in accordance with State requirements. The evaporation and solids ponds will be managed in accordance with the APP.

g. How will injection operations impact unknown faults or fractures?

EPA Response: Injection operations are not expected to have any impact on unknown faults or fractures. Injection pressures are limited in the Permit to 0.9 times the lowest fracture gradient of all formations open to injection and formation pressures for the specific purpose of ensuring that fractures are not initiated from injection operations; existing faults or fractures will not increase over time because more fluids will be extracted than injected into the orebody.

h. What would happen in the event of a major earthquake? A seismic study should be performed.

EPA Response: There was a reference listed in the feasibility study for the project that discussed seismic activity in southern Arizona, which provided information on five seismic

events occurring since 1938 ranging in magnitude from 4.5 to 5.5. Four of those events occurred in 1938 to 39, and one occurred in 2014. Lesser seismic events are apparently fairly common. The reference is the Arizona Geology Magazine, Seismic News, October 17, 2014.

The risk of earthquake damage to infrastructure and wells that could affect a USDW is very low since the wells and surface facilities are contained within the AOR and AE boundaries wherein no USDWs exist. The wells will not penetrate the sulfide zone below the exempted zone (200 feet into the sulfide zone), so a well collapse or damage due to an earthquake would not impact a USDW (if it exists) in the non-exempt portion of the sulfide zone. Movement of existing faults in the project area would not be expected to affect containment of ISR fluids to the wellfield since maintenance of an inward gradient and over-extraction of fluids is required. Well damage that causes a loss of mechanical integrity would be remediated when detected by monitoring and/or Mechanical Integrity Test (see Part II.E.3), as required under contingency plans and actions included in the Permit.

i. Contamination may affect the down-gradient parts of the formation, including water wells.

EPA Response: Downgradient water wells and parts of the formation will be well protected by hydraulic control wells, an extensive monitoring well network, restoration of the aquifer to water quality standards, and post-rinse monitoring of water quality in the wellfield and downgradient of the wellfield.

j. The Permit should describe how the public would be notified in the event of contamination.

EPA Response: As described in several responses above, EPA believes the Permit's terms and conditions will ensure compliance with the SDWA and protection of USDWs from contamination. An uncorrected release of contaminants to a USDW would represent a significant violation of the Permit terms and conditions, and public notification would be provided in the process of a formal enforcement action against the permittee.

k. Does EPA have the ability to oversee the operation given reductions in agency staff?

EPA Response: Yes, EPA Region 9 has a sufficient level of staffing to oversee the Excelsior Permit, and ensure compliance with the terms and conditions.

Several comments raised concerns about other regulations, permits, and evaluations associated with issuance of the UIC Permit. These concerns and EPA's responses include:

81. A commenter strongly disagrees with Excelsior's claim that "there is no active water use downstream or nearby the site, there's no one living nearby, no special scenic value."

EPA Response: The UIC Permit requires Excelsior to operate the project in a manner that is fully protective of USDWs and existing drinking water wells located within the AOR and downgradient of the ISR operation.

82. The historic preservation review process for this Permit is inadequate and needs to be redone before a final Permit may be granted. The historic preservation review process should include cultural and archeological surveys at a minimum. The assessment should also give attention to the landscape scale, indirect, and cumulative effects to the well- known historic property

complexes in the immediate vicinity.

EPA Response: EPA is required to meet the statutory responsibilities under Section 106 of the National Historic Preservation Act (NHPA). The Statement of Basis for the Draft Permit describes EPA's compliance with the NHPA, which included EPA's consultation with the State Historic Preservation Officer as required by that law. Refer to Statement of Basis at page 3. EPA consulted with the Arizona State Historic Preservation Office (SHPO) by letter dated March 15, 2017, describing the project, the area of potential effect, steps taken to identify historic properties, and the proposed finding of no historic properties affected. The SHPO concurred with EPA's finding that no historic properties will be affected based on the information.

83. The impacts to wildlife and habitat within and near the project area should be evaluated. Twelve special status species occur within five miles of the Project, including the federally listed Lesser Long-nosed Bat and Chiricahua Leopard Frog. Also, 79 Species of Greatest Conservation Need and 12 Species of Economic and Recreation Importance occur within five miles of the Project. A significant number of federally listed wildlife species may occur in the area.

