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MINERALS PROGRAM
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State of Utah
DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH

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November 7, 1990

Mr. Frank D. Wicks
Vice President & General Manager
Barrick Mercur Gold Mine
P.O. Box 838
Tooele, Utah 84074

RE: Barrick October 24, 1990 Response to BWPC Letter of Deficiency, Dated October 11, 1990

Dear Mr. Wicks:

We have received your response regarding our earlier comments on the Hydrogeologic Report for Dump Leach No. 3, a study required by your Ground Water Quality Discharge Permit, No. UGW450001.

Several of our original comments remain unsatisfied or are in need of clarification and are revisited herein. Consequently, we are unable to approve the Hydrogeologic Report at this time.

After the necessary ground water monitoring wells are installed and all hydrogeologic information is available, please address these attached comments in a final version of the Hydrogeologic Report.

If you have any questions or comments please call Loren Morton at 538-6146. We look forward to the completion of the report and monitoring well system.

Sincerely,

Utah Water Pollution Control Committee

Don A. Ostler

Don A. Ostler, P.E.
Executive Secretary

Enclosure

DAO:LM:kc
cc: Terry Vandell, Dames & Moore
Fred Nelson, Asst. Attorney General
Wayne Hedberg, DOGM
Matt Trujillo, Tooele County Health Dept.

Q:BMD3RESP.LTR

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DIVISION OF
OIL, GAS & MINING

Review of Bureau of Water Pollution Control

October 11, 1990 Comments On:

Barrick July 30, 1990 Dump Leach No. 3 Hydrogeologic Report

1. Comments 1.a.1, and 1.a.2 - comments satisfied.

2. Comment 1.a.3: Meadow Canyon Fault - we acknowledge that the curvature of the fault trace is a product of earlier geologic mapping by Barrick (not Dames & Moore), which inferred the trace followed drainage course in Meadow Canyon. Our comment however, was that a truly vertical fault will ignore topography and form a relatively straight line in crossing all types of topographic features. This is a part of the commonly accepted "Rule-of-V's" from structural geology. Accordingly, if the fault is truly vertical it should not curve about on the geologic map, regardless whether or not it is buried by structural fill. Also, your response on page 3 further suggests the fault may not exist; if not please explain and remove it from Plates 1, 2 and 3.

3. Comments 1.a.4, 1.a.5, and 1.a.6 - satisfied.

4. Comments 1.b.1 and 1.b.2 - satisfied.

5. Comment 1.b.3: Known Potentiometric Contours - our original statement stands; the number and location of downgradient compliance monitoring wells must be justified, by <u>known</u> potentiometric contours.

6. Comment 1.b.4 - satisfied.

7. Comment 1.b.5: Location of MW-11 in Local Flow System - approximate potentiometric contours have been provided on Plate 3; we asked for known contours. However, this is not critical if MW-1 is <u>not</u> to be used as a downgradient compliance monitoring well.

8. Comment 1.b.6: Manning Canyon Thrust - response accepted, however, because the location of Dump Leach No. 3 site in the local ground water flow system is not clearly known, the issue may need to be revisited at some point in the future.

9. Comment 2 - satisfied.

10. Comment 3.a: Dominant Joint Pattern on Figure 4 - we were originally referring to a small cluster of pole projections found between a compass bearing of 110° and 144° with northwest dips ranging from about 80° to 90°. Your subsequent plotting of joint measurements from Plate 1 onto Figure 4 places several more pole projections in the general vicinity of this cluster. Though this cluster may not form a dominant array of joints, it is interesting to note the apparent grouping of joints with a northeast orientation.

13. Comment 4.a: Reported Flow Directions - we agree that the dip of the Long Trail Shale will be a significant control of ground water flow. Another important control should be the permeability tensor created by the conjugate joints seen on outcrops east of process pool.

14. Comment 4.b: Historic Water Level Data and Local Flow Directions - our original comments stand. Barrick must base its known potentiometric contours on current water level data. Consequently, once the monitoring well network is complete, Barrick must add known equipotentials to Plate 3, based on three-point solutions.

15. Comment 4.c: Hydraulic Gradient - our original comment still stands; known equipotentials are needed before hydraulic gradient can be determined.

16. Comment 4.d: Vertical Gradient - nested monitoring wells are also used in unconfined aquifers, where vertical hydraulic gradient is critical to compliance monitoring. The possibility of nested wells was mentioned because of the statement in the July, 1990 report (p.13) that the vertical gradient was the most significant component to ground water flow. If vertical discretization of the aquifer by nested wells is not possible for some reason, fully penetrating monitoring wells will be satisfactory. However, fully penetrating and screened wells do have the disadvantage of borehole dilution effects during sampling. This dilution factor causes the fully penetrating well to lack the same degree of quantitative monitoring that a nested well system could provide. Consequently, if nested wells are not used the Executive Secretary will be forced to treat all potential exceedances of the protection levels, even small ones, with the same degree of enforcement scrutiny as a large exceedance of the permit limits.

17. Comment 4.e: Compliance Monitoring Well Numbers and Locations - our comment still remains unresolved. Ground water flow direction, relative to the process pool, must be determined; as has been referred to in other sections above. Dispersion of a released pollutant must be calculated or estimated through a quantitative process in order to justify the use of a monitoring well that is not directly hydraulically downgradient of the deepest part of the process pool. Such dispersion calculations must address both transverse and longitudinal dispersion.

