

B R O W N A N D
C A L D W E L L

September 28, 1996

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San Francisco, California 94105

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APP Mining Unit
Arizona Department of Environmental Quality
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15-3355/45

Subject: Revised and Sealed Responses to Agency Comments
 Concerning the Hydrogeological Modeling Aspects of
 BHP Copper's Aquifer Protection Permit (APP) and
 Underground Injection Control (UIC) Permit Application

Dear Mr. Olson and Ms. Tolle:

I am enclosing two sets of BHP Copper's responses to the comments of the Arizona Department of Environmental Quality (ADEQ) and the United States Environmental Protection Agency (EPA) concerning permit applications for the Florence project. They are to replace the sets that Mr. John Kline distributed on September 4, 1996. (See enclosed copy of Mr. Kline's September 4 letter.)

As you will recall, the September 4 responses were the subject of an extended teleconference involving personnel from ADEQ, EPA, BHP Copper and Brown and Caldwell. A significant part of the teleconference was devoted to questions concerning the proposed aquifer exemption, the location of the monitoring wells, and the number of monthly samples obtained from each well. It was agreed that Mr. Kline would consider the agency concerns voiced during the telephone conference and submit a revised proposal concerning the boundaries of the proposed aquifer exemption. The revised proposal concerning the boundary exemption is shown in Part II, Responses to Comments 2 and 3 in the enclosed copies of Table 3 (Response to EPA Technical Comments Issued June 27, 1996).

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Mr. Greg Olson
Ms. Shirin Tolle
September 28, 1996
Page 2

You will note that the enclosed sets of responses have been sealed by Mr. James M. Oliver, Registered Geologist.

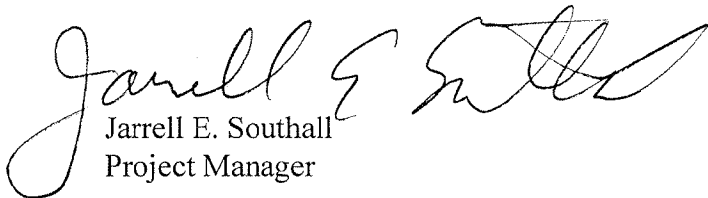
A table showing the Point of Compliance (POC) wells and number of monthly samples is separately enclosed.

In accordance with Ms. Shirin Tolle's request, Brown and Caldwell is preparing three visual aids (posters) for use during the scheduled October 2 video conference. One will show the location of the POC wells relative to the in-situ mine area and the surface facilities. One will present a 3-D perspective of the proposed area of aquifer exemption. The remaining poster will present a magnified version of the table (Table 2) of operational variables that form the basis of the operations, monitoring, and contingency plans. For a discussion of those plans and Table 2, please refer to the enclosed set of responses to EPA comments, Table 3, Comment 11 and Attachment 5.

Please call me at 602-222-4533 if you have comments or questions regarding this letter or the enclosures.

Very truly yours,

BROWN AND CALDWELL


Jarrell E. Southall
Project Manager

Enclosures - see Attachments - Responses to Comments

cc: Mr. John T. Kline, BHP Copper
Mr. James Oliver, Brown and Caldwell
Mr. Joe R. Williams, United States Environmental Protection Agency