EPA Response: Under Section 7 of the Endangered Species Act (ESA), EPA is required to ensure that any action authorized by the Agency does not jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat. The Statement of Basis for the Draft Permit describes EPA's compliance with the ESA and confirms that EPA consulted with the U.S. Fish and Wildlife Service (USFWS) as required by that law. Refer to Statement of Basis at page 2. EPA informally consulted with the USFWS of the Arizona Ecological Services Field Office by correspondence dated April 14, 2017, on the determination that the proposed project may affect, but is not likely to adversely affect, the lesser long-nosed bat listed as an endangered species under ESA. EPA provided the USFWS a copy of the biological evaluation prepared by Excelsior on December 15, 2016, which documented the screening for the potential occurrence of special-status species at the project area and the evaluation of the effects from the proposed action. The USFWS concurred with our determination that the proposed action may affect, but is not likely to adversely affect, the lesser long-nosed bat and required no additional consultation. EPA also determined that the proposed action will have no effect on other listed species in Cochise County because the project area is outside of their known ranges or field surveys confirm no detections in the project area. Listed species with "no effect" determinations do not require review by the USFWS.

84. If EPA grants an aquifer exemption for the project, a current and future source of drinking water would be permanently compromised.

EPA Response: As described in the Statement of Basis (see page 12), EPA has reviewed whether the portion of the proposed exempt aquifer that will be impacted by the Project meets the regulatory criteria for exemption in 40 CFR §146.4(a) and (b)(1). Based on this review, EPA concluded that the portion of the aquifer that would be impacted by Project operations meets the criteria for an Aquifer Exemption because it: 1) does not currently serve as a source of drinking water; and 2) will not serve as a future source of drinking water because it contains minerals that are expected to be commercially producible. Additional detail about EPA's Aquifer Exemption review and conclusions are provided in a Record of Decision that is part of the Administrative Record for this UIC permitting action.

85. The groundwater is the sole source of local drinking water and is potentially threatened.

EPA Response: The exempted aquifer at the Project site does not currently serve as a source of drinking water. In addition, as described in responses to similar comments above, the non-exempt portion of the aquifer surrounding the exempt portion of the aquifer will be protected from contamination by the terms and conditions of the Permit.

86. The mine is on Native American lands that have been occupied for 13,000 years, with a long cultural history.

EPA Response: The proposed project area is on a parcel of 66.85 acres of Arizona State Trust land and 265.88 acres of private land. The proposed project area is not on Native American land based on the information provided in the cultural resources research report and the UIC application materials. The closest Indian Tribal lands to the project area are approximately 60 miles away. EPA reviewed current and past cultural resource surveys covering the existing and proposed project area compiled in Cultural Resources Inventory Reports by West Land Resources for Excelsior. Based on this information, EPA was satisfied that further investigation of cultural resources was not necessary for the project area under the historic preservation review process requirements mandated by Section 106 of the NHPA, and the Arizona SHPO concurred with EPA's NHPA findings. See the response to Comment number 82 above for additional information regarding EPA's review and compliance with the NHPA.

87. A commenter and local resident, living in a home located approximately two miles south-southwest of the Gunnison Project site, expressed concerns about the risk of contamination of the aquifer that supplies his private water well on the property. The resident wants an analysis to establish a base characterization (background standard), to have for any future issues, including the potential sale of his property, especially given the unique nature of our water source and the shallow depth.

The resident is concerned about losing his well or having its water quality degraded. A poorly handled exploration drill-hole or accidental tool- loss, could cause an open hole. Incomplete plugging could also drain away the aquifer or negatively change the fragile aquifer quality with foreign water.

EPA Response: The commenter's well is located approximately two miles beyond the Project AOR and is not downgradient of the Gunnison wellfield. According to water level mapping in Figure 13 and the geologic model depicted in Figure 17 of Attachment A-2 of the UIC Permit application, this well is upgradient of the wellfield and outside of the major fault and fracture zones that transect the Project area. Moreover, over-extraction and maintenance of an inward gradient at the wellfield is designed to contain ISR fluids within the wellfield. Water quality monitoring at IMWs, outer OWs, non-pumping HC wells, and POC wells will detect any excursions of ISR fluids and trigger corrective action to reverse the excursions. Furthermore, the subject water well is located two miles beyond the AOR boundary and not at risk of contamination by an escape of ISR fluids, based on the geologic and groundwater simulation models developed by the applicant and evaluated by EPA. The model will be re-evaluated periodically by Excelsior, based on operational and monitoring data, and remedial/operational adjustments may be required in accordance with the results of those re-evaluations. However, the

UIC Permit does not require water quality monitoring at private water wells located beyond the AOR boundary.