18. Comment 4.g.1: East-West Fault - Barrick's interpretation of the hydraulic properties of the two faults on the site contradict each other. The Meadow Canyon Fault has been interpreted as being potentially sealed with fault gouge (see Barrick Response to Comment 3.c) and therefore may not act as a significant conductor of ground water. Meanwhile, the east-west fault with a greater amount of vertical offset is said to pose no barrier to ground water flow. In reality, no one yet knows what the hydraulic properties of these faults are. However, we are willing to allow Barrick to collect more ground water quality data from wells MW-10 and 11 and other data as necessary to further assess the hydraulic properties of the east-west fault.

19. Comment 4.g.2 and 3 - no response, we will await the submittal of additional ground water quality data.

20. Comment 4.g.4: No Flow Boundary in Well MW-11 - Barrick must provide evidence to show the change in the time-drawdown slope was due to a change in the pumping rate.

21. Comment 4.g.5 and 4.h - satisfied.

22. Comment 5.1 - satisfied.

23. Comment 5.b and c - acknowledged.

24. Comment 5.d - we are awaiting the ground water quality data and diagrams.

25. Comment 6.a: Shallow Alluvial/Colluvial Monitoring Well - higher permeability of the bedrock is also illustrated by detailed joint surveys conducted on similar rock outcrops near Dumps 1 and 2, as found in a Barrick April, 1985 report entitled "Geologic Report for Dump Leach Project Area, Getty Mining Company, Mercur Mine, Tooele County, Utah". Personal communication with Barrick staff in review of this report indicated that joint apertures measured during the survey varied from 1/8 inch to 2 inches, with an average width of 1/4 inch. Ignoring bedding plane and intra-bed joints the results of the survey were used by Bureau staff to estimate hydraulic conductivity of the bedrock, after the equations of Snow (1968, 1969). From the four outcrops surveyed, hydraulic conductivity estimates are as follows:

	Hydraulic Conductivity (cm/sec)	
Outcrop	Assume 1/4" Aperture	Assume 1/8" Aperture
1	18.32	2.29
2	34.36	4.29
3	30.54	3.81
4	36.65	4.58

As can be seen, the hydraulic conductivity of the bedrock is much higher, as much as 5 orders of magnitude higher than the 10^{-4} cm/sec range estimated for the alluvium (July, 1990 Report, p.9).

As a result, there is a potential that a shallow alluvial monitoring well could experience a false negative response. Accordingly, such a well must not be relied on solely for compliance monitoring. However, Barrick is free to install it at its own risk, and we will be happy to review any monitoring information from said well.

Subsequent to our meeting we reviewed Barrick Engineering plan 8.8.2, Rev B, dated January 19, 1990 and discovered that the subdrain for the conveyance of stormwater from Dead Horse and Meadow Canyons under the dump leach has perforated sections in it. Two of these perforated sections occur near the proposed location for the shallow well (approximately N 27,140, E 20,875 and approximately N 26,730, E 20, 910). Barrick must show that potential stormwater losses could not occur through these perforations, or if they did occur they would not bias or alter any ground water quality results in the shallow alluvial monitoring well.

26. Comment 6.b - we agree, with your statement; however it is now Barrick's burden to show that the final ground water monitoring well network is not susceptible to false negative response. As of yet this has not been demonstrated.

27. Comment 6.c - satisfied.

28. Comment 7.a - accepted, however, in the future we recommend removal of all drill cuttings, as much as possible, and backfill with bentonite pellets, neat cement grout or cement/bentonite grout mixture.

29. Comment 7.b - satisfied.

30. Comment 7.c: Well Development - field filtration and dissolved analysis will need to continue for the foreseeable future due to difficulties in achieving a turbidity of 5 NTU during well development.

31. Comment 7.d: Geologic Logs - we appreciate the descriptions provided, please indicate the Upper Great Blue Limestone/Long Trail Shale contact on the geologic logs and boring diagrams in Appendix A.

32. Comment 8.a - satisfied, please refer to point 21, above.

33. Comment 8.b - satisfied, the fractured aquifer appears to behave as a Darcy continuum.

34. Comment 8.c: Confined System - when was water first encountered during the drilling of MW-10? How will the confining layers described effect compliance monitoring; will these layers cause a false negative response in monitoring well MW-10? With regard to drawdown correction for MW-11, we agree that it is not necessary given the conservative assumption used for saturated thickness.

35. Comment 8.d - satisfied

36. Comment 8.c - please provide data to show that the flow rate changed to effect the time-drawdown response at 28.8 minutes into the test, see point 20, above.

37. Comments 9.a and 9.b - satisfied.

38. Comment 9.c: Missing Chain of Custody Forms and Field Sampling Logs - we have reviewed the field sampling logs submitted and have found the log for the MW-10, June 28, 1990 sample did not identify the volume of ground water purged before sampling. Barrick must provide this information.

39. Comment 9.d - satisfied.

40. Boring Z-21 - during our subsequent review of your July 1990 report we have determined that boring Z-21 has been omitted from Plate 1, please add.