Table 3: Response to EPA Technical Comments Issued June 27, 1996

EPA Comments	BHP Response
<p><i>Oxide Zone.</i> A ring of wells in the oxide zone would be placed to detect a horizontal excursion and to monitor water levels to confirm the hydraulic control of the injectate. These wells would be placed around the perimeter in locations that would be used when the neighboring block is developed. For Block 10, this would entail monitoring wells in Blocks 1, 9, 11, and 14 in the locations that abut Block 10. These wells should be monitored for water level and TDS and/or conductance.</p>	<p>Please refer to Attachment 3 to Table 3.</p>
<ol style="list-style-type: none"> 1. Will air lift or bailing methods be sufficient to lift to the surface the potentially large grains (gravel) that has caved into the hole? Some of the core holes may need to be reamed out if they cannot be properly cleaned out to get an adequate grout placement. 2. If the holes are only cleaned to the bedrock interface, as outlined above, then how will they be grouted to 20 feet below the bedrock-sedimentary unit contact as stated in this step? 3. The existing corehole casing will not serve as a tremie pipe. A tremie pipe is a small diameter pipe designed to be removed as material is placed, prevent bridging and avoid dilution as the cement falls through hundreds of feet of groundwater. A separate tremie pipe needs to be used. 4. The cement must be placed under pressure in the tremie pipe in order to fill the voids through the perforated casing. 5. Type V cement grout should be placed in the zone where the Middle Basin Fill Unit is expected. 	<p>Appendix E, Well Abandonment Plan, of Volume V has been substantially revised in response to ADEQ and EPA comments (see Attachment 4 to Table 3). BHP's responses to the specific comments are given below.</p> <p>Circulation techniques will be used to clean holes and prepare them for the placement of grout at least 20 feet below the bedrock interface. If necessary, coreholes will be reamed so as to ensure the proper placement of grout 20 feet below the interface. Pressure grouting techniques will be used to transfer the grout to the bottom of the corehole through a separate tremie pipe. An acid-resistant and sulfate-resistant cement will be placed at the bedrock/Lower Basin-Fill Unit contact and also throughout the interval spanned by the Middle Fine-Grained Unit.</p>
<p>Part II: Overall Technical Review</p>	
<p>Aquifer Exemption:</p>	
<p>Comment 1: Under 40 CFR Parts 146.4(a) and 146.4(b)(1), the aquifer meets the exemption requirements as it does not currently serve as a source of drinking water and it has been demonstrated to have minerals which are commercially producible. However, the request for a "minor" aquifer exemption should be explained. According to "EPA Region 9 Aquifer Exemption Guidance, March 1993" (page 4), a major aquifer exemption is required if the exemption is approved under 146.4(b).</p>	<p>During a pre-permit application meeting, the major/minor issues were discussed with then permit officer, Jose Gutierrez. The discussion centered on EPA Region IX Aquifer Exemption Guidance document dated March 1993. It was BHP's understanding at that time that a major aquifer exemption was not required because of IV.A.1.(c) since the exemption is part of a permitting action.</p> <p>The word "or" is used between IV.A.1.(a), (b), and (c) and as such, each section was believed to be exclusive, and the aquifer not currently approved as an exemption under 40 CFR § 146.04 (b) was believed to be a minor exemption. BHP believes the difference is technical in nature and requires public notification in either case. Since EPA concurs that the exemption criteria are met under 40 CFR parts 145.4 (a) and 146.4b1, BHP requests that publication in the Federal Register proceed as soon as possible in order to determine the need for a public hearing.</p>
<p>Comment 2: The proposed aquifer exemption boundary has been defined in the plan view. The proposed aquifer exemption boundary should be explicitly defined in 3 dimensions (i.e., in terms of its areal extent <u>and</u> <u>depth</u>).</p>	<p>BHP recommends the boundaries of the proposed aquifer exemption to be as follows:</p> <p>The areal extent of the proposed exemption is described in response to Comment 3 below.</p> <p>The lower extent of the proposed exemption is the base of the reactive interval that is amenable to copper recovery by leach solutions. This includes the oxide zone and copper in the sulfide zone that is leachable.</p>