In addition, the UIC Permit will authorize the drilling of new wells only within the AOR and those wells will be constructed and eventually plugged and abandoned in accordance with Permit conditions. All existing coreholes and non-Class III wells located within 100 feet of an active mine block shall be properly plugged and abandoned, if not converted for temporary use as IMWs, before the mine block is activated.

Excelsior Mining Corporation Comments (Permit Conditions noted):

Part II.F.1. Monitoring Program

88. Excelsior proposed changes to the monitoring program at the eastern boundary of Block 1 operations during the first years of ISR operations. They recommended three additional HC wells should be installed and monitored instead of the three OW pairs prior to year 1. Excelsior asserts that monitoring of the three HC wells at the eastern boundary would be consistent with HC well monitoring at the southern boundary.

    EPA Response: This proposed change is consistent with the HC well monitoring protocol approved for the southern wellfield perimeter. EPA agrees with the proposal and has revised the permit conditions accordingly, consistent with provisions for HC well monitoring at the southern boundary. This change is justified because it will allow conservation of groundwater and allow earlier detection of an excursion as compared to monitoring at the associated outer OWs. In addition, monitoring SC at the outer IMWs within the wellfield and the distance of the first mine blocks to the eastern wellfield perimeter reduces the risk of an excursion reaching the perimeter and the HC wells in the early years of ISR operations. Furthermore, the distance and long groundwater travel time from the first mine blocks to the eastern AOR boundary allows ample time to detect and correct any potential excursion, preventing the risk of endangerment of USDWs located downgradient of the wellfield, especially since the carbonate rocks through which groundwater flows will increase its pH and tend to attenuate residual metals concentrations in the groundwater. If the IMWs and/or HC wells detected an excursion, pumping would be initiated immediately at the HC wells to capture ISR fluids before breaching the wellfield perimeter and the associated OWs would be installed.

89. Excelsior requests that the use of hydrasleeves and other non-purging methods be allowed as an alternative to purging three wellbore volumes before collection of water samples from the HC wells.

    EPA Response: The use of hydrasleeves is usually applicable only when purging the wellbore causes the well to go dry and not recover within 24 hours. Thus, EPA amended the Permit to allow this type of sampling device instead of purging the wellbore before collection of water samples with further justification that demonstrates hydrasleeves or similar device provides an equivalent sample quality or are necessary due to very low recharge rates. EPA also supports and recommends the Groundwater Monitoring and Sampling Protocols described at Section 2.5.3 in the APP. Hydrasleeves or similar devices would be applicable and considered for collection of water samples in wells that display stratification of water quality and at the intersection of high permeability zones and preferential pathways in a wellbore.

90. Excelsior claims that demonstration of an inward gradient is not necessary to control mining solution in the first few years of operations and that pumping of the HC wells used for monitoring would be wasteful of the groundwater resource.

    EPA Response: EPA agrees that the demonstration of an inward gradient is not necessary in the first year and included this clarification in the Permit, with further clarification that wellfield extraction rates shall still exceed injection rates regardless of the inward gradient monitoring. Excelsior provided modeling results that show demonstrating an inward gradient for the inactive HC wells is not necessary to control the mining solutions in the first few years of operations. Refer to the response to Comment 88 for a description of the justification for this recommended change to permit conditions. If an excursion is detected at one of the HC monitoring wells, the permit requires that the associated OWs be drilled and monitoring be activated as soon as possible. An inward gradient of 0.01 ft/ft must be maintained at each observation well pair when the associated HC wells are pumping.

91. Excelsior provided revised language for Part II.F.1 of the draft Permit that would be consistent with their above comments regarding the water quality monitoring program.

    EPA Response: EPA considered the proposed language revisions and incorporated them into the final Permit, with some modifications.

Part II.E.3.a.ii (A)

92. Excelsior claims that casing and cementing records are not available for all the existing test wells and coreholes that will be converted to IMWs.

    EPA Response: EPA amended the Permit to require casing and cementing records for existing test wells and coreholes that are converted to IMWs, if available, as a Permit condition. Monitoring and operational controls will ensure fluids are controlled to the orebody in the wellfield. This change to the mechanical integrity requirement will not have an impact on USDWs outside the AOR boundaries.

Table A-1 in Appendix A

93. Excelsior submitted a proposed revision to Table A-1 to reflect a shift in the location of Mine Block 1. The change reflects abandonment of NSD-011 prior to the start of mining because it is inside the new mine block. CS-06 and NSM-001 are changed from outer IMWs to inner IMWs because of their closer proximity.

    EPA Response: EPA agrees to include the revised Table A-1 in Appendix A in the final permit. The shift in the location of Mine Block 1 will have no material effect on the proposed ISR operations, monitoring well locations, and protection of USDWs.

Part II.F.2

94. Excelsior commented that the footnotes to Tables 1 and 2 should be revised to the actual schedule for POC and OW installation. Footnotes at end of Tables 1 and 2 say: "TBD - To be

determined and approved by the director for the five (5) POC wells and the eleven (11) outer observation wells required by EPA prior to the commencement of injection." This footnote is not consistent with the schedule of POC and OW installation. POCs 1, 2, and 3 will be installed prior to year 1, but POCs 4 and 5 will not be installed until prior to Stage 2 operations (year 10). OWs will be phased in during the course of the project as shown in the table provided with Excelsior's comment. Excelsior recommends the following language: "TBD - To be determined and approved by the director for the POC wells and observation wells required by EPA according to the installation schedules for these wells."

EPA Response: These proposed revisions are adopted in the final Permit with an additional modification to state that the final schedule for POC well and OW installation will be subject to EPA review based on ISR operations performance and monitoring data as operations proceed.

Part II.F.3.a

95. Excelsior recommends revisions to the language regarding the schedule for collection of baseline water quality data from all POC wells and outer OWs to be consistent with the installation schedule for those wells.

EPA Response: The proposed revisions are consistent with the POC well and OW installation schedule and are clarified in the final Permit.

Part II.F.4

96. Excelsior recommends revisions to the language regarding the schedule for monitoring at all POC wells and outer OWs to be consistent with the installation schedule for those wells.

EPA Response: The proposed revisions are acceptable and are adopted in the final Permit.

Part II.H.1.i

97. Excelsior recommends adding "HC" wells to the text.

EPA Response: EPA agrees and made these additions in the final Permit.

Part II.F.6.a.i

98. Excelsior recommends that this section be revised to require SC measurements in the IMWs and outer OWs (not HC wells), to be consistent with Part II.E.1.c. HC wells will be monitored for SC as an operational activity, but they are expected to have elevated SC levels as mining approaches the edges of the wellfield.

EPA Response: Baseline SC measurements in IMWs and HC wells are required under Part II.F.6.a.i. Outer OWs will be added to the Section as requested in the comment, but inactive HC wells used for monitoring SC levels at the southern and eastern boundaries in the early ISR operations will be included in the requirement. Active HC wells are included to obtain baseline SC levels for confirmation of a change from background levels indicating outward ISR fluid movement when HC wells are active.

Part II.E.6.d

99. Excelsior requested that the TPH-DRO analysis be removed from the injectate monitoring requirement, and provided supportive information and proposed revised permit language consistent with that request.

EPA Response: The draft Permit allowed for a demonstration lasting six months that BTEX MCLs will not be exceeded when the TPH in the injectate exceeds 10 mg/L. If the MCLs for BTEX are met in the injection fluids, EPA is satisfied that the injection fluids would not contribute to an AQL exceedance from any potential loss of hydraulic control or excursion. Therefore, EPA modified the permit language to reduce the required demonstration interval for BTEX analysis in the injectate solution (lixiviant) from six months to one month of operations, subject to an extension of up to six months if results are inconclusive. The information provided in Excelsior's comments indicate that BTEX concentrations will be below MCL levels in the injectate fluids, and EPA anticipates the BTEX concentrations will not cause an MCL exceedance due to the process related contaminates over time regardless of the length of time of operations. The lixiviant would still be subject to monthly monitoring of organics pursuant to Permit condition Part II.F.7. The process related organics in Table 2 are the hydrocarbon constituents of concern, including BTEX and TPH, and are included in the monitoring program for the OWs, POC and inactive HC wells that would also monitor for any formation related contribution to these constituents. Under the Permit, if an AL or AQL exceedance occurs, EPA may require additional monitoring or action beyond those specified in the permit. Actions could be required to reduce the TPH compounds in the injected fluids if BTEX levels exceed AQLs in outer OWs, POC wells, or inactive HC wells at the southern and eastern wellfield perimeter.