Table 3: Response to EPA Technical Comments Issued June 27, 1996

EPA Comments	BHP Response
<p>Comment 2 - Continued</p>	<p>BHP proposes that the upper bound of the aquifer exemption include the zone 200 feet above the oxide zone, or the distance from the oxide zone to the base of the MFGU, whichever is less. Note that the base of MFGU is 50 feet or less above the oxide zone in much of the eastern portion of the mine area. In the western portion of the mine area, the average distance between the base of the MFGU and oxide zone is about 200 feet, sloping from about 50 feet in the central portion of the mine area to about 600 feet along the extreme western boundary of the mine area.</p>
<p>Comment 3: The area to be surveyed for drinking water wells should extend a minimum of 1/4 mile around the mine site. BHP has successfully addressed this requirement by surveying and proposing to re-locate all wells within 1/2 mile of the mine site. However, this "buffer zone" should not be considered as exempted. To exempt an aquifer there must be minerals which are commercially producible. The aquifer exemption boundary should be placed on the edge of the mine site, immediately before the point of compliance (POC) wells.</p>	<p>BHP agrees to place the exemption boundary on a line passing through the POC wells.</p>
<p>Comment 4: All drinking water wells and agricultural wells located within 1/4 mile of the mine boundary shall be shut in prior to the issuance of an aquifer exemption. Furthermore, it is BHP's responsibility to ensure that no new drinking water wells or agricultural wells are drilled within 1/4 mile of the mine site during the 15-year mining life.</p>	<p>BHP will ensure that all water wells and agricultural wells within 1/4 mile of the mine boundary will be abandoned and understands that it is their responsibility to ensure that no new drinking water wells or agricultural wells are drilled within 1/4 mile of the mine boundary during the 15-year mining life. No drinking water wells currently exist within a 1/4-mile radius of the mine site.</p>
<p>Closure:</p>	
<p>Comment 5: BHP has established that at a sulfate concentration of 750 mg/L, all constituents are below primary MCLs and closure will be complete. Using sulfate as an indicator is acceptable. However, BHP should document that this is an appropriate indicator by showing that the concentrations of other constituents fall below primary MCLs (or AWQS) when sulfate reaches 750 mg/L. This demonstration should consist of more than one test (i.e., it should be a series of statistically significant tests).</p>	<p>Although not explicitly stated in the Section 7.2.4 of Volume 1, the effective goal of the closure is not just to reduce the sulfate concentrations to 750 ppm. Rather, it is to reduce contaminant concentrations to below their respective standards. In that regard, measurement of sulfate will serve as an economic way of measuring water quality improvements as the block is swept with fresh water. Once the quality is improved to a sulfate level of 750 ppm or less, it would then be reasonable to analyze for all parameters. If these analyses indicate compliance with the applicable standards, BHP would then discontinue flushing the block and proceed with the next closure step. Section 7.2.4 will be revised to more clearly state that blocks will be cleaned to a level of 750 ppm sulfate, or less, if necessary, to meet the MCLs.</p>
<p>Monitoring:</p>	
<p>Comment 6: The monitoring array should be increased. Monitoring wells should surround the site in all potentially affected formations and along all faults. Furthermore, if the aquifer exemption is for the oxide zone only, it would be reasonable to place monitoring wells in the center of the mining area, above the oxide formation. Mining wells in the center of the mine site would demonstrate that there are no vertical excursions.</p>	<p>The number of POC monitoring wells has been increased. The current POC monitoring array (shown on Figure 1 of Attachment 3 to Table 3) includes monitoring along the two major faults and within all of the potentially-affected formations. Placing monitoring wells along every fault is not feasible due to the large number of subsidiary faults present. Although aquifer tests have demonstrated some minor influence on flow of the major faults, the numerous smaller faults do not appear to influence flow.</p>
<p>The direction of groundwater flow can change with changes in weather, agricultural pumping, and municipal pumping. Although the emphasis of the monitoring program should clearly be in the direction of historic flow (northwesterly), a skeleton monitoring array should cover any potential changes throughout the life of the project. Over a 15-year mining life and a 30-year post-closure period, it is possible, at least temporarily, for flow to change directions and move in a more southerly or easterly direction. This is particularly important since the Town of Florence and public water supply wells are located southeast of the site.</p>	<p>The current POC monitoring well array includes a UBFU well and a LBFU well (wells M18-GU and M1-GL, respectively) outside of the southern boundary of the in-situ mine area, and a three-well cluster screened in the UBFU, LBFU, and oxide zone, at a location southeast of the in-situ mine area (wells M2-GU, M3-GL, M4-O). These wells are available to detect contaminants from the mine area in the highly unlikely event that the regional gradient should ever be reversed to the extent that groundwater from the in-situ mine area would flow in a southeasterly direction toward Florence. Additionally, 15 new wells have recently been installed to increase downgradient coverage and to provide a reasonable degree of cross-gradient coverage. This monitoring well network will provide adequate detection for all conditions, including the extremely unlikely event that the gradient would significantly change direction on a regional scale within the area of the site. The following factors should be taken into consideration.</p> <ol style="list-style-type: none"> 1. The regional flow in the area of the BHP site is dominated by the mountains east of Florence and, to a lesser degree, by the Gila